

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI (AUTONOMOUS)**  
**B. Tech - Artificial Intelligence and Data Science (AI&DS)**  
**(Effective for the batches admitted from 2020-21)**

**Semester I (First year)**

Sl. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P				
1	BS	20ABS9901	Algebra and Calculus	4	2	0	3	30	70	100
2	BS	20ABS9902	Applied Physics	4	2	0	3	30	70	100
3	HS	20AHS9901	Communicative English	4	2	0	3	30	70	100
4	ES	20AES0301	Engineering Graphics	1	0	4	3	30	70	100
5	ES	20AES0501	Problem Solving and Programming	4	0	2	3	30	70	100
6	HS LAB	20AHS9902	Communicative English Lab	0	0	3	1.5	30	70	100
7	BS LAB	20ABS9907	Applied Physics Lab	0	0	3	1.5	30	70	100
8	ES LAB	20AES0503	Problem Solving and Programming Lab	0	0	3	1.5	30	70	100
			<b>Total credits</b>				<b>19.5</b>	<b>240</b>	<b>560</b>	<b>800</b>

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**Semester II (First year)**

Sl. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P				
1	BS	20ABS9911	Probability and Statistics	4	2	0	3	30	70	100
2	BS	20ABS9921	Numerical Methods	4	2	0	3	30	70	100
3	ES	20AES0509	Basics of Python Programming	4	2	0	3	30	70	100
4	ES	20AES0502	Data Structures	4	2	0	3	30	70	100
5	ES	20AES0507	Web Design	1	0	4	3	30	70	100
6	ES LAB	20AES0510	Basics Of Python Programming Lab	0	0	3	1.5	30	70	100
7	BS LAB	20ABS9918	Computation Lab -I	0	0	3	1.5	30	70	100
8	ES LAB	20AES0504	Data Structures Lab	0	0	3	1.5	30	70	100
9	MC	20AMC9903	Environmental Studies	3	0	0	0	30	0	30
			<b>Total credits</b>				<b>19.5</b>	<b>270</b>	<b>560</b>	<b>830</b>

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**Semester III (Second year)**

Sl. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CL	P				
1	BS	20ABS9914	Discrete Mathematical Structures	4	2	0	3	30	70	100
2	PC	20APC3001	Digital Electronics and Microprocessor	4	2	0	3	30	70	100
3	PC	20APC3002	Database Management Systems	4	2	0	3	30	70	100
4	PC	20APC3004	Object Oriented Programming through Java	4	2	0	3	30	70	100
5	PC	20APC3006	Computer Organization	4	2	0	3	30	70	100
6	PC	20APC3003	Database Management Systems Lab	0	0	3	1.5	30	70	100
7	PC	20APC3005	Object Oriented Programming through Java Lab	0	0	4	2	30	70	100
8	PC	20APC3007	Computer Organization Lab	0	0	2	1	30	70	100
9	SC	20ASC3001	Client Side Scripting	1	0	2	1	100	0	100
10	MC	20AMC9902	Constitution of India	3	0	0	0	30	0	30
			<b>Total credits</b>				<b>21.5</b>	<b>370</b>	<b>560</b>	<b>930</b>

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**Semester IV (Second year)**

Sl. No	Category	Course Code	Course Title	Hour per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P				
1	PC	20APC3008	Formal Languages and Automata Theory	4	2	0	3	30	70	100
2	PC	20APC3009	Computer Networks	4	2	0	3	30	70	100
3	PC	20APC3011	Data warehousing and Mining	4	2	0	3	30	70	100
4	PC	20APC3013	Operating Systems	4	2	0	3	30	70	100
5	HS	20AHSMB01	Managerial Economics and Financial Analysis	3	0	0	3	30	70	100
6	HS	20AHS9905	Universal Human Values	4	2	0	3	30	70	100
7	PC	20APC3010	Computer Networks Lab	0	0	3	1.5	30	70	100
8	PC	20APC3012	Data warehousing and Mining Lab	0	0	3	1.5	30	70	100
9	PC	20APC3014	Operating Systems Lab	0	0	3	1.5	30	70	100
10	SC	20ASC3002	Server Side Scripting	1	0	2	2	100	0	100
			<b>Total credits</b>				<b>24.5</b>	<b>370</b>	<b>630</b>	<b>1000</b>

**Community Service Project (Mandatory) for 6 weeks duration during summer vacation.**

(To visit the selected community to conduct survey (Socio-economic & domain survey) and conduct sensitization/awareness program/activities at the end of IV- semester before commencement of V-semester and complete immersion programme also during V-Semester and submit report in V - semester. Assessment will be done at the end of V-Semester)

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**Semester V (Third year)**

Sl. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P				
1	PC	20APC3015	Principles of Data Science	4	2	0	3	30	70	100
2	PC	20APC3017	Artificial Intelligence	4	2	0	3	30	70	100
3	PC	20APC3019	Big data Technologies	4	2	0	3	30	70	100
4	OE-1	20AOE9925	Deterministic and Stochastic Statistical Methods	4	2	0	3	30	70	100
		20AOE0303	Optimization Techniques	3	0	0				
		20AOE0552	Internet of Things	3	0	0				
5	PE-1	20APE3001 20APE3002 20APE3003	Design And Analysis of Algorithms Computer Graphics Adhoc & Sensor Networks	4	2	0	3	30	70	100
6	PC LAB	20APC3018	Artificial Intelligence Lab	0	0	3	1.5	30	70	100
7	PC LAB	20APC3016	Principles of Data Science Lab	0	0	3	1.5	30	70	100
8	SC	20ASC3003	Conversational AI/ AI Chat Bot	1	0	2	2	100	0	100
9	Mandatory Course (AICTE Suggested)	20AMC9901	Biology for Engineers	3	0	0	0	30	0	30
10	CSP	20CSP3001	Evaluation of Community Service Project	0	0	0	1.5	100	0	100
<b>Total credits</b>							<b>21.5</b>	<b>440</b>	<b>490</b>	<b>930</b>

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**OE/JOEs for NPTEL**

<b>S. No</b>	<b>Open Elective (12 weeks)</b>
1	Blockchain and its Applications
2	Introduction to Cyber Security
3	Business analytics and data mining modeling using R.
4	Decision making with spread sheet
5	Introduction To Wireless And Cellular Communications
6	Text, Textuality And Digital Media
7	Psychology Of Learning
8	Public Speaking
9	Organizational Behaviour
10	Entrepreneurship
11	Introduction to Film Studies
12	Partition of India in print media and Cinema.
13	Data Analysis and decision making
14	Education for sustainable development
15	Training and development
16	Literature Culture and Media
17	Introduction to Cultural Studies
18	Science, Technology and Society
19	Human Resource Development
20	E- Business.

\*Student shall register any number of MOOC courses listed above (Professional Elective/ Open Elective) by the department as approved by the BOS from III year. But student is required to submit the pass certificate on NPTEL platform for at least one course with in the Programme duration (Before IV-II examination notification released).

ARTS

### Semester VI (Third year)

[illegible]

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**Semester VII (Fourth year)**

Sl. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P				
1	PE-3	20APE3007 20APE3008 20APE3009	Predictive Analytics Information Retrieval Techniques Deep Learning Techniques	4	2	0	3	30	70	100
2	JOE/OE-2	20AOE3001 20AOE3002/ 20APE3011 20AOE3003 20AOE3004 20AOE3005 20AOE3006	Natural Language Processing Virtual Reality Applications of AI AI for Image Analysis Ethics And Privacy In AI Reinforcement Learning	4	2	0	3	30	70	100
3	PE-4	20APE3016 20APE3017 20APE3018	Data Analytics Software Project Management Linux Environment System	4	2	0	3	30	70	100
4	PE -5	20APE3019 20APE3020 20APE3021 20APE3022 20APE3023	Data Science Applications Data Science for Business Data Stream Mining Process mining Computer Vision	4	2	0	3	30	70	100
5	OE -3	20APE0407 20APE0411 20AOE3601 20APE0415	Digital Image Processing Embedded Systems Enabling Technologies for data science and analytics :IOT Wireless Communications	4	2	0	3	30	70	100
6	HE	20AOE0302 20AOE9901 20AHSMB02	Management Science English for Research Paper Writing Entrepreneurship Development	4	2	0	3	30	70	100
7	SC	20ASC3004	Exploratory Data Analysis with R	1	0	2	2	100	0	100
8	PR	20APR3001	Evaluation of Industry Internship(III-II Summer Internship)	0	0	0	3	100	0	100
Total credits							23	380	420	800



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**Semester VIII (Fourth year)**

Sl. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P				
1	OE-4	20MOC3001	MOOCS-I	0	0	0	3	25	75	100
2	PR	20APR3002	Internship	0	0	0	3	100	-	100
3	PR	20APR3003	Project work	0	0	0	9	60	140	200
			<b>Total credits</b>				<b>15</b>	<b>185</b>	<b>215</b>	<b>400</b>

**HONOURS IN ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**Note:** Students can choose a few courses from the following list approved by BOS either 3 credits/ 4 credits courses based on the availability in SWYAM-NPTEL portal, and secure minimum of 20 credits on passing the selected courses.

S.NO	SUB.CODE	COURSE NAME	WEEKS	CREDITS
1	20AHN3001	DESIGN AND IMPLEMENTATION OF HUMAN COMPUTER INTERFACES	12 Weeks	3 or 4
2	20AHN3002	SOCIAL NETWORKS	12 Weeks	3 or 4
3	20AHN3003	NO SQL DATABASES	12 Weeks	3 or 4
4	20AHN3004	ADVANCED IOT APPLICATIONS	12 Weeks	3 or 4
5	20AHN3005	INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS	12 Weeks	3 or 4
6	20AHN3006	GETTING STARTED WITH COMPETITIVE PROGRAMMING	12 Weeks	3 or 4
7	20AHN3007	COMMUNICATION NETWORKS	12 Weeks	3 or 4
8	20AHN3008	COMPUTER NETWORKS AND INTERNET PROTOCOL	12 Weeks	3 or 4
9	20AHN3009	ALGORITHMIC GAME THEORY	12 Weeks	3 or 4
10	20AHN3010	SCALABLE DB.	12 Weeks	3 or 4
11	20AHN3011	APPLIED ACCELERATED ARTIFICIAL INTELLIGENCE.	12 Weeks	3 or 4
12	20AHN3012	AI: SEARCH METHODS FOR PROBLEM SOLVING.	12 Weeks	3 or 4
13	20AHN3013	ARTIFICIAL INTELLIGENCE: KNOWLEDGE REPRESENTATION AND REASONING	12 Weeks	3 or 4
14	20AHN3014	MULTI-CORE COMPUTER ARCHITECTURE-STORAGE	12 Weeks	3 or 4
15	20AHN3015	SOCIAL NETWORK ANALYSIS.	12 Weeks	3 or 4
		<b>TOTAL</b>		<b>20</b>

**MINOR DEGREE IN ARTIFICIAL INTELLIGENCE AND DATA SCIENCE FOR ECE, EEE, CE & ME**

**Note:** Students of other programmes to get “minor in AIDS” shall pass a few SWAYAM-NPTEL courses listed below which are approved by BOS and obtain 15 credits and submitting a minor discipline project in AIDS for scoring 5 credits is compulsory and all together total credits requirement count to be minimum of 20.

S.NO	SUB.CODE	COURSE NAME	WEEKS	CREDITS
1	20AMN3001	OPERATING SYSTEMS	12 Weeks	3 or 4
2	20AMN3002	COMPUTER ORGANIZATION	12 Weeks	3 or 4
3	20AMN3003	COMPUTER NETWORKS	12 Weeks	3 or 4
4	20AMN3004	ARTIFICIAL INTELLIGENCE	12 Weeks	3 or 4
5	20AMN3005	DATA SCIENCE	12 Weeks	3 or 4
6	20AMN3006	PROGRAMMING IN MODERN C++	12 Weeks	3 or 4
7	20AMN3007	DATA ANALYTICS WITH PYTHON	12 Weeks	3 or 4
8	20AMN3008	SOFTWARE ENGINEERING	12 Weeks	3 or 4
9	20AMN3009	SOFTWARE PROJECT MANAGEMENT	12 Weeks	3 or 4
10	20AMN3010	INTRODUCTION TO DATABASE SYSTEMS	12 Weeks	3 or 4
11	20AMN3011	CLOUD COMPUTING	12 Weeks	3 or 4
12	20AMN3012	FOUNDATION OF CRYPTOGRAPHY	12 Weeks	3 or 4
13	20AMN3013	HARDWARE SECURITY	12 Weeks	3 or 4
14	20AMN3014	COMPUTER NETWORKS AND INTERNET PROTOCOL	12 Weeks	3 or 4
15	20AMN3015	COMMUNICATION NETWORKS	12 Weeks	3 or 4
16	20AMN3016	<b>MINOR DISCIPLINE PROJECT IN AIDS (COMPULSORY)</b>	-	5
		<b>TOTAL</b>		<b>20</b>

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Sl. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P				
1	BS	20ABS9901	Algebra and Calculus	4	2	0	3	30	70	100
2	BS	20ABS9902	Applied Physics	4	2	0	3	30	70	100
3	HS	20AHS9901	Communicative English	4	2	0	3	30	70	100
4	ES	20AES0301	Engineering Graphics	1	0	4	3	30	70	100
5	ES	20AES0501	Problem Solving and Programming	4	0	2	3	30	70	100
6	HS LAB	20AHS9902	Communicative English Lab	0	0	3	1.5	30	70	100
7	BS LAB	20ABS9907	Applied Physics Lab	0	0	3	1.5	30	70	100
8	ES LAB	20AES0503	Problem Solving and Programming Lab	0	0	3	1.5	30	70	100
			<b>Total credits</b>				<b>19.5</b>	<b>240</b>	<b>560</b>	<b>800</b>



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data**

**Science(AI&DS)**

**Year: I**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	Algebra and Calculus	L	T/CLC	P	C
20ABS9901	I-I		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

- CO1. Apply the matrix algebra techniques for solving various linear equations.
- CO2. Analyze the linear transformations of quadratic forms and mean value theorems.
- CO3. Apply the fundamental concepts of partial derivatives for multi variable functions.
- CO4. Evaluate the multiple integrals in cartesian, polar, cylindrical, and spherical co-ordinate systems.
- CO5. Evaluate the improper integrals using special functions like Beta and Gamma.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Apply	the matrix algebra techniques	for solving various linear equations		L3
2	Analyze	the linear transformations of quadratic forms and mean value theorems.			L4
3	Apply	the fundamental concepts of partial derivatives	for multi variable functions		L3
4	Evaluate	the multiple integrals	in cartesian, polar, cylindrical, and spherical co-ordinate systems		L5
5	Evaluate	the improper integrals	using special functions like Beta and Gamma		L5

**Unit I : Matrix Operations and Solving Systems of Linear Equations**

**12hrs**

Rank of a matrix by echelon form, solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigen vectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem,

**Unit II : Quadratic Forms and Mean Value Theorems**

**9hrs**

Diagonalisation of a matrix, quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation. Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin's theorems with remainders (without proof);

**Unit III: Multivariable calculus**

**9hrs**

Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

**Unit IV: Multiple Integrals**

**10hrs**

Double integrals, change of order of integration, double integration in polar coordinates, change of Variables in double integration (Cartesian to polar), areas enclosed by plane curves. Evaluation of triple integrals.

**Unit V: Special Functions**

**10hrs**

Beta and Gamma functions and their properties, relation between beta and gamma functions, Bessel functions, Bessel's equation, Recurrence formulae or  $J_n(x)$ , Generating function- Orthogonality of Bessels functions.

**Textbooks:**

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

**References:**

1. Dr.T.K.Viyengar, B.Krishna Gandhi, S. Ranganathamamd M.V.S.S.N Prasad, Mathematics – 1, S.Chand publications.
2. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
3. B.V.Ramana, Higher Engineering Mathematics, McGraw Hill Education.
4. N.Bali, M.Goyal, C.Watkins, Advanced Engineering Mathematics, Infinity Science Press.

**Mapping of COs to POs**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1		3									
CO2	3										
CO3	3										
CO4		3									
CO5		3									

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

**Correlation matrix**

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	14	21.21	3	Apply	L3	PO2	Apply (L3)	3
2	10	15.15	2	Analyze	L4	PO2	Analyze (L4)	3
3	14	21.21	3	Apply	L3	PO1	Apply (L3)	3
4	14	21.21	3	Evaluate	L5	PO1	Apply (L3)	3
5	14	21.21	3	Evaluate	L5	PO1	Apply (L3)	3

**Justification:**

**CO1: Apply** the matrix algebra techniques for solving various linear equations.

Action Verb: Analyze (L4)

PO2 Verbs: Analyze (L4)

CO1 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

**CO2: Analyze** the linear transformations of quadratic forms and mean value theorems.

Action Verb: Analyze (L4)

PO2 Verbs: Analyze (L4)

CO2 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

**CO3: Apply** the fundamental concepts of partial derivatives for multi variable functions.

Action Verb: Apply (L3)

PO2 Verbs: Analyze (L4)

CO3 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

**CO4: Evaluate** the multiple integrals in cartesian, polar, cylindrical, and spherical co-ordinate systems.

Action Verb: Evaluate (L5)

PO1 Verb: Apply (L3)

CO4 Action Verb is high level to PO1 verb; Therefore correlation is high (3).

**CO5: Evaluate** the improper integrals using special functions like Beta and Gamma.

Action Verb: Evaluate (L5)

PO1 Verb: Apply (L3)

CO5 Action Verb is high level to PO1 verb; Therefore correlation is high (3).



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**Artificial Intelligence and Data Science (AI&DS)**

**Year: I**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	APPLIED PHYSICS	L	T/CLC	P	C
20ABS9902	I-I		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

**CO 1: Understand** the properties of light and electromagnetic waves.

**CO 2: Analyze** the fundamentals of Lasers and optical fibers.

**CO 3: Analyze** the properties of dielectric and magnetic materials.

**CO 4: Analyze** the charge carrier dynamics in semiconductors by implementing the equations of state.

**CO 5: Apply** the basic concepts of superconductors and nanomaterials for engineering problems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	<b>Understand</b>	The properties of light and electromagnetic waves.			L2
2	<b>Analyze</b>	The fundamentals of Lasers and optical fibers.			L4
3	<b>Analyze</b>	The properties of dielectric and magnetic materials.			L4
4	<b>Analyze</b>	The charge carrier dynamics in semiconductors.	By implementing the equations of state.		L4
5	<b>Apply</b>	The basic concepts of superconductors and nanomaterials		for engineering problems.	L3

**Unit I: Optics and EM Theory**

**10 Hrs**

Interference of light -principle of superposition-Conditions for sustained Interference-Interference in thin films (reflected light) - Newton's Rings -Determination of Wavelength. Diffraction-Fraunhofer diffraction- Single slit and double slit- Diffraction Grating. Divergence and Curl of Electric and Magnetic Fields - Gauss' theorem for divergence and Stokes' theorem for curl - Maxwell's Equations (Quantitative) - Electromagnetic wave - propagation in non-conducting medium - Poynting's Theorem.

**Unit II : Lasers and Fiber Optics**

**10 Hrs**

Lasers - Introduction - Characteristics - Spontaneous and Stimulated Emission - Einstein Coefficients - Population Inversion - Excitation Mechanism and Optical Resonator - He-Ne Laser - Nd:YAG Laser - Semiconductor Diode Laser - Applications of Lasers.

Introduction to Optical Fibers - Total Internal Reflection - Critical angle of propagation -Acceptance angle - Numerical Aperture - Classification of fibers based on Refractive index profile - Propagation of electromagnetic wave through optical fiber - modes - importance of V-number-Attenuation, Block Diagram of Fiber optic Communication - Industrial Applications -Fiber optic Sensors.

**Unit III : Dielectric and Magnetic Materials**

**8 Hrs**

Introduction—Dielectric polarization-Dielectric polarizability, Susceptibility and Dielectric constant-Types of polarizations : Electronic and Ionic,(Quantitative), Orientation Polarizations (Qualitative) - Frequency dependence of polarization-Lorentz (internal) field-Claussius-Mosotti equation-Applications of Dielectrics: Ferroelectricity. Introduction-Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability-Origin of permanent magnetic moment - Classification of Magnetic materials - Weiss theory of ferromagnetism (qualitative) - Hysteresis- soft and hard magnetic materials - Magnetic memory device applications.

Origin of Energy bands (Qualitative)-Intrinsic and Extrinsic semiconductors -Direct and indirect band gap semiconductors- Density of charge carriers – Fermi energy--Dependence of Fermi energy on carrier concentration and temperature – Electrical conductivity – Drift and Diffusion currents – Continuity equation - Hall effect -Applications of Hall effect and Semiconductors.

**Unit V: Superconductors and Nanomaterials**

Superconductors-Properties-Meissner's effect-BCS Theory (Qualitative) - Josephson effect (AC&DC)- Types of Superconductors-Applications of superconductors.

Nanomaterials-Significance of nanoscale-: Physical, Mechanical, Magnetic, Optical properties of nanomaterials -Synthesis of nanomaterials:Top-down-Ball Milling, Bottom-up-Chemical vapour deposition-Characterization of nanomaterials : X-Ray Diffraction (XRD), Scanning Electron Microscope (SEM)-Applications of Nanomaterials.

**Textbooks:**

1. M. N. Avadhanulu, P. G. Kshirsagar &TVS Arun Murthy" A Text book of Engineering Physics"-S. Chand Publications,11th Edition2019.
2. B.K.Pandey and S.Chaturvedi, Engineering Physics, Cengage Learning,2012.

**References:**

1. K Thyagarajan "Engineering Physics",-Mc Graw Hill Publishing Company Ltd, 2016
2. Shatendra Sharma, Jyotsna Sharma, " Engineering Physics", Pearson Education,2018
3. David J.Griffiths,"Introduction to Electrodynamics"-4/e, Pearson Education, 2014
4. T Pradeep, "A Text book of NanoScience and NanoTechnology"-Tata Mc Graw Hill 2013.

**Mapping of COs to POs and PSOs**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2												
CO2	3			3									
CO3	3			3									
CO4	3			3									
CO5	3												

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

**Correlation matrix**

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	16	23.8	3	Understand	L2	PO1	PO1: Apply (L3)	2
2	11	16.4	2	Analyze	L4	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
3	12	17.9	2	Analyze	L4	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
4	13	19.4	2	Analyze	L4	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
5	15	22.3	3	Apply	L3	PO1, PO4	PO1: Apply (L3)	3
	67							



## **Justification Statements :**

**CO1: 1.Understand the properties of light and electromagnetic waves.**

**Action Verb: Understand (L2)**

PO1 Verbs: Apply (L3)

CO1 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

**CO2: Analyze the fundamentals of Lasers and optical fibers.**

**Action Verb: Analyze (L4)**

PO1 Verbs: Apply (L3);

PO4 Verbs: Analyze (L4);

CO2 Action Verb is greater than PO1 verb; Therefore, correlation is high (3).

CO2 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).

**CO3: Analyze the properties of dielectric and magnetic materials.**

**Action Verb: Analyze (L4)**

PO1 Verbs: Apply (L3);

PO4 Verbs: Analyze (L4);

CO3 Action Verb is greater than PO1 verb; Therefore, correlation is high (3).

CO3 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).

**CO4: Analyze the charge carrier dynamics in semiconductors by implementing the equations of state.**

**Action Verb: Analyze (L4)**

PO1 Verbs: Apply (L3); PO4 Verbs: Analyze (L4);

CO4 Action Verb is greater than PO1 verb; Therefore, correlation is high (3).

CO4 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).

**CO5: 5.Apply the basic concepts of superconductors and nanomaterials for engineering problems.**

**Action Verb: Apply (L3)**

PO1 Verb: Apply (L3)

CO5 Action verb is equal to PO1 verb; therefore, the correlation is high (3).



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: I**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	COMMUNICATIVE ENGLISH	L	T/CLC	P	C
20AHS9901	I-I		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

**CO1:** Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English (Listening and Writing)

**CO2:** Apply grammatical structures to formulate sentences and correct word forms (Grammar )

**CO3:** Analyze discourse markers to speak clearly on a specific topic in informal discussions (Speaking)

**CO4:** Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.(Reading and Writing)

**CO5:** Create a coherent paragraph interpreting a figure/graph/chart/table (Writing)

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English.			L2
2	Apply	grammatical structures to formulate sentences and correct word forms.			L3
3	Analyze	discourse markers to speak clearly on a specific topic in informal discussions.			L4
4	Evaluate	reading/listening texts and to write summaries based on global comprehension of these texts.			L5
5	Create	a coherent paragraph interpreting a figure/graph/chart/table.			L6

<b>UNIT - I</b>		10 Hours (4L+6P)
<b>Lesson: On the Conduct of Life: William Hazlitt</b> <b>Listening:</b> Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions. <b>Speaking:</b> Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others. <b>Reading:</b> Skimming to get the main idea of a text; scanning to look for specific pieces of information. <b>Writing :</b> Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph. <b>Grammar and Vocabulary- I :</b> Parts of Speech, Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countable and uncountable; singular and plural; basic sentence structures; simple question form – wh questions; word order in sentences.		
<b>UNIT - II</b>	<b>Probability</b>	10 Hours (4L+6P)
<b>Lesson: The Brook: Alfred Tennyson</b> <b>Listening:</b> Answering a series of questions about main idea and supporting ideas after listening to audio texts. <b>Speaking:</b> Discussion in pairs/small groups on specific topics followed by short structured talks. <b>Reading:</b> Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together. <b>Writing:</b> Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters. <b>Grammar &amp; Vocabulary building-1:</b> Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions. <b>Vocabulary building:2</b> Idioms and Phrases, Homonyms, Homophones and Homographs.		
<b>UNIT - III</b>		10 Hours (4L+6P)

<b>Lesson: The Death Trap: Saki</b>		
<b>Listening:</b> Listening for global comprehension and summarizing what is listened to.		
<b>Speaking:</b> Discussing specific topics in pairs or small groups and reporting what is discussed		
<b>Reading:</b> Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension.		
<b>Writing:</b> Summarizing – identifying main idea/s and rephrasing what is read.		
<b>Grammar and Vocabulary building-II:</b> Direct and indirect speech, reporting verbs for academic purposes.		
<b>Technical Writing-1:</b> personal experiences, unforgettable incidents, travelogues. (Imaginative, Narrative and Descriptive).		
<b>UNIT – IV</b>		10 Hours (4L+6P)
<b>Lesson: Innovation: Muhammad Yunus</b>		
<b>Listening:</b> Making predictions while listening to conversations/ transactional dialogues without video; listening with video.		
<b>Speaking:</b> Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions		
<b>Reading:</b> Studying the use of graphic elements in texts to convey information, reveal trends / patterns / relationships, communicate processes or display complicated data.		
<b>Writing:</b> Letter Writing: Official Letters/Report writing, e-mail writing		
<b>Grammar and Vocabulary:</b> Quantifying expressions - adjectives and adverbs; comparing and contrasting; Voice - Active & Passive Voice.		
<b>Vocabulary:2 :</b> Jigsaw Puzzles, Vocabulary Activities through Web tools		
<b>UNIT – V</b>		10 Hours (4L+6P)
<b>Lesson: Politics and the English Language: George Orwell</b>		
<b>Listening:</b> Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.		
<b>Speaking:</b> Formal oral presentations on topics from academic contexts - without the use of PPT slides.		
<b>Reading:</b> Reading for comprehension.		
<b>Writing:</b> Writing structured essays on specific topics using suitable claims and evidences.		
<b>Grammar and Vocabulary:</b> Editing short texts –identifying and correcting common errors in grammar and usage.		
<b>Technical Writing-2:</b> Narrative short story, News paper articles on science fiction.		
<b>Textbooks:</b>		
1. Language and Life: A Skills Approach- I Edition 2019, Orient Black Swan		
<b>Reference Books:</b>		
1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.		
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.		
3. Raymond Murphy’s English Grammar in Use Fourth Edition (2012) E-book		
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.		
5. Oxford Learners Dictionary, 12th Edition, 2011		
6. Norman Lewis Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary (2014)		
7. Speed Reading with the Right Brain: Learn to Read Ideas Instead of Just Words by David Butler		
<b>Web Links</b>		
<a href="http://www.englishclub.com">www.englishclub.com</a>		
<a href="http://www.easyworldofenglish.com">www.easyworldofenglish.com</a>		
<a href="http://www.languageguide.org/english/">www.languageguide.org/english/</a>		
<a href="http://www.bbc.co.uk/learningenglish">www.bbc.co.uk/learningenglish</a>		
<a href="http://www.eslpod.com/index.html">www.eslpod.com/index.html</a>		
<a href="http://www.myenglishpages.com">www.myenglishpages.com</a>		

#### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01										3			
C02									2	3			
C03										3			
C04										3			
C05										3			

**Corelation Matrix**

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	10	20	2	Understand	L2	PO10	Communication	2
2	10	20	2,2	Apply	L3	PO9,PO10	Individual and Team work, Communication	2,2
3	10	20	3	Analyze	L4	PO10	Communication	3
4	10	20	3	Evaluate	L5	PO10	Communication	3
5	10	20	3	Create	L6	PO10	Communication	3

**Justification Statements :**

**CO1: Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English**

**Action Verb: Understand (L2)**

CO1 Action Verb Understand is of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate(2).

**CO2: Apply grammatical structures to formulate sentences and correct word forms.**

**Action Verb: Apply (L3)**

CO2 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2)

**CO3: Analyze discourse markers to speak clearly on a specific topic in informal discussions**

**Action Verb: Analyze (L4)**

CO3 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 to PO11 as high (3).

**CO4: Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.**

**Action Verb: Evaluate (L5)**

CO4 Action Verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 to PO11 as high (3).

**CO5: Create a coherent paragraph interpreting a figure/graph/chart/table**

**Action Verb: Create (L6)**

CO5 Action Verb Create is of BTL 6. Using Thumb rule, L6 correlates PO6 to PO11 as high (3).



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: I**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	Engineering Graphics	L	T/CLC	P	C
20AES0301	I-I		1	0	4	3

**Course Outcomes:**

After studying the course, student will be able to

CO1. **Apply** the concepts of engineering curves for technical drawing

CO2. **Understand** the quadrant system to locate the position of points and projection of lines

CO3. **Analyze** the projection of planes as well as solids located in quadrant system

CO4. **Analyze** the sectional views and development of surfaces of regular solids

CO5. **Apply** orthographic and isometric projections concepts to construct the given object.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Apply	the concepts of engineering curves		for technical drawing	L3
CO2	Understand	the quadrant system to locate the position of points and projection of lines			L2
CO3	Analyze	draw the projection of planes as well as solids		located in quadrant system	L4
CO4	Analyze	the sectional views and development of surfaces		of regular solids	L4
CO5	Apply	orthographic and isometric projections concepts to construct the given object			L3

**Unit I: Introduction to Engineering graphics:** Principles of Engineering Graphics and their significance Conventions in drawing - lettering - BIS conventions.

- Conic sections including the rectangular hyperbola- general method only,
- Cycloid, epicycloids and hypocycloid

**Unit II: Projection of points, lines:** Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line, traces.

**Unit III: Projections of Planes:** Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line. Projections of regular plane surfaces.

**Projections of Solids:** Projections of regular solids inclined to one or both planes by rotational or auxiliary views method.

**Unit IV: Sections of solids:** Section planes and sectional view of right regular solids- prism, cylinder, pyramid and cone. True shapes of the sections.

**Development of surfaces:** Development of surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts.

**Unit V: Orthographic Projections:** Systems of projections, conventions and application to orthographic projections.

**Isometric Projections:** Principles of isometric projection- Isometric scale; Isometric views -lines, planes, figures, simple and compound solids.

**Text Books:**

- K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers
- N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers
- Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill

4. Shah and Rana, Engineering Drawing, 2/e, Pearson Education
5. Basant Agarwal & C.M. Agarwal, Engineering Drawing, Tata McGraw-Hill

### Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3		3							3		2	2
CO2	2		2							3		2	2
CO3	2		2							3		2	2
CO4	3		3							3		2	2
CO5	3		3							3		2	2

### Co-relation Matrix:

CO	CO					Program Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO5)	Level of Correlation
	Lesson Plan (Hrs)	%	Correlation	Verb	BTL			
1	18	24	3	Apply	L3	PO1 PO3 PO10 PSO1 PSO2	Apply (L3) Develop (L3) TR TR TR	3 3 1 2 2
2	15	20	2	Understand	L2	PO1 PO3 PO10 PSO1 PSO2	Apply (L3) Develop (L3) TR TR TR	2 2 1 2 2
3	15	20	2	Analyze	L4	PO1 PO3 PO10 PSO1 PSO2	Apply (L3) Develop (L3) TR TR TR	3 3 1 2 2
4	15	20	2	Analyze	L4	PO1 PO3 PO10 PSO1 PSO2	Apply (L3) Develop (L3) TR TR TR	3 3 1 2 2
5	12	16	2	Apply	L3	PO1 PO3 PO10 PSO1 PSO2	Apply (L3) Develop (L3) TR TR TR	3 3 1 2 2

### Justification Statements:

**CO1: Apply** the concepts of engineering curves for technical drawing

Action Verb: **Apply (L3)**

PO1 Verb: **Apply (L3)**

CO1 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2 Verb: **Develop (L3)**

CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO10 Verb: Thumb Rule (TR)

CO1: Engineering graphics involves creating visual representations and technical drawings to communicate design ideas, concepts and specifications. Therefore, the correlation is high (3)

**CO2: Understand** the quadrant system to locate the position of points and projection of lines.

Action Verb: **Understand (L2)**

PO1 Verb: **Apply (L3)**

CO2: Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)

PO2 Verb: **Develop (L3)**

CO2: Action verb is less than PO2 verb by one level. Therefore, the correlation is medium (2)

PO10 Verb: Thumb Rule (TR)

CO2: Engineering graphics involves creating visual representations and technical drawings to communicate design ideas, concepts and specifications. Therefore, the correlation is high (3)

**CO3: Analyze** the projection of planes as well as solids located in quadrant system.

Action Verb: Analyze (L4)

PO1 Verb: **Apply (L3)**

CO3: Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2 Verb: **Develop (L3)**

CO3: Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO10 Verb: Thumb Rule (TR)

CO3: Engineering graphics involves creating visual representations and technical drawings to communicate design ideas, concepts and specifications. Therefore, the correlation is high (3)

**CO4: Analyze** the sectional views and development of surfaces of regular solids

Action Verb: Analyze (L4)

PO1 Verb: **Apply (L3)**

CO4: Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2 Verb: **Develop (L3)**

CO4: Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO10 Verb: Thumb Rule (TR)

CO4: Engineering graphics involves creating visual representations and technical drawings to communicate design ideas, concepts and specifications. Therefore, the correlation is high (3)

**CO5: Apply** orthographic and isometric projections concepts to construct the given object.

Action Verb: **Apply (L3)**

PO1 Verb: **Apply (L3)**

CO5: Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2 Verb: **Develop (L3)**

CO5: Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO10 Verb: Thumb Rule (TR)

CO5: Engineering graphics involves creating visual representations and technical drawings to communicate design ideas, concepts and specifications. Therefore, the correlation is high (3)





**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: I**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	Problem Solving And Programming	L	T/CLC	P	C
20AES0501	I-I		4	0	2	3

**Course Outcomes:**

After studying the course, student will be able to

CO 1: **Understand** the Programming and Algorithms concepts to Perform Basic operations.

CO 2: **Apply** the problem solving approaches to generate different algorithms.

CO 3: **Understand** the various operators to perform mathematical operations.

CO 4: **Apply** the Pointers and Array Techniques to manipulate the data.

CO 5: **Analyze** the Sorting and Searching Techniques to arrange the data in sorted order.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the Programming and Algorithms concepts		to Perform Basic operations.	L2
CO2	Apply	the problem solving approaches		to generate different algorithms	L3
CO3	Understand	the various operators		to perform mathematical operations	L2
CO4	Apply	the Pointers and Array Techniques		to manipulate the data	L3
CO5	Analyze	the Sorting and Searching Techniques		to arrange the data in sorted order.	L4

<b>UNIT - I</b>	8 Hrs
<b>Computer Fundamentals:</b> What is a Computer, Evolution of Computers, Generations of Computers, Classification of Computers, Anatomy of a Computer, Memory revisited, Introduction to Operating systems, Operational overview of a CPU. <b>Introduction to Programming, Algorithms and Flowcharts:</b> Programs and Programming, Programming languages, Compiler, Interpreter, Loader, Linker, Program execution, Fourth generation languages, Fifth generation languages, Classification of Programming languages, Structured programming concept, Algorithms, Pseudo-code, Flowcharts, Strategy for designing algorithms, Tracing an algorithm to depict logic, Specification for converting algorithms into programs.	
<b>UNIT - II</b>	9 Hrs
<b>Introduction to computer problem solving:</b> Introduction, the problem-solving aspect, top-down design, implementation of algorithms, the efficiency of algorithms, and the analysis of algorithms. <b>Fundamental algorithms:</b> Exchanging the values of two variables, counting, summation of a set of numbers, factorial computation, sine function computation, generation of the Fibonacci sequence, reversing the digits of an integer.	
<b>UNIT - III</b>	8 Hrs
<b>Types, Operators, and Expressions:</b> Variable names, data types and sizes, constants, declarations, arithmetic operators, relational and logical operators, type conversions, increment and decrement operators, bitwise operators, assignment operators and expressions, conditional expressions precedence and order of evaluation. <b>Input and output:</b> standard input and output, formatted output-Printf, formatted input-Scanf. <b>Control Flow:</b> Statements and blocks, if-else, else-if, switch, Loops-while and for, Loops-Do- while, break and continue, Goto and labels. <b>Functions and Program Structure:</b> Basics of functions, functions returning non-integers, external variables, scope variables, header variables, register variables, block structure, initialization, recursion, the C processor.	
<b>UNIT - IV</b>	9 Hrs
<b>Factoring methods:</b> Finding the square root of a number, the smallest divisor of a number, the greatest common divisor of two integers, generating prime numbers.	



**Pointers and arrays:** Pointers and addresses, pointers and function arguments, pointers and arrays, address arithmetic, character pointers and functions, pointer array; pointers to pointers, Multi-dimensional arrays, initialization of arrays, pointer vs. multi-dimensional arrays, command line arguments, pointers to functions, complicated declarations.

**Array Techniques:** Array order reversal, finding the maximum number in a set, removal of duplicates from an order array, finding the kth smallest element

<b>UNIT - V</b>	9 Hrs
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**Sorting and Searching:** Sorting by selection, sorting by exchange, sorting by insertion, sorting by partitioning, binary search.

**Structures:** Basics of structures, structures and functions, arrays of structures, pointers to structures, self referential structures, table lookup, typedef, unions, bit-fields.

**Some other Features:** Variable-length argument lists, formatted input-Scanf, file access, Error handling-stderr and exit, Line Input and Output, Miscellaneous Functions.

**Textbooks:**

1. Pradip Dey, and Manas Ghosh, "Programming in C", 2018, Oxford University Press.
2. R.G. Dromey, "How to Solve it by Computer". 2014, Pearson.
3. Brian W. Kernighan, and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Pearson.

**Reference Books:**

1. RS Bichkar "Programming with C", 2012, Universities Press.
2. Pelin Aksoy, and Laura Denardis, "Information Technology in Theory", 2017, Cengage Learning.
3. Byron Gottfried and Jitender Kumar Chhabra, "Programming with C", 4th Edition, 2019, McGraw Hill Education.

**Online Learning Resources:**

[www.nptel.ac.in](http://www.nptel.ac.in)

**Mapping of course outcomes with program outcomes**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3										3	
CO2	3	2	3								2	2	
CO3	2	3									2	2	
CO4	3	3	3								2	2	
CO5	3	3	3								2	2	2

**Correlation matrix**

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	19	25%	3	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	10	14%	2	CO2: Apply	L3	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO11: Thumb rule	3 2 3 2
3	19	25%	3	CO3: Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review (L2) PO11: Thumb rule	2 3 2
4	15	20%	2	CO4: Apply	L3	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO11: Thumb rule	3 3 3 2
5	12	16%	2	CO5: Analyze	L4	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop(L3) PO11: Thumb rule	3 3 3 2
	75	100 %						

## Justification Statements :

**CO1: Analyze** the Programming and Algorithms concepts to Perform Basic operations.

**Action Verb: Analyze (L4)**

**PO1 Verb: Apply (L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)

**PO2 Verb: Review (L2)**

CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

**CO2: Apply** the problem solving approaches to generate different algorithms.

**Action Verb: Apply (L3)**

**PO1: Apply (L3)**

CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

**PO2: Analyze (L4)**

CO2 Action verb is less than PO2 verb by one level. Therefore, the correlation is medium (2)

**PO3: Develop (L3)**

CO2 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)

**PO11: Thumb rule**

**Some of the Algorithm knowledge are used to solve various problems. Therefore, the correlation is medium (2)**

**CO3: Understand** the various operators to perform mathematical operations.

**Action Verb: Understand (L2)**

**PO1: Apply (L3)**

CO3 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)

**PO2: Review (L2)**

CO3 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

**PO11: Thumb rule**

For some mathematical operations to perform operators are used to create programs. Therefore, the correlation is medium (2)

**CO4: Apply** the Pointers and Array Techniques to manipulate the data.

**Action Verb: Apply (L3)**

**PO1: Apply (L3)**

CO4 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

**PO2: Review (L2)**

CO4 Action verb is greater than PO2 verb by one level. Therefore, the correlation is high (3)

**PO3: Develop (L3)**

CO4 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)

**PO11: Thumb rule**

For some mathematical operations to perform Pointers and Array Techniques are used to create programs. Therefore, the correlation is medium (2)

**CO5: Analyze** the Sorting and Searching Techniques to arrange the data in sorted order.

**Action Verb: Analyze (L4)**

**PO1: Apply (L3)**

CO5 Action verb is less than PO1 verb by two levels. Therefore, the correlation is low (1)

**PO2: Review (L2)**

CO5 Action verb is greater than PO2 verb by one level. Therefore, the correlation is high (3)

**PO3: Develop (L3)**

CO5 Action verb is greater than PO3 verb by one level. Therefore, the correlation is high (3)

**PO11: Thumb rule**

For some Data Structures operations to perform Sorting and Searching Techniques are used to create programs. Therefore, the correlation is medium (2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: I**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	COMMUNICATIVE ENGLISH LAB	L	T/CLC	P	C
20AHS9902	I-I		0	0	3	1.5

**Course Outcomes:**

After studying the course, student will be able to

**CO1:** Evaluate awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.

**CO2:** Understanding the different aspects of the language with emphasis on LSRW skills and make use of different strategies in discussions.

**CO3:** Apply knowledge of vocabulary and skills in various language learning activities.

**CO4:** Analyze speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.

**CO5:** Evaluate the acceptable etiquette essentials in social and professional presentations.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	<b>Evaluate</b>	awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.			<b>L5</b>
2	<b>Understand</b>	The different aspects of the language with emphasis on LSRW skills and make use of different strategies in discussions.			<b>L2</b>
3	<b>Apply</b>	knowledge of vocabulary and skills in various language learning activities			<b>L3</b>
4	<b>Analyze</b>	speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.			<b>L4</b>
5	<b>Evaluate</b>	the acceptable etiquette essentials in social and professional presentations.			<b>L5</b>

<b>UNIT - I</b>	
1. Phonetics 2. Non - verbal communication 3. Vocabulary (word formation, one word substitutes, words often misused & confused, collocations idioms & phrases)	
<b>UNIT - II</b>	
1. Reading Comprehension 2. JAM 3. Distinction between Native and Indian English accent (Speeches by TED and Kalam).	
<b>UNIT - III</b>	
1. Situational dialogues/Giving Directions 2. Describing objects/places/persons	
<b>UNIT - IV</b>	
1. Fun - Buzz (Tongue twisters, riddles, puzzles etc) 2. Formal Presentations	
<b>UNIT - V</b>	
1. Debate (Contemporary / Complex topics) 2. Group Discussion	
<b>Software Source</b>	
K-Van Solutions Software	
<b>Reference Books:</b>	

**Mapping of course outcomes with program outcomes**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1										3			
CO2									2				
CO3										2			
CO4										3			
CO5										3			

**Corelation Matrix**

CO	Percentage of contact hours over the total planned contact hours (Approx. Hrs)			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
		%	corr	Verb	BTL			
1	9	25	3	Evaluate	L5	PO10	Communicate	3
2	6	16	2	Understand	L2	PO9	Function	2
3	6	16	2	Apply	L3	PO10	Communicate	2
4	6	16	3	Analyze	L4	PO10	Communicate	3
5	9	25	3	Evaluate	L5	PO10	Communicate	3

**Justification Statements:**

**CO1: Evaluate awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.**

**Action Verb: Evaluate (L5)**

CO1 Action Verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 to PO11 as high (3).

**CO2: Understanding the different aspects of the language with emphasis on LSRW skills and make use of different strategies in discussions**

**Action Verb: Understand(L2)**

CO2 Action Verb Understand is of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2)

**CO3: Apply knowledge of vocabulary and skills in various language learning activities**

**Action Verb: Apply (L3)**

CO3 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).

**CO4: Analyze speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension**

**Action Verb: Analyze (L4)**

CO4 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 to PO11 as high (3).

**CO5: : Evaluate the acceptable etiquette essentials in social and professional presentations.**

**Action Verb: Evaluate (L5)**

CO5 Action Verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 to PO11 as high (3).

Course Code	Year & Sem	Applied Physics Lab	L	T/CLC	P	C
20ABS9907	I-I		0	0	3	1.5

### Course Outcomes:

After studying the course, student will be able to

**C01:** Analyze the properties of light for solving engineering problems.

**C02:** Understand the basic concepts of electromagnetic induction.

**C03:** Evaluate the crystallite size using X-ray diffraction.

**CO4:** Analyze the basic properties of dielectric and magnetic behavior of the given material.

**C05:** Evaluate the basic parameters of a given semiconductor material.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Analyze	The properties of light for solving engineering problems.			L4
2	Understand	The basic concepts of electromagnetic induction.			L2
3	Evaluate	The crystallite size	using X-ray diffraction.		L5
4	Analyze	The basic properties of dielectric and magnetic behavior of the given material.			L4
5	Evaluate	The basic parameters of a given semiconductor material.			L5

## List of Experiments

1. Determination of the thickness of the wire using wedge shape method. **(C01)**
2. Determination of the radius of curvature of the lens by Newton's ring method. **(C01)**
3. Determination of wavelength by plane diffraction grating method. **(C01)**
4. Dispersive power of a diffraction grating. **(C01)**
5. Study of the Magnetic field along the axis of a circular coil carrying current. **(C02)**
6. Study the variation of B versus H of the magnetic material (B-H curve) **(C04)**
7. Determination of the numerical aperture of a given optical fiber and angle of acceptance. **(C01)**
8. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect. **(C05)**
9. Determination of the energy gap of a semiconductor. **(C05)**
10. Determination of crystallite size using X-Ray diffraction spectra. **(C03)**
11. Determination of Wavelength of LASER using diffraction grating. **(C01)**
12. Determination of particle size using LASER. **(C01)**
13. Determination of the resistivity of semiconductor by Four probe method. **(C05)**
14. Determination of dielectric constant by charging and discharging method. **(C04)**
15. Study the temperature dependence of resistance of a thermister. **(C05)**

### Reference Books:

1. S. Balasubramanian, M.N.Srinivasan, "A Text book of Practical Physics"-S Chand Publishers, 2017.
2. <http://vlab.amrita.edu/index.php-VirtualLabs>, Amrita University.

### Mapping of course outcomes with program outcomes

[illegible]

### Corelation Matrix:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	9	25	3	Analyze	L4	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3
2	6	16	2	Understand	L2	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	2
3	6	16	2	Evaluate	L5	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3
4	9	25	3	Analyze	L4	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3
5	6	16	2	Evaluate	L5	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3
	36							

### Justification Statements:

**CO1: Analyze the properties of light for solving engineering problems.**

**Action Verb: Analyze (L4)**

PO1 Verbs: Apply (L3)

PO4 Verb: Analyze (L4)

CO1 Action Verb is greater than PO1 verb by one level; Therefore, correlation is high (3).

CO1 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).

**CO2: Understand the basic concepts of electromagnetic induction.**

**Action Verb: Understand (L2)**

PO1 Verbs: Apply (L3)

PO4 Verb: Analyze (L4)

CO2 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).

CO2 Action Verb is greater than PO1 verb by two levels; Therefore correlation is low (1).

**CO3: Evaluate the crystallite size using X-ray diffraction.**

**Action Verb: Evaluate (L5)**

PO1 Verbs: Apply (L3)

PO4 Verb: Analyze (L4)

CO3 Action Verb level is greater than PO1 action verb by two levels; Therefore correlation is high (3).

CO3 Action Verb level is greater than PO4 action verb by one level; Therefore correlation is high (3).

**CO4: Analyze the basic properties of dielectric and magnetic behavior of the given material.**

**Action Verb: Analyze (L4)**

PO1 Verbs: Apply (L3)

PO4 Verb: Analyze (L4)

CO4 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).

CO4 Action Verb is equal to PO4 verb; Therefore correlation is high (3).

**CO5: Evaluate the basic parameters of a given semiconductor material.**

**Action Verb: Evaluate (L5)**

PO1 and PO4 Verb: Apply (L3)

CO5 Action Verb is greater than PO1 verb by two levels; Therefore correlation is high (3).

CO5 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: I**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	Problem Solving And Programming Lab	L	T/CLC	P	C
20AES0503	I-I		0	0	3	1.5

**Course Outcomes:**

After studying the course, student will be able to

**CO 1: Analyze** the basics of computer and concepts of C for writing simple programs.

**CO 2: Analyze** the control statements for solving the problems using C

**CO 3: Design** the algorithm for implementing complex problems using C.

**CO 4: Analyze** the arrays to store and retrieve the elements.

**CO 5: Apply** the different sorting techniques for solving real world problems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Analyze	the basics of computer and concepts of C		for writing simple programs	L4
CO2	Analyze	the control statements	using C	for solving the problems	L4
CO3	Design	the algorithm	using C	for implementing complex problems	L6
CO4	Analyze	the arrays		to store and retrieve the elements.	L4
CO5	Apply	the different sorting techniques		for solving real world problems	L3

**List of Experiments**

1. Assemble and disassemble parts of a Computer **(CO1)**
2. Design a C program which reverses the number **(CO1)**
3. Design a C program which finds the second maximum number among the given list of numbers. **(CO2)**
4. Construct a program which finds the kth smallest number among the given list of numbers. **(CO2)**
5. Design an algorithm and implement using C language the following exchanges  $a \leftarrow b \leftarrow c \leftarrow d \leftarrow a$  **(CO2)**
6. Develop a C Program which counts the number of positive and negative numbers separately and also compute the sum of them. **(CO2)**
7. Implement the C program which computes the sum of the first n terms of the series  $\text{Sum} = 1 - 3 + 5 - 7 + 9$  **(CO2)**
8. Design a C program which determines the numbers whose factorial values are between 5000 and 32565. **(CO2)**
9. Design an algorithm and implement using a C program which finds the sum of the infinite series  $1 - x^2/2! + x^4/4! - x^6/6! + \dots$  **(CO3)**
10. Design a C program to print the sequence of numbers in which each number is the sum of the three most recent predecessors. Assume first three numbers as 0, 1, and 1. **(CO3)**
11. Implement a C program which converts a hexadecimal, octal and binary number to decimal number and vice versa. **(CO3)**
12. Develop an algorithm which computes the all the factors between 1 and 100 for a given number and implement it using C. **(CO3)**
13. Construct an algorithm which computes the sum of the factorials of numbers between m and n. **(CO3)**
14. Design a C program which reverses the elements of the array. **(CO4)**
15. Given a list of n numbers, Design an algorithm which prints the number of stars equivalent to the value of the number. The stars for each number should be printed horizontally. **(CO4)**
16. Implement the sorting algorithms a. Insertion sort b. Exchange sort c. Selection sort d. Partitioning sort. **(CO5)**
17. Illustrate the use of auto, static, register and external variables. **(CO5)**
18. Design algorithm and implement the operations creation, insertion, deletion, traversing on a singly linked list. **(CO5)**
19. Develop a C program which takes two numbers as command line arguments and finds all the common factors of those two numbers. **(CO5)**
20. Design a C program which sorts the strings using array of pointers. **(CO5)**

Instructors may add some experiments to the above list. Moreover, 50% of the experiments are to be changed every academic year. Instructors can choose the experiments, provided those experiments are not repetitions.

#### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3										2	
CO2	3	3	3	3	3							2	
CO3	3	3	3	3	3						3	2	
CO4	3	3	3	3	3						3	2	2
CO5	3	3	3	2	3							2	2

#### Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: Analyze	L4	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	3 3
2	CO2: Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3)	3 3 3 3 3
3	CO3: Design	L6	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Formulate (L6) PO3: Design(L6) PO4: Analyze (L4) PO5: Create (L6) PO11: Thumb rule	3 3 3 3 3 3
4	CO4: Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3) PO11: Thumb rule	3 3 3 3 3 3
5	CO5: Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3)	3 3 3 2 3

#### Justification Statements :

**CO1: Analyze** the basic concepts of C for writing simple programs.

**Action Verb: Analyze (L4)**

**PO1 Verb: Apply (L3)**

CO1 Action verb is Greater than PO1 verb. Therefore, the correlation is high(3)

**PO2 Verb: Review(L2)**

CO1 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)

**CO2: Analyze** the control statements for solving the problems.

**Action Verb: Analyze (L4)**

**PO1: Apply (L3)**

CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)

**PO2: identify(L3)**



C02 Action verb is greater than as P02 verb. Therefore, the correlation is high (3)

**P03: Develop (L3)**

C02 Action verb is greater than as P03 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

C02 Action verb is same as P04 verb. Therefore, the correlation is high (3)

**P05: Apply (L3)**

C02 Action verb is greater than as P05 verb. Therefore, the correlation is high (3)

**C03: Design** the algorithm for implementing complex problems using C.

**Action Verb: Design (L6)**

**P01: Apply (L3)**

C03 Action verb is greater than as P01 verb. Therefore, the correlation is high (3)

**P02: Formulate(L6)**

C03 Action verb is same as P02 verb. Therefore, the correlation is high (3)

**P03: Design (L6)**

C03 Action verb is same as P03 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

C03 Action verb is greater than as P04 verb. Therefore, the correlation is high (3)

**P05: create (L6)**

C03 Action verb is same as P05 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

Algorithms analysis is learning process to find the solution better manner the correlation is high (3)

**C04: Analyze** the arrays to store and retrieve the elements.

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

C04 Action verb is greater than as P01 verb. Therefore, the correlation is high (3)

**P02: identify(L3)**

C04 Action verb is greater than as P02 verb. Therefore, the correlation is high (3)

**P03: Develop (L3)**

C04 Action verb is greater than as P03 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

C04 Action verb is same as P04 verb. Therefore, the correlation is high (3)

**P05: Apply (L3)**

C04 Action verb is greater than as P05 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

Data analysis is the trending approach in the current days Therefore, the correlation is high (3)

**C05: Apply** the different sorting techniques for solving real world problems.

**Action Verb: Apply (L3)**

**P01: Apply (L3)**

C05 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P02: identify(L3)**

C05 Action verb is same as P02 verb. Therefore, the correlation is high (3)

**P03: Develop (L3)**

C05 Action verb is same as P03 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

C05 Action verb is less than P04 verb by one level. Therefore, the correlation is medium (2)

**P05: Apply (L3)**

C05 Action verb is same as P05 verb. Therefore, the correlation is high (3)

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI**  
**(AUTONOMOUS)**  
**B. Tech - Artificial Intelligence and Data Science (AI&DS)**  
**(Effective for the batches admitted from 2020-21)**

**Semester II (First year)**

Sl. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P				
1	BS	20ABS9911	Probability and Statistics	4	2	0	3	30	70	100
2	BS	20ABS9921	Numerical Methods	4	2	0	3	30	70	100
3	ES	20AES0509	Basics of Python Programming	4	2	0	3	30	70	100
4	ES	20AES0502	Data Structures	4	2	0	3	30	70	100
5	ES	20AES0507	Web Design	1	0	4	3	30	70	100
6	ES LAB	20AES0510	Basics Of Python Programming Lab	0	0	3	1.5	30	70	100
7	BS LAB	20ABS9918	Computation Lab -I	0	0	3	1.5	30	70	100
8	ES LAB	20AES0504	Data Structures Lab	0	0	3	1.5	30	70	100
9	MC	20AMC9903	Environmental Studies	3	0	0	0	30	0	30
			<b>Total credits</b>				<b>19.5</b>	<b>270</b>	<b>560</b>	<b>830</b>



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: I**

**Semester: II**

**Branch of study: AIDS**

Course Code	Year & Sem	Probability and Statistics	L	T/CLC	P	C
20ABS9911	I-II		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the discrete and continuous data through various statistical methods.

**CO2: Analyze** the concepts of probability, Baye's theorem and its applications.

**CO3: Analyze** the discrete and continuous probability distributions for random data.

**CO4: Apply** the techniques for testing of hypothesis for large samples.

**CO5: Apply** the techniques for testing of hypothesis for small samples.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the discrete and continuous data	through statistical methods.		L2
CO2	Analyze	The concepts of probability and its applications			L4
CO3	Analyze	The discrete and continuous probability distributions	for random data.		L4
CO4	Apply	The techniques for testing of hypothesis	For large samples		L3
CO5	Apply	The techniques for testing of hypothesis	For small samples		L3

<b>UNIT - I</b>	<b>Descriptive statistics and methods for data science</b>	9 Hrs
Data science, Statistics Introduction, Population vs Sample, Collection of data, primary and secondary data, Type of variable: dependent and independent Categorical and Continuous variables, Data visualization, Measures of Central tendency, Measures of Variability (spread or variance) Skewness Kurtosis, correlation, correlation coefficient, rank correlation, regression coefficients, principle of least squares, method of least squares, regression lines		
<b>UNIT - II</b>	<b>Probability</b>	9 Hrs
Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.		
<b>UNIT - III</b>	<b>Probability distributions</b>	9 Hrs
Probability distribution - Binomial, Poisson approximation to the binomial distribution and normal distribution-their properties.		
<b>UNIT - IV</b>	<b>Estimation and Testing of hypothesis, large sample tests</b>	9 Hrs
Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems.		
<b>UNIT - V</b>	<b>Small sample tests</b>	9 Hrs
Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), $\chi^2$ - test for goodness of fit.		
<b>Textbooks:</b>		
1. Miller and Freunds, Probability and Statistics for Engineers, 7/e, Pearson, 2008.		
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.		
<b>Reference Books:</b>		

1. S.Chand ,Probability and Statistics, Dr.T.K.V.Iyengar, Dr.B.Krishna Gandhi, S.Ranganatham, Dr.M.V.S.S.N.Prasad
2. S. Ross, a First Course in Probability, Pearson Education India, 2002.
3. W. Feller, an Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.

#### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1		1											
CO2		3											
CO3		3											
CO4	3												
CO5	3												

#### Correlation matrix

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	11	15.06	2	Understand	L2	PO2	Analyze (L4)	1
2	15	20.52	3	Analyze	L4	PO2	Analyze (L4)	3
3	16	21.9	3	Analyze	L4	PO2	Analyze (L4)	3
4	16	21.9	3	Apply	L3	PO1	Apply (L3)	3
5	14	20	3	Apply	L3	PO1	Apply (L3)	3

#### Justification Statements :

**CO1:** Understand the discrete and continuous data through various statistical methods.

**Action Verb: Understand (L2)**

PO2 Verbs: Analyze(L4)

CO1 Action Verb is low level to PO2 verb by two levels; Therefore correlation is low (1).

**CO2:** Analyze the concepts of probability, Baye's theorem and its applications.

**Action Verb: analyze (L4)**

PO2 Verbs: Analyze (L4)

CO2 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

**CO3:** Analyze the discrete and continuous probability distributions for random data.

**Action Verb: Analyze (L4)**

PO2 Verb: Analyze (L4)

CO3 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).

**CO4:** Apply the techniques for testing of hypothesis for large samples.

**Action Verb: Apply (L3)**

PO1 Verb: Apply(L3)

CO4 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).

**CO5:** Apply the techniques for testing of hypothesis for small samples.

**Action Verb: Apply**

PO1 Verb: Apply (L3)

CO5 Action verb is equal to PO1 verb ; therefore the correlation is high (3).



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI**  
**(AUTONOMOUS)**  
**Artificial Intelligence and Data Science**  
**(AI&DS)**

**Year: I**

**Semester: II**

**Branch of study: AIDS**

Course Code	Year & Sem	Numerical Methods	L	T/CLC	P	C
20ABS9921	I-II		4	2	0	3

**Course Outcomes:**

After Studying the Course, student will be able to

**CO1: Understand** the concept of errors in numerical computations and series approximations.

**CO2: Apply** the iteration methods to solve Algebraic, Transcendental and Simultaneous Equations.

**CO3: Analyze** the relevant numerical techniques for interpolation with equal and unequal intervals.

**CO4: Analyze** the concepts of Curve fitting, Numerical differentiation and integration techniques.

**CO5: Evaluate** the numerical solutions of ordinary differential equations by using different methods.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the concept of errors in numerical computations and series approximations.			L2
CO2	Apply	the iteration methods	to solve Algebraic, Transcendental and Simultaneous Equations.		L3
CO3	Analyze	the relevant numerical techniques for interpolation	with equal and unequal intervals.		L4
CO4	Analyze	the concepts of Curve fitting, Numerical differentiation and integration techniques			L4
CO5	Evaluate	the numerical solutions of ordinary differential equations	by using different methods.		L5

<b>UNIT - I</b>		
<b>Errors in Numerical computations:</b> Errors and their Accuracy, Mathematical Preliminaries, Errors and their Analysis, Absolute, Relative and Percentage Errors, A general error formula, Error in a series approximation.		
<b>UNIT - II</b>		
<b>Solution of Algebraic and Transcendental Equations:</b> The Bisection Method – The Method of False Position– Newton-Raphson Method, Solution of linear simultaneous equation: Crout's triangularisation method, Gauss - Seidal iteration method.		
<b>UNIT - III</b>		
<b>Interpolation:</b> Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.		
<b>UNIT - IV</b>		
<b>Curve fitting:</b> Fitting of a straight line – Second degree curve – Exponential curve-Power curve by method of least squares. Numerical Differentiation for Newton's interpolation formula. Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule.		
<b>UNIT - V</b>		
<b>Numerical solution of Ordinary Differential equations:</b> Solution by Taylor's series-Picard's Method of successive Approximations-Euler's Method- Runge - Kutta Methods. Numerical solutions of Laplace		

equation using finite difference approximation.

**Textbooks:**

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI publisher.

**Reference Books:**

1. Engineering Mathematics, Volume - II, E. Rukmangadachari Pearson Publisher.
2. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S.Chand publication.
3. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
4. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.

**Mapping of course outcomes with program outcomes**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1		2											
CO2	3												
CO3		3											
CO4		3											
CO5		3											

**Correlation matrix**

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BT L			
1	10	14	3	CO1: Understand	L2	PO2	PO2: Analyze (L4)	2
2	15	21.4	2	CO2: Apply	L3	PO1	PO1: Apply(L3)	3
3	15	21.4	3	CO3: Analyze	L4	PO2	PO2: Analyze (L4)	3
4	16	22.8	3	CO4: Analyse	L4	PO2	PO2: Analyze (L4)	3
5	14	20	3	CO5: Evaluate	L5	PO2	PO2: Analyze (L4)	3
	70	100 %						

**Justification Statements:**

**CO1:** Understand the concept of errors in numerical computations and series approximations.

**Action Verb: Understand (L2)**

PO2 Verbs: Analyze (L4)

CO1 Action Verb is low level to PO2 verb by one level; Therefore correlation is moderate (2).

**CO2:** Apply the iteration methods to solve Algebraic, Transcendental and Simultaneous Equations.

**Action Verb: Apply (L3)**

PO1 Verbs: Apply (L3)

CO2 Action Verb is equal to PO1 verb; Therefore correlation is high (3).

**CO3:** Analyze the relevant numerical techniques for interpolation with equal and unequal intervals.

**Action Verb: Analyze (L4)**

PO1 Verb: Analyze (L4)

CO3 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).

**CO4:** Analyze the concepts of Curve fitting, Numerical differentiation and integration techniques.

**Action Verb: Analyze (L4)**

PO2 Verb: Analyze (L4)

CO4 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).

**CO5:** . Evaluate the numerical solutions of ordinary differential equations by using different methods.

**Action Verb: Evaluate(L5)**

PO2 Verb: Analyze (L4)

CO5 Action verb is high level to PO2 verb; therefore the correlation is high (3).



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science**

**(AI&DS)**

**Year: I**

**Semester: II**

**Branch of study: AIDS**

Course Code	Year & Sem	Basics of Python Programming	L	T/CLC	P	C
20AES0509	I-II		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the Basic concepts of python programming to build scripts in IDLE.

**CO2: Apply** the modularity techniques to invoke user defined functions.

**CO3: Apply** the concept of Strings and Lists to perform iterative operations on data.

**CO4: Apply** the Mutable and Immutable data types to perform python Programs.

**CO5: Analyze** the oops concepts to develop applications with reusability.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the Basic concepts of python programming		to build scripts in IDLE	L2
CO2	Apply	the modularity techniques		to invoke user defined functions	L3
CO3	Apply	the concept of Strings and Lists		to perform iterative operations on data	L3
CO4	Apply	the Mutable and Immutable data types		to perform python Programs	L3
CO5	Analyze	the oops concepts		to develop applications with reusability .	L4

<b>UNIT - I</b>	9Hrs
<b>Introduction:</b> What is a program, Running python, Arithmetic operators, Value and Types. <b>Variables, Assignments and Statements:</b> Assignment statements, Script mode, Order of operations, string operations, comments. <b>Functions:</b> Function calls, Math functions, Composition, Adding new Functions, Definitions and Uses, Flow of Execution, Parameters and Arguments, Variables and Parameters are local, Stack diagrams, Fruitful Functions and Void Functions, Why Functions.	
<b>UNIT - II</b>	9 Hrs
<b>Case study:</b> The turtle module, Simple Repetition, Encapsulation, Generalization, Interface design, Refactoring, docstring. <b>Conditionals and Recursion:</b> floor division and modulus, Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, Recursion, Infinite Recursion, Keyboard input. <b>Fruitful Functions:</b> Return values, Incremental development, Composition, Boolean functions, more recursion, Leap of Faith, Checking types	
<b>UNIT - III</b>	9 Hrs
<b>Iteration:</b> Reassignment, Updating variables, The while statement, Break, Square roots, Algorithms. <b>Strings:</b> A string is a sequence, len, Traversal with a for loop, String slices, Strings are immutable, Searching, Looping and Counting, String methods, The in operator, String comparison. <b>Case Study:</b> Reading word lists, Search, Looping with indices. <b>Lists:</b> List is a sequence, Lists are mutable, Traversing a list, List operations, List slices, List methods, Map filter and reduce, Deleting elements, Lists and Strings, Objects and values, Aliasing, List arguments.	
<b>UNIT - IV</b>	8 Hrs
<b>Dictionaries:</b> A dictionary is a mapping, Dictionary as a collection of counters, Looping and dictionaries, Reverse Lookup, Dictionaries and lists, Memos, Global Variables. <b>Tuples:</b> Tuples are immutable, Tuple Assignment, Tuple as Return values, Variable-length argument tuples, Lists and tuples, Dictionaries and tuples, Sequences of sequences. <b>Files:</b> Persistence, Reading and writing, Format operator, Filename and paths, Catching exceptions, Databases, Pickling, Pipes, Writing modules. <b>Classes and Objects:</b> Programmer-defined types, Attributes, Instances as Return values, Objects are mutable, Copying.	
<b>UNIT - V</b>	10Hrs
<b>Classes and Functions:</b> Time, Pure functions, Modifiers, Prototyping versus Planning <b>Classes and Methods:</b> Object oriented features, Printing objects, The init method, The _str_method, Operator overloading, Type-based Dispatch, Polymorphism, Interface and Implementation <b>Inheritance:</b> Card objects, Class attributes, Comparing cards, decks, Printing the Deck, Add Remove shuffle and sort, Inheritance, Data encapsulation. <b>The Goodies:</b> Conditional expressions, List comprehensions, Generator expressions, any and all, Sets, Counters, default dict, Named tuples, Gathering keyword Args	
<b>Textbooks:</b>	



1. Allen B. Downey, "Think Python", 2nd edition, SPD/O'Reilly, 2016.

#### Reference Books:

1. Martin C. Brown, "The Complete Reference: Python", McGraw-Hill, 2018.
2. Kenneth A. Lambert, B.L. Juneja, "Fundamentals of Python", CENGAGE, 2015.
3. R. Nageswara Rao, "Core Python Programming", 2nd edition, Dreamtech Press, 2019

#### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3			2								
CO2	3	3	3		3						2	2	2
CO3	3	3	3	2							2	2	2
CO4	3	3	3	2							2	2	2
CO5	3	3	3	3							2	2	2

#### Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan (Hrs)	%	Correlation	Co's Action verb	BTL			
1	10	19%	2	CO1 : Understand	L2	PO1 PO2 PO5	PO1: Apply(L3) PO2: Review(L2) PO5: Apply(L3)	2 3 2
2	13	24%	3	CO2 : Apply	L3	PO1 PO2 PO3 PO5 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO5: Apply(L3) PO11: Thumb rule	3 3 3 3 2
3	10	19%	2	CO3 : Apply	L3	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO4: Analyze (L4) PO11: Thumb rule	3 3 3 2 2
4	9	17%	2	CO4 : Apply	L3	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze(L4) PO11: Thumb rule	3 3 3 2 2
5	11	20%	3	CO5 : Analyze	L4	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO4: Analyze (L4) PO11: Thumb rule	3 3 3 3 2
	53	100 %						

#### Justification Statements :

**CO1: Understand the Basic concepts of python programming to build scripts in IDLE..**

**Action Verb : Understand(L2)**

PO1 Verb : Apply(L3)

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

PO2 Verb : Review(L2)

CO1 Action verb is same as PO2 verb.. Therefore the correlation is high (3)

PO5: Apply(L3)

CO1 Action verb is less than PO5 verb by one level. Therefore the correlation is medium (2)

**CO2: Apply the modularity techniques to invoke user defined functions.**

**Action Verb : Apply (L3)**

PO1: Apply(L3)

CO2 Action verb is same as PO1 verb. Therefore the correlation is high (3)

PO2: Review (L2)

CO2 Action verb is greater than PO2 verb. Therefore the correlation high (3)

PO3: Develop (L3)

CO2 Action verb same as PO3 verb. Therefore the correlation high (3)

PO5: Apply(L3)

CO2 Action verb same as PO5 verb. Therefore the correlation high (3)

PO11: Thumb rule

For some modular applications user defined functions are created to meet societal needs. Therefore the correlation is medium (2)

**CO3: Apply the concept of Strings and Lists to perform iterative operations on data.****Action Verb : Apply(L3)**

PO1: Apply(L3)

CO3 Action verb is less than PO1 verb by two level. Therefore the correlation is medium (2)

PO2: Review (L2)

CO3 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

PO3: Develop (L3)

CO3 Action verb is same level as PO3 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO3 Action verb is less than one level as PO4 verb. Therefore the correlation is medium (2)

PO11: Thumb rule

For some of python Program Concepts are used to create programs. Therefore the correlation is medium (2)

**CO4: Apply the Mutable and Immutable data types to perform python Programs.****Action Verb : Apply(L3)**

PO1: Apply(L3)

CO4 Action verb is same as PO1 verb by one level. Therefore the correlation is high (3)

PO2: Review(L2)

CO4 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

PO3: Develop (L3)

CO4 Action verb is same as PO3 verb. Therefore the correlation is high (3)

PO4: Analyze(L4)

CO4 Action verb is less than one level as PO4 verb. Therefore the correlation is medium (2)

PO11: Thumb rule

For some of python Program Concepts are used to create programs. Therefore the correlation is medium(2)

**CO5: Analyze the oops concepts to develop applications with reusability.****Action Verb : Analyze(L4)**

PO1: Apply(L3)

CO5 Action verb is greater than PO1 verb. Therefore the correlation is high (3)

PO2: Review (L2)

CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

PO3: Develop (L3)

CO5 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO5 Action verb is same level as PO4 verb. Therefore the correlation is high (3)

PO11: Thumb rule

For some of python Program Concepts are used to create programs. Therefore the correlation is medium (2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: I**

**Semester: II**

**Branch of study: AIDS**

Course Code	Year & Sem	Data Structures	L	T/CLC	P	C
20AES0502	I-II		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

**CO 1: Understand** the basic concepts of an Algorithm to measure its performance

**CO 2: Apply** the Linear Data Structure to arrange the data in memory

**CO 3: Apply** the Non-Linear Data Structure to organize the data in hierarchical structure

**CO 4: Evaluate** the real time problems using graphs and hashing techniques

**CO 5: Apply** the File handling and sorting methods to rearrange the data.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the basic concepts of an Algorithm		to measure its performance	L2
CO2	Apply	the Linear Data Structure		to arrange the data in memory	L3
CO3	Apply	the Non-Linear Data Structure		to organize the data in hierarchical structure	L3
CO4	Evaluate	the Real Time Problems	using Graphs and Hashing Techniques		L5
CO5	Apply	the File handling and sorting methods		to rearrange the data	L3

<b>UNIT - I</b>	9 Hrs
<b>Introduction</b> Algorithm Specification, Performance analysis, Performance Measurement. Arrays: Arrays, Dynamically Allocated Arrays. Structures and Unions. Sorting: Motivation, Quick sort, how fast can we sort, Merge sort, Heap sort	
<b>UNIT - II</b>	9 Hrs
<b>Stack, Queue and Linked lists</b> Stacks, Stacks using Dynamic Arrays, Queues, Circular Queues Using Dynamic Arrays, Evaluation of Expressions, Multiple Stacks and Queues. Linked lists: Singly Linked Lists and Chains, Representing Chains in C, Linked Stacks and Queues, Additional List Operations, Doubly Linked Lists.	
<b>UNIT - III</b>	9 Hrs
<b>Trees</b> Introduction, Binary Trees, Binary Tree Traversals, Additional Binary Tree Operations, Binary Search Trees, Counting Binary Trees, Optimal Binary search Trees, AVL Trees. B-Trees: B- Trees, B + Trees.	
<b>UNIT - IV</b>	9 Hrs
<b>Graphs and Hashing</b> The Graph Abstract Data Type, Elementary Graph Operations, Minimum Cost Spanning Trees, Shortest Paths and Transitive Closure Hashing: Introduction to Hash Table, Static Hashing, Dynamic Hashing.	
<b>UNIT - V</b>	9 Hrs
<b>Files and Advanced sorting</b> File Organization: Sequential File Organization, Direct File Organization, Indexed Sequential File Organization. Advanced sorting: Sorting on Several keys, List and Table sorts, Summary of Internal sorting, External sorting.	
<b>Textbooks:</b> 1. Ellis Horowitz and Sartaj Sahni, "Fundamentals of Data Structures in C", 2 <sup>nd</sup> Edition, Galgotia Book Source, Pvt. Ltd., 2004. 2. Alan L. Tharp, "File Organization and Processing", Wiley and Sons, 1988.	
<b>Reference Books:</b> 1. D. Samanta, "Classic Data Structures", 2 <sup>nd</sup> Edition, Prentice-Hall of India, Pvt. Ltd., India, 2012. 2. Peter Bras, "Advanced Data Structures", Cambridge University Press, 2016	

3. Richard F. Gilberg, Behrouz A. Forouzan, "Data Structures A Pseudo code Approach with C", Second Edition, Cengage Learning 2005.

### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3										2	
CO2	3	3		3							2	2	1
CO3	3	3		3							2	2	1
CO4	1	2	3	3			3				3	2	2
CO5	3	3	3	2							3	2	2

### Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	18	24%	3	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	14	19%	2	CO2: Apply	L3	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Review (L2) PO4: Develop (L3) PO11: Thumb rule	3 3 3 2
3	15	20%	2	CO3: Apply	L3	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Review (L2) PO4: Develop (L3) PO11: Thumb rule	3 3 3 2
4	13	18%	2	CO4: Evaluate	L5	PO1 PO2 PO3 PO4 PO7 PO11	PO1: Apply(L3) PO2: Formulate (L6) PO3: Develop (L3) PO4: Analyze(L4) PO7: Thumb rule PO11: Thumb rule	1 2 3 3 3 3
5	14	19%	2	CO5: Apply	L3	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze(L4) PO11: Thumb rule	3 3 3 2 3
	74	100 %						

### Justification Statements :

**CO1: Understand the basic concepts of an Algorithm to measure its performance**

**Action Verb: Understand (L2)**

PO1 Verb: Apply (L3)

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)

PO2 Verb: Review (L2)

CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

**CO2: Apply the Linear Data Structure to arrange the data in memory**

**Action Verb: Apply (L3)**

PO1: Apply (L3)

CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2: Review (L2)

CO2 Action verb is less than PO2 verb by one level. Therefore, the correlation is medium (2)

PO4: Develop (L3)

CO2 Action verb is same level as PO4 verb. Therefore, the correlation is high (3)

PO11: Thumb rule

For some of Linear Data Structure applications, array and structure concepts are used to write programs. Therefore, the correlation is medium (2)

**CO3: Apply the Non-Linear Data Structure to organize the data in hierarchical structure**

**Action Verb: Apply (L3)**

PO1: Apply (L3)

CO3 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2: Review (L2)

CO3 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)

PO4: Develop (L3)

CO3 Action verb is same level as PO4 verb. Therefore, the correlation is high (3)

PO11: Thumb rule

For some of Non-Linear Data Structure applications, array and structure concepts are used to write programs. Therefore, the correlation is medium (2)

**CO4: Evaluate the real time problems using graphs and hashing techniques**

**Action Verb: Evaluate (L5)**

PO1: Apply(L3)

CO4 Action verb is less than PO1 verb by two levels. Therefore, the correlation is low (1)

PO2: Review (L2)

CO4 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)

PO3: Develop (L3)

CO4 Action verb is greater than PO3 verb. Therefore, the correlation is high (3)

PO4: Analyze (L4)

CO4 Action verb is greater than PO4 verb. Therefore, the correlation is high (3)

PO7: Thumb rule

For some of Real Time problems Data Structure applications, Graph concept is indirectly used to sustainable environment development. Therefore, the correlation is high (3)

PO11: Thumb rule

For some of Real Time problems Data Structure applications, Graph and Hash concepts are used to write programs and evaluation. Therefore, the correlation is high (3)

**CO5: Apply the File handling and sorting methods to rearrange the data.**

**Action Verb: Apply (L3)**

PO1: Apply(L3)

CO5 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2: Review (L2)

CO5 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)

PO3: Develop (L3)

CO4 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)

PO4: Analyze (L4)

CO5 Action verb is less than PO4 verb by one level. Therefore, the correlation is medium (2)

PO11: Thumb rule

For some of data manipulations Sorting and File Organization methods are used to solve storage problems. Therefore, the correlation is high (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: I**

**Semester: II**

**Branch of study: AIDS**

Course Code	Year & Sem	Web Design	L	T/CLC	P	C
20AES0507	I-II		1	0	4	3

**Course Outcomes:**

After studying the course, student will be able to

**CO 1: Understand** basic HTML tags to design web pages

**CO 2: Apply** Advanced features to your webpage including special effects

**CO 3: Apply** The CSS Knowledge to add colors and text formatting

**CO 4: Apply** Advanced CSS to style effective presentation of webpage

**CO 5: Create** HTML and CSS Programs to create registration form

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	basic HTML tags		to design web pages	L2
CO2	Apply	Advanced features		to your webpage including special effects	L3
CO3	Apply	The CSS Knowledge		to add colours and text formatting	L3
CO4	Apply	Advanced CSS style		to style effective presentation of webpage	L3
CO5	Create	HTML and CSS Programs		to create Registration form	L6

<b>UNIT – I</b>	9 Hrs
<p><b>Where Do I Start</b>-What Does a Web Designer Do, What Languages Do I Need to Learn, What Do I Need to Buy, How the Web Works-The Internet Versus the Web, Serving Up Your Information, A Word About Browsers, Web Page Addresses (URLs), The Anatomy of a Web Page, Some Big Concepts You Need to Know-A Dizzying Multitude of Devices, Sticking with the Standards, Progressive Enhancement, Responsive Web Design, One Web for All (Accessibility), The Need for Speed (Site Performance)</p> <p><b>HTML Markup for Structure:</b> Creating a Simple Page-A Web Page, Launch a Text Editor, Step 1: Start with Content, Step 2: Give the Document Structure, Step 3: Identify Text Elements, Step 4: Add an Image, Step 5: Change the Look with a Style Sheet, When Good Pages Go Bad, Validating Your Documents. Marking Up Text-Paragraphs, Headings, Lists, More Content Elements, Organizing Page Content, The Inline Element Roundup, Generic Elements (div and span), Some Special Characters</p>	
<b>UNIT – II</b>	9 Hrs
<p><b>HTML Markup for Structure:</b> Adding Links-The href Attribute, Linking to Pages on the Web, Linking Within Your Own Site, Targeting a New Browser Window, Mail Links, Telephone Links. Adding Images-First, a Word on Image Formats, The img Element, A Window in a Window. Table Markup-How Tables Are Used, Minimal Table Structure, Spanning Cells, Table Accessibility, Wrapping Up Tables</p> <p><b>HTML Markup for Structure:</b> Forms-How Forms Work, The form Element, Variables and Content, The Great Form Control Roundup, Form Accessibility Features, Form Layout and Design. What's Up, HTML5-A Funny Thing Happened on the Way to XHTML 2, In the Markup Department, Meet the APIs, Video and Audio, Canvas</p>	
<b>UNIT – III</b>	9 Hrs
<p><b>CSS for Presentation:</b> Cascading Style Sheets Orientation-The Benefits of CSS, How Style Sheets Work, The Big Concepts, Moving Forward with CSS. Formatting Text-The Font Properties, Changing Text Color, A Few More Selector Types, Text Line Adjustments, Underlines and Other "Decorations", Changing Capitalization, Spaced Out, Text Shadow, Changing List Bullets and Numbers. Colors and Backgrounds-Specifying Color Values, Foreground Color, Background Color, Playing with Opacity, Introducing...Pseudo-class Selectors, Pseudo-element Selectors, Attribute Selectors, Background</p>	

Images, The Shorthand background Property, Like a Rainbow (Gradients), External Style Sheets. Thinking Inside the Box-The Element Box, Specifying Box Dimensions, Padding, Borders, Margins, Assigning Display Roles, Adding Drop Shadows to Boxes

#### UNIT – IV

9 Hrs

**CSS for Presentation:** Floating and Positioning- Normal Flow, Floating, Positioning Basics, Relative Positioning, Absolute, Positioning, Fixed Positioning. Page Layout with CSS- Page Layout Strategies, page Layout Techniques, Multicolumn Layouts Using Floats, Positioned Layout, Top-to-Bottom Column Backgrounds. Transitions, Transforms, and Animation- Ease-y Does It (CSS Transitions), CSS Transforms, Keyframe Animation. **CSS Techniques-** A Clean Slate (CSS Reset), Image Replacement Techniques, CSS Sprites, Styling Forms, Styling Tables, Basic Responsive Web Design, Wrapping Up Style Sheets.

#### UNIT – V

9 Hrs

1. Design a page having suitable background colour and text colour with title “My First Web Page” using all the attributes of the Font tag.
2. Create a HTML document giving details of your [Name, Age], [Address, Phone] and [Register Number, Class] aligned in proper order using alignment attributes of Paragraph tag.
3. Write HTML code to design a page containing some text in a paragraph by giving suitable heading style.
4. Create a page to show different character formatting (B, I, U, SUB, SUP) tags.
  - i. viz :  $\log_b m^p = p \log_b m$
5. Write HTML code to create a Web Page that contains an Image at its centre.
6. Create a web page with an appropriate image towards the left hand side of the page, when user clicks on the image another web page should open.
7. Create web Pages using Anchor tag with its attributes for external links.
8. Create a web page for internal links; when the user clicks on different links on the web page it should go to the appropriate locations/sections in the same page.
9. Write a HTML code to create a web page with pink colour background and display moving message in red colour.
10. Create a web page, showing an ordered list of all second semester courses (Subjects).
11. Create a web page, showing an unordered list of names of all the Diploma Programmes (Branches) in your institution.
12. Create a HTML document containing a nested list showing a content page of any book.
13. Create the following table in HTML

Student	Maths	Physics	Chemistry	Computer
I-R2C1	I-R1C1	I-R4C1	I-C2	II-R1C5
	II-C1		II-C1	
III-R2C2			III-C1	
			IV-C1	

14. Create a web page which divides the page in two equal frames and place the audio and video clips in frame-1 and frame-2 respectively.

i. FRAME-1	ii. FRAME-2
------------	-------------

15. Create a web page which should generate following output:

i. FRAME-1	ii. FRAME-2
	iii. FRAME-3

16. Create a table to show your class time table.
17. Use tables to provide layout to your HTML page describing your college infrastructure.
18. Use <span> and <div> tags to provide a layout to the above page instead of a table layout.
19. Use frames such that page is divided into 3 frames 20% on left to show contents of pages, 60% in center to show body of page, remaining on right to show remarks.

20. Embed Audio and Video into your HTML web page.
21. Create a webpage with HTML describing your department use paragraph and list tags.
22. Apply various colors to suitably distinguish key words , also apply font styling like italics, underline and two other fonts to words you find appropriate , also use header tags.
23. Create links on the words e.g. —Wi-Fi and —LAN|| to link them to Wikipedia pages.
24. Insert an image and create a link such that clicking on image takes user to other page.
25. Change the background color of the page; At the bottom create a link to take user to the top of the page.
26. Develop static pages (using only HTML) of an online book store, the pages should resemble: www.amazon.com, the website should consist the following pages, home page, registration and user login, user profile page, books catalog, shopping cart, payment by credit card, order confirmation.
27. Create a web page using Embedded CSS and multimedia
28. Write an HTML page that contains a selection box with a list of 5 countries, when the user selects a country, its capital should be printed next to the list; Add CSS to customize the properties of the font of the capital (color, bold and font size).
29. Wap in html to design a Bio-Data.
30. Wap in html to create a webpage with four frames (Picture, table, list, and hyperlink).
31. Wap in html to show all character elements in html.
32. Wap in html to create a webpage to show the block level elements and text level elements.
33. Wap in html to create a webpage to show various confectionary items using ordered list and unordered list.
34. Wap in html to create a webpage to show different hobbies.
35. Wap in html to show India map.
36. Wap in html to create a web page using style sheet.
37. Wap in html to create a web page to show registration
38. Wap in html to show books in inventory in different tables by using rowspan and colspan.
39. Create a Web Page in HTML to show Admission form in OITM
40. A Web Page in HTML to show your resume using Appropriate Formatting Elements.
41. A Web Page in HTML to show all the Text, Color, Background and Font Elements
42. Write a Program to Create a Nested List.

#### Textbooks:

1. Jennifer Niederst Robbins, “Learning Web Design”, OREILLY 4th Edition

#### Reference Books:

1. Uttam K Roy, —Web Technologies||, Oxford University Press, 1st Edition, 2010.
2. HTML and CSS: Design and Build Websites 1st Edition by Jon Duckett (Author) india price
3. Steven Holzner, —The Complete Reference PHP||, Tata McGraw-Hill, 1st Edition, 2007.
4. HTML & CSS: The Complete Reference, Fifth Edition (Complete Reference Series)
5. Deitel and Deitel and Nieto, —Internet and World Wide Web - How to Program||, Prentice Hall, 5th Edition, 2011.

#### Online Learning Resources:

1. <http://www.scoopworld.in>
2. <http://www.sxecw.edu.in>
3. <http://www.technofest2u.blogspot.com>
4. <http://www.ptutorial.com/php-example/php-upload-image>
5. <http://www.ptutorial.com/php-example/php-change-case>

#### Mapping of course outcomes with program outcomes

CO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02
CO1	2		2					3				2	2
CO2	3		2					3				2	2
CO3	3		2					3	3	3		2	2
CO4	3		2					3	3	3	3	2	2
CO5	3		3	3				3	3	3	3	2	2



### Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	<b>CO1: Understand</b>	L2	PO1 PO3 PO9	PO1: Apply(L3) PO3: Design(L6) PO9: Thumb Rule	2 2 3
2	<b>CO2: Apply</b>	L3	PO1 PO3 PO9	PO1: Apply(L3) PO3: Design(L6) PO9: Thumb Rule	3 2 3
3	<b>CO3: Apply</b>	L3	PO1 PO3 PO9 PO10 PO11	PO1: Apply(L3) PO3: Design(L6) PO9: Thumb Rule PO10: Thumb Rule PO11: Thumb Rule	3 2 3 3 3
4	<b>CO4: Apply</b>	L3	PO1 PO3 PO9 PO10 PO11 PO11	PO1: Apply(L3) PO3: Design(L6) PO8: Thumb Rule PO9: Thumb Rule PO10: Thumb Rule PO11: Thumb Rule	3 2 3 3 3 3
5	<b>CO5: Create</b>	L6	PO1 PO3 PO4 PO8 PO9 PO10 PO11	PO1: Apply(L3) PO3: Design(L6) PO4: Design(L6) PO8: Thumb Rule PO9: Thumb Rule PO10: Thumb Rule PO11: Thumb Rule	3 3 3 3 3 3 3

### Justification Statements:

**CO1: Understand** basic HTML tags to design web pages

**Action Verb: Understand (L2)**

**PO1 Verb: Apply (L3)**

CO1 Action verb is lesser than as PO1 verb. Therefore, the correlation is medium (2)

**PO3: Design(L6)**

CO1 Action verb is lesser than as PO3 verb. Therefore, the correlation is medium (2)

**PO9: Thumb Rule**

CO1 Using Basic HTML tags, mages and colors, therefore the correlation is high (3)

**CO2: Apply** Advanced features to your webpage including special effects

**Action Verb: Apply (L3)**

**PO1: Apply (L3)**

CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)

**PO3: Design(L6)**

CO2 Action verb is lesser than as PO3 verb. Therefore, the correlation is high (2)

**PO9: Thumb rule**

CO2 Using HTML elements like links, adding audio & video to the web page, therefore the correlation is high (3)

**CO3: Apply** The CSS Knowledge to add colours and text formatting

**Action Verb: Apply(L3)**

**PO1: Apply (L3)**

CO3 Action verb is same as PO1 verb. Therefore, the correlation is high (3)

**PO3: Design(L6)**

CO3 Action verb is lesser than as PO3 verb. Therefore, the correlation is medium (2)

**PO9: Thumb rule**

C03 Styling and decorating with box dimensions, padding. Websites plays very crucial role in present days, therefore the correlation is high (3)

**PO10: Thumb rule**

C03 Web pages are used to create blogs to share effective content, therefore the correlation is high (3)

**PO11: Thumb rule**

C03 Web pages and CSS knowledge is to manage projects in multi-disciplinary environments as a member or leader in a team, therefore the correlation is high (3)

**C04: Apply** Advanced CSS to style effective presentation of webpage

**Action Verb: Apply(L3)**

**PO1: Apply (L3)**

C04 Action verb is same as PO1 verb. Therefore, the correlation is high (3)

**PO3: Design(L6)**

C04 Action verb is lesser than as PO3 verb. Therefore, the correlation is medium (2)

**PO8: Thumb rule**

C04 Using advanced CSS style presentations, therefore the correlation is high (3)

**PO9: Thumb rule**

C04 Using advanced CSS techniques, therefore the correlation is high (3)

**PO10: Thumb rule**

C04 Advanced CSS style presentation and techniques to manage projects in multi-disciplinary environments as a member or leader in a team, therefore the correlation is high (3)

**PO11: Thumb rule**

C04 Using page layout strategies & techniques, CSS Image Replacement Techniques, Styling Tables for life long learning in the broadest context of technological change, therefore the correlation is (3)

**C05: Create** HTML and CSS Programs to create registration form, to show India map

**Action Verb: Create(L6)**

**PO1: Apply (L3)**

C05 Action verb is greater than PO1 verb. Therefore, the correlation is high (3)

**PO3: Design(L6)**

C05 Action verb is same as PO3 verb. Therefore, the correlation is high (3)

**PO4: Design(L6)**

C05 Action verb is same as PO4 verb. Therefore, the correlation is high (3)

**PO8: Thumb rule**

C05 Creating HTML and CSS programs, therefore the correlation is high (3)

**PO9: Thumb rule**

C05 Creating HTML and CSS programs, therefore the correlation is high (3)

**PO10: Thumb rule**

C05 Using HTML and CSS programs to manage projects in multi-disciplinary environments as a member or leader in a team, therefore the correlation is high (3)

**PO11: Thumb rule**

C05 Using HTML and CSS programs, Styling Tables for lifelong learning in the broadest context of technological change, therefore the correlation is (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: I**

**Semester: II**

**Branch of Study: AIDS**

Course Code	Year & Sem	Basics of Python Programming Lab	L	T/CLC	P	C
20AES0510	I-II		0	0	3	1.5

**Course Outcomes:**

After studying the course, student will be able to

**C01: Analyze** the basic concepts of Python Programming

**C02: Apply** the loops and conditional statements of python using IDLE and programs.

**C03: Analyze** the compound data using Lists, Tuples and dictionaries using functions.

**C04: Apply** the development applications using python datatypes to read and write data from files.

**C05: Design** the solutions using OOPs concepts for real world problems in python.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Analyze	the basic concepts of Python Programming			L4
C02	Apply	the loops and conditional statements of python	using IDLE and programs.		L3
C03	Analyze	the compound data using Lists, Tuples and dictionaries	using functions.		L4
C04	Apply	the development applications	using python datatypes	to read and write data from files	L3
C05	Design	the solutions	using OOPs concepts.	for real world problems in python	L6

**List of Experiments:**

1. Install Python Interpreter and use it to perform different Mathematical Computations. Try to do all **(C01)**

the operations present in a Scientific Calculator

2. Write a function that draws a grid like the following:**(C01)**

```

+---+---+
|   |   |
+---+---+
|   |   |
+---+---+
|   |   |
+---+---+

```

3. Write a function that draws a Pyramid with # symbols**(C01)**

```

#
###
####
#####

```

4. Using turtles concept draw a wheel of your choice**(C01)**

5. Write a program that draws Archimedean Spiral**(C01)**

6. The letters of the alphabet can be constructed from a moderate number of basic elements, like vertical and horizontal lines and a few curves. Design an alphabet that can be drawn with a minimal number of basic elements and then write functions that draw the letters. The alphabet can belong to any Natural language excluding English. You should consider at least Ten letters of the alphabet.**(C01)**

7. The time module provides a function, also named time that returns the current Greenwich Mean Time in "the epoch", which is an arbitrary time used as a reference point.

On UNIX systems, the epoch is 1 January 1970.

```
>>> import time
```

```
>>> time.time()
```

```
1437746094.5735958
```

Write a script that reads the current time and converts it to a time of day in hours,

minutes, and seconds, plus the number of days since the epoch.(C01)

8. Given  $n+r+1 \leq 2r$ .  $n$  is the input and  $r$  is to be determined. Write a program which computes minimum value of  $r$  that satisfies the above(C02)

9. Write a program that evaluates Ackermann function(C02)

10. The mathematician Srinivasa Ramanujan found an infinite series that can be used to generate a numerical approximation of  $1/\pi$ :

Write a function called `estimate_pi` that uses this formula to compute and return an estimate of  $\pi$ .

$$\frac{1}{\pi} = \frac{2\sqrt{2}}{9801} \sum_{k=0}^{\infty} \frac{(4k)!(1103 + 26390k)}{(k!)^4 396^{4k}}$$

It should use a while loop to compute terms of the summation until the last term is smaller than  $1e-15$  (which is Python notation for  $10^{-15}$ ). You can check the result by comparing it to `math.pi`.(C02)

11. Choose any five built-in string functions of C language. Implement them on your own in Python. You should not use string related Python built-in functions.(C02)

12. Given a text of characters, Write a program which counts number of vowels, consonants and special characters.(C02)

13. Given a word which is a string of characters. Given an integer say 'n', Rotate each character by 'n' positions and print it. Note that 'n' can be positive or negative.(C02)

14. Given rows of text, write it in the form of columns.(C02)

15. Given a page of text. Count the number of occurrences of each letter (Assume case insensitivity and don't consider special characters). Draw a histogram to represent the same(C02)

16. Write program which performs the following operations on list's. Don't use built-in functions(C03)

- Updating elements of a list
- Concatenation of list's
- Check for member in the list
- Insert into the list
- Sum the elements of the list
- Push and pop element of list
- Sorting of list
- Finding biggest and smallest elements in the list
- Finding common elements in the list

17. Write a program to count the number of vowels in a word.(C03)

18. Write a program that reads a file, breaks each line into words, strips whitespace and punctuation from the words, and converts them to lowercase.(C04)

19. Go to Project Gutenberg (<http://gutenberg.org>) and download your favorite out-of-copyright book in plain text format. Read the book you downloaded, skip over the header information at the beginning of the file, and process the rest of the words as before. Then modify the program to count the total number of words in the book, and the number of times each word is used. Print the number of different words used in the book. Compare different books by different authors, written in different eras.(C04)

20. Go to Project Gutenberg (<http://gutenberg.org>) and download your favorite out-of-copyright book in plain text format. Write a program that allows you to replace words, insert words and delete words from the file.(C04)

21. Consider all the files on your PC. Write a program which checks for duplicate files in your PC and displays their location. Hint: If two files have the same checksum, they probably have the same contents.(C04)

22. Consider turtle object. Write functions to draw triangle, rectangle, polygon, circle and sphere. Use object oriented approach.(C05)

23. Write a program illustrating the object oriented features supported by Python.(C05)

24. Design a Python script using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorizing them into distinction, first class, second class, third class and failed.(C05)

25. Design a Python script to determine the difference in date for given two dates in

YYYY:MM:DD format(0 <= YYYY <= 9999, 1 <= MM <= 12, 1 <= DD <= 31) following the leap year rules.(C05)

26. Design a Python Script to determine the time difference between two given times in HH:MM:SS format.( 0 <= HH <= 23, 0 <= MM <= 59, 0 <= SS <= 59)(C05)

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	2	3											
C02	3	2	2										
C03	3	3	2	2					1		1		
C04	3	2											
C05		1	3	3	3			2	1		2		

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	CO1 : Analyze	L4	PO1	PO1: Apply(L3)	2
			PO2	PO2: Analyze(L4)	3
2	CO2 : Apply	L3	PO1	PO1: Apply(L3)	3
			PO2	PO2: Analyze (L4)	2
			PO11	PO11: Thumb rule	2
3	CO3 :Analyze	L4	PO1	PO1: Apply(L3)	3
			PO2	PO2: Analyze (L4)	3
			PO3	PO3: Design (L6)	2
			PO4	PO4: Design (L6)	2
			PO9	PO9: Thumb rule	1
4	CO4 :Apply	L3	PO1	PO1: Apply(L3)	3
			PO2	PO2: Analyze (L4)	2
5	CO5 : Design	L6	PO2	PO2: Analyze (L4)	1
			PO3	PO3: Design (L6)	3
			PO4	PO4: Design (L6)	3
			PO5	PO5: Develop (L6)	3
			PO8	PO8: Thumb rule	2
			PO9	PO9: Thumb rule	1
			PO11	PO11: Thumb rule	2

### Justification Statements :

#### C01: Analyze the basic concepts of Python Programming

##### Action Verb : Analyze (L4)

PO1 Verb : Apply(L3)

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

PO2 Verb : Analyze(L4)

CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

#### C02: Apply the loops and conditional statements of python using IDLE and programs.

##### Action Verb : Apply (L3)

PO1 Verb : Apply(L3)

CO1 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

PO2 Verb : Analyze(L4)

CO1 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)

PO11: Thumb rule

For usage of the loops and conditional statements of python using IDLE is medium. Therefore the correlation is medium (2)

#### C03: Analyze the compound data using Lists, Tuples and dictionaries using functions.

##### Action Verb : Analyze(L4)

PO1: Apply(L3)

C03 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

PO2: Analyze (L4)

C03 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)

PO3: Design (L6)

C03 Action verb is less than PO3 verb by one level. Therefore the correlation is medium (2)

PO4: Design (L6)

C03 Action verb is less than PO4 verb by one level. Therefore the correlation is medium (2)

PO9 : Thumb rule

Team work is required to Analyze the compound data using. Hence the correlation is low (1)

PO11: Thumb rule

Construct real time applications using functions can be life long learning. Therefore the correlation is low (1)

**C04: Apply the development applications using python datatypes to read and write data from files.**

**Action Verb : Apply (L3)**

PO1: Apply(L3)

C04 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

PO2: Analyze (L4)

C04 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)

**C05: Design the solutions using OOPs concepts for real world problems in python.**

**Action Verb : Design (L6)**

PO2: Analyze (L4)

C05 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

PO3: Design (L6)

C05 Action verb is same level as PO3 verb. Therefore the correlation is high (3)

PO4: Design (L6)

C05 Action verb is same level as PO4 verb. Therefore the correlation is high (3)

PO5: Develop(L6)

C05 Action verb is same level as PO5 verb. Therefore the correlation is high (3)

PO8 : Thumb rule

IOT Applications can be used to make society better place. Therefore the correlation is medium(2)

PO9 : Thumb rule

Team work is required to Create BPP applications. Hence the correlation is low (1)

PO11: Thumb rule

In real time oops concepts are used to solve the societal problems. Therefore the correlation is medium (2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: I**

**Semester: II**

**Branch of Study: AIDS**

Course Code	Year & Sem	Computational Lab-I	L	T/CLC	P	C
20ABS9918	I-II		0	0	3	1.5

**Course Outcomes:**

After Studying the Course, student will be able to

**CO1:** Apply MS Excel tools for solving problems in linear algebra.

**CO2:** Analyze the Central Tendency, Correlation and Regression analysis using MS- Excel Tools.

**CO3:** Analyze the properties of probability distributions using MS- Excel Tools.

**CO4:** Apply MS- Excel Tools for solving definite integrals numerically.

**CO5:** Analyze small and large sample problems using statistical tools in MS- Excel .

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Apply	MS Excel tools	for solving problems	in linear algebra	L3
2	Analyze	the Central Tendency, Correlation and Regression analysis	Using MS-Excel Tools.		L4
3	Analyze	the properties of probability distributions	Using MS-Excel Tools.		L4
4	Apply	MS Excel tools	for solving definite integrals numerically.		L3
5	Analyze	small and large sample problems	using statistical tools	in MS- Excel	L4

**List of Experiments:**

1. Algebraic operations on matrices, transpose of a matrix.
2. Finding determinant, inverse of a matrix.
3. Solving system of equations and consistency – Non Homogeneous equations
4. Rank of a matrix - Row reduced Echelon form.
5. Practice theory behind the descriptive statistics like measures of central tendency with examples.
6. Solving Measures of dispersion concepts with examples.
7. Practicing concept of Correlation with some examples.
8. Solving Regression analysis with some examples.
9. Solving Skewness concept with examples.
10. Practising the Concept of Kurtosis with examples.
11. Solving the Numerical Integration by Trapezoidal rule and Simpson's 1/3 rule .
12. Fitting a Straight line and power curve using Ms-Excel Tools.
13. Using functions in MS-Excel to calculate the probabilities for Binomial distribution.
14. Using functions in MS-Excel to calculate the probabilities for Poisson distribution.
15. Using functions in MS-Excel to calculate the probabilities for Normal distribution.
16. Using functions in MS-Excel to calculate the probabilities for Geometric distribution.

17. Using functions in MS-Excel to calculate the probabilities for Uniform distribution.
18. Testing Single mean in large samples and difference between two means large samples using Z – test.
19. Testing Single proportion in large samples and difference between two proportions in large samples using Z – test.
20. Testing Single mean in small samples using t- test.
21. Testing Student's t-test for difference of means.
22. Testing Paired-Sample 't'-test in small samples using t- test.
23. Testing difference between two means in small samples using t- test.
24. Solving problems on Chi- square test for testing goodness of fit .

#### Reference:

1. Higher Engineering in Mathematics, Dr. B.S. Grewal of Khanna Publishers, 42<sup>nd</sup> Edition .
2. Miller and Freund's, Probability and Statistics for Engineers, 7/e, Pearson, 2008.
3. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.
4. S.Chand ,Probability and Statistics, Dr.T.K.V.Iyengar, Dr.B.Krishna Gandhi, S.Ranganatham, Dr.M.V.S.S.N.Prasad.

#### Mapping of COs to POs and PSOs

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
1				2									
2				3									
3				3									
4				2									
5				3									

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

#### CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	6	14	1	Apply	L3	PO4	PO4: Analyze (L4)	2
2	12	26	3	Analyze	L4	PO4	PO4: Analyze (L4)	3
3	9	20	3	Analyze	L4	PO4	PO4: Analyze (L4)	3
4	9	20	3	Apply	L3	PO4	PO4: Analyze (L4)	2
5	9	20	3	Analyze	L4	PO4	PO4: Analyze (L4)	3
	45							



### **Justification:**

**CO1:** Apply MS Excel tools for solving problems in linear algebra.

**Action Verb:** Apply (**L3**)

PO4 Verb: Analyze (L4)

CO1 Action Verb is one less than PO4 verb; Therefore correlation is moderate (2).

**CO2:** Analyze the Central Tendency, Correlation and Regression analysis using MS- Excel Tools.

**Action Verb:** Analyze (**L4**)

PO4 Verb: Analyze (L4)

CO2 Action Verb equal to PO4 verb; therefore, correlation is high (3)

**CO3:** Analyze the properties of probability distributions using MS- Excel Tools.

**Action Verb:** Analyze (**L4**)

**PO4 Verb:** Analyze (L4)

CO3 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).

**CO4:** Apply MS- Excel Tools for solving definite integrals numerically

**Action Verb:** Apply (**L3**)

**PO4 Verb:** Analyze (L4)

CO4 Action Verb is one less than PO4 verb; therefore, correlation is moderate (2)

**CO5:** Analyze small and large sample problems using statistical tools in MS- Excel .

**Action Verb:** Analyze (**L4**)

PO4 Verb: Analyze (L4)

CO5 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: I**

**Semester: II**

**Branch of study: AIDS**

Course Code	Year & Sem	Data Structures Lab	L	T/CLC	P	C
20AES0504	I-II		0	0	3	1.5

**Course Outcomes:**

After studying the course, student will be able to

**CO 1: Apply** the sorting and searching algorithms using suitable data structure

**CO 2: Design** the algorithms to solve real time problems using Linked lists

**CO 3: Design** the solutions for computational problems using stacks and queues

**CO 4: Evaluate** the operations of breadth first search using queues

**CO 5: Design** the algorithms to perform operations on trees and graphs

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Apply	sorting and searching algorithm	using suitable data structure		L3
CO2	Design	the algorithms	using Linked lists	To solve real time problems	L6
CO3	Design	the solutions for computational problems	using stacks and queues		L6
CO4	Evaluate	the operations of breadth first search	using queues		L5
CO5	Design	the algorithms		to perform operations on trees and graphs	L6

**List of Experiments**

- String operations using array of pointers **(CO1)**
- Searching Algorithms (With the Number of Key Comparisons) Sequential, Binary and Fibonacci Search Algorithms. **(CO1)**
- Sorting Algorithms: Insertion Sort, Selection Sort, Shell Sort, Bubble Sort, Quick Sort, Heap Sort, Merge Sort, and Radix Sort. Using the system clock, compute the time taken for sorting of elements. The time for other operations like I/O etc should not be considered while computing time. **(CO1)**
- Implementation of Singly Linked List, Doubly Linked List, Circular Linked List **(CO2)**
- Stack implementation using arrays **(CO3)**
- Stack implementation using linked lists **(CO3)**
- Queue implementation using arrays. Implement different forms of queue. While implementing you should be able to store elements equal to the size of the queue. No positions should be left blank. **(CO3)**
- Queue implementation using linked lists **(CO3)**
- Creation of binary search tree, performing operations insertion, deletion, and traversal. **(CO4)**
- Breadth first search **(CO4)**
- Depth first search **(CO4)**
- Travelling sales man problem **(CO4)**
- File operations **(CO4)**
- Indexing of a file **(CO4)**
- Reversing the links (not just displaying) of a linked list. **(CO4)**
- Consider a linked list consisting of name of a person and gender as a node. Arrange the linked list using 'Ladies first' principle. You may create new linked lists if necessary. **(CO5)**
- An expression can be represented in three ways: infix, prefix and postfix. All the forms are necessary in different contexts. Write modules to convert from one form to another form. **(CO5)**
- A table can be defined as a collection of rows and columns. Each row and column may have a label. Different values are stored in the cells of the table. The values can be of different data types. Numerical operations like summation, average etc can be performed on rows/columns which contain numerical data. Such operations are to be prevented on data which is not numeric. User may like to insert row/columns in the already existing table. User may like to remove row/column. Create table data type and support different operations on it. **(CO5)**

### Mapping of course outcomes with program outcomes

CO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02
CO1	3	3	3		3							2	
CO2	3	3	3	3	3						3	2	1
CO3	3	3	3	3	3						3	2	1
CO4	3	3	2	3	2		3				3	2	2
CO5	3	3	3	3	3						3	2	2

### Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for P01 to P011)	Level of Correlation (0-3)
1	CO1: Apply	L3	P01 P02 P03 P05	P01: Apply(L3) P02: Review(L2) P03: Develop (L3) P05:Apply(L3)	3 3 3 3
2	CO2: Design	L6	P01 P02 P03 P04 P05 P011	P01: Apply(L3) P02: Develop (L3) P03: Design (L6) P04: Design (L6) P05:Create(L6) P011: Thumb rule	3 3 3 3 3 3
3	CO3: Design	L6	P01 P02 P03 P04 P05 P011	P01: Apply(L3) P02: Develop (L3) P03: Design (L6) P04: Design (L6) P05:Create(L6) P011: Thumb rule	3 3 3 3 3 3
4	CO4: Evaluate	L5	P01 P02 P03 P04 P05 P07 P011	P01: Apply(L3) P02: Review (L2) P03: Design (L6) P04: Analysis(L4) P05:Create(L6) P07: Thumb rule P011: Thumb rule	3 3 3 2 2 3 3
5	CO5: Design	L6	P01 P02 P03 P04 P05 P011	P01: Apply(L3) P02: Review(L2) P03: Design(L6) P04: Analysis(L4) P05:Create(L6) P011: Thumb rule	3 3 3 3 3 3

### Justification Statements :

**CO1: Apply** the sorting and searching algorithms using suitable data structure

**Action Verb: Apply (L3)**

P01 Verb: Apply (L3)

CO1 Action verb is same as P01 verb. Therefore, the correlation is high (3)

P02 Verb: Review(L2)

CO1 Action verb is greater than P02 verb. Therefore, the correlation is high (3)

P03 Verb: Develop(L3)

CO1 Action verb is greater than P03 verb. Therefore, the correlation is high (3)

P05 Verb: Apply (L3)

CO1 Action verb is same as P05 verb. Therefore, the correlation is high (3)

**CO2: Design** the algorithms to solve real time problems using Linked lists

**Action Verb: Design (L6)**

P01: Apply (L3)

CO2 Action verb is greater than as P01 verb. Therefore, the correlation is high (3)

P02: Develop (L6)

C02 Action verb is same level P02 verb. Therefore, the correlation is high (3)

P03 Verb: Design(L3)

C02 Action verb is same as P03 verb. Therefore, the correlation is high (3)

P04: Design (L6)

C02 Action verb is same as P04 verb. Therefore, the correlation is high (3)

P05 Verb: Create(L6)

C01 Action verb is same as P05 verb. Therefore, the correlation is high (3)

P011: Thumb rule

For some of Linear Data Structure applications, Linked lists concepts are used to write programs store the data. Therefore, the correlation is high (3)

**C03: Design** the solutions for computational problems using stacks and queues

**Action Verb: Design (L6)**

P01: Apply (L3)

C03 Action verb is greater than as P01 verb. Therefore, the correlation is high (3)

P02: Develop (L3)

C03 Action verb is same level P02 verb. Therefore, the correlation is high (3)

P03 Verb: Design(L6)

C03 Action verb is same as P03 verb. Therefore, the correlation is high (3)

P04: Design (L6)

C03 Action verb is same as P04 verb. Therefore, the correlation is high (3)

P05 Verb: Create(L6)

C03 Action verb is same as P05 verb. Therefore, the correlation is high (3)

P011: Thumb rule

For some of Data Structure applications, stacks concepts are used to manage data in the memory. Therefore, the correlation is high (3)

**C04: Evaluate** the operations of breadth first search using queues

**Action Verb: Evaluate (L5)**

P01: Apply(L3)

C04 Action verb is greater than P01 verb by two levels. Therefore, the correlation is high (3)

P02: Review (L2)

C04 Action verb is greater than P02 verb. Therefore, the correlation is high (3)

P03: Design (L6)

C04 Action verb is less than P03 verb by one level. Therefore, the correlation is medium (2)

P04: Analysis (L4)

C04 Action verb is greater than P04 verb by one level. Therefore, the correlation is high (3)

P05 Verb: Create(L6)

C04 Action verb is greater than P05 verb. Therefore, the correlation is medium (2)

P07: Thumb rule

For some of Real Time problems Data Structure applications, queues concept is indirectly used to sustainable environment development. Therefore, the correlation is high (3)

P011: Thumb rule

For some of Real Time problems Data Structure applications, queues concepts are used to write programs and evaluation the memory operations. Therefore, the correlation is high (3)

**C05: Design** the algorithms to perform operations on trees and graphs

**Action Verb: Design (L6)**

P01: Apply(L3)

C05 Action verb is greater than P01 verb. Therefore, the correlation is high (3)

P02: Review (L2)

C05 Action verb is same level as P02 verb. Therefore, the correlation is high (3)

P03: Design (L6)

C04 Action verb is same level as P03 verb. Therefore, the correlation is high (3)

P04: Analysis (L4)

C05 Action verb is greater than P04 verb. Therefore, the correlation is high (3)

P05 Verb: Create(L6)

C01 Action verb is same as P05 verb. Therefore, the correlation is high (3)

P011: Thumb rule

For some of data manipulations tree and graphs concepts are used to solve data storage problems. Therefore, the correlation is high (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: I**

**Semester: II**

**Branch of study: AIDS**

Course Code	Year & Sem	ENVIRONMENTAL STUDIES	L	T/CLC	P	C
20AMC9903	I-II		3	0	0	0

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the multidisciplinary nature of environmental studies and various renewable and nonrenewable resources.

**CO2: Understand** the ecosystem and biodiversity to solve complex environmental problems

**CO3: Apply** various types of pollution and solid waste management and related preventive measures

**CO4: Apply** rainwater harvesting, watershed management, ozone layer depletion and wasteland reclamation.

**CO5: Understand** the population explosion

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	Multidisciplinary nature of environmental studies and various renewable and nonrenewable resources			L2
2	Understand	Ecosystem and biodiversity to solve complex environmental problems			L2
3	Apply	Various types of pollution and solid waste management and related preventive measures			L3
4	Apply	Rainwater harvesting, watershed management, ozone layer depletion and wasteland reclamation			L3
5	Understand	Population explosion			L2

<b>UNIT - I</b>		9 Hrs
<b>Multidisciplinary Nature of Environmental Studies:</b> Introduction Multidisciplinary Nature of Environmental Studies-Definition, Scope and Importance – Need for Public Awareness. <b>Natural Resources:</b> Renewable and non-renewable energy resources – Natural resources and associated problems. <b>Forest resources:</b> Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people. <b>Water resources:</b> Use and over utilization of surface and sub-surface – Floods, drought, conflicts over water, dams – benefits and problems. <b>Mineral resources:</b> Use and exploitation, environmental effects of extracting and using mineral resources, case studies. <b>Food resources:</b> World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticides problems, water logging, salinity, case studies. <b>Energy resources:</b> Renewable and non-renewable energy resources.		
<b>UNIT - II</b>		9 Hrs
<b>Ecosystems:</b> Concept of an ecosystem. – Structure and functions of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). <b>Biodiversity And Its Conservation:</b> Introduction- Definition: genetic, species and ecosystem diversity – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.		
<b>UNIT - III</b>		9 Hrs

**Environmental Pollution:** Definition, Causes, effects and its control measures of: Air Pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, and Thermal pollution and Nuclear hazards. **Solid Waste Management:** Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone, Tsunami and landslides.

**UNIT – IV** 9 Hrs

**Social Issues and the Environment:** From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting and watershed management – Resettlement and rehabilitation of people Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies–Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act–Public awareness

**UNIT – V** 9 Hrs

**Human Population and the Environment:** Population growth, variation among nations. Population explosion – Family Welfare Programmed. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

**Textbooks:**

1. Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
2. Environmental Studies by Kaushik, New Age Publishers.
3. Environmental Studies by Sri Krishna Hitech publishing Pvt. Ltd.

**Reference Books:**

1. Environmental studies by R.Rajagopalan, Oxford University Press.
2. Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
3. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.
4. Environmental studies by A. Ravi Krishnan, G. Sujatha Sri Krishna Hitech publications.

#### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1						2	2						
CO2							2				2		
CO3						2	2						
CO4						2	2						
CO5							2				2		

#### Correlation matrix

CO	Percentage of contact hours over the total planned contact hours				CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Register (Hrs)	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	10	12	23	3	Understand	L2	PO6,PO7	PO6: PO7:	2,2
2	15	15	28	3	Understand	L2	PO7,PO11	PO7: PO11:	2,2
3	8	8	15	2	Apply	L3	PO6 PO7	PO6: PO7:	2,2
4	9	10	19	2	Apply	L3	PO6,PO7	PO6: PO7:	2,2
5	8	8	15	2	Understand	L2	PO7,PO11,	PO7: PO11:	2,2
	50	53	100						

### **Justification Statements:**

**CO1: Understand the multidisciplinary nature of environmental studies and various renewable and nonrenewable resources.**

#### **Action Verb: Understand (L2)**

CO1 Action Verb is **Understand** of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

**CO2: Understand the ecosystem and biodiversity to solve complex environmental problems**

#### **Action Verb: Understand (L2)**

CO2 Action Verb is **Understand** of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

**CO3: Apply various types of pollution and solid waste management and related preventive measures**

#### **Action Verb: APPLY (L3)**

CO3 Action Verb is **APPLY** of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

**CO4: Apply rainwater harvesting, watershed management, ozone layer depletion and wasteland reclamation.**

#### **Action Verb: APPLY (L3)**

CO4 Action Verb is **APPLY** of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

**CO5: Understand the population explosion**

#### **Action Verb: Understand (L2)**

CO5 Action Verb is **Understand** of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
B. Tech - Artificial Intelligence and Data Science (AI & DS)  
(Effective for the batches admitted from 2020-21)**

**Semester III (Second year)**

Sl. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CL	P				
1	BS	20ABS9914	Discrete Mathematical Structures	4	2	0	3	30	70	100
2	PC	20APC3001	Digital Electronics and Microprocessor	4	2	0	3	30	70	100
3	PC	20APC3002	Database Management Systems	4	2	0	3	30	70	100
4	PC	20APC3004	Object Oriented Programming through Java	4	2	0	3	30	70	100
5	PC	20APC3006	Computer Organization	4	2	0	3	30	70	100
6	PC	20APC3003	Database Management Systems Lab	0	0	3	1.5	30	70	100
7	PC	20APC3005	Object Oriented Programming through Java Lab	0	0	4	2	30	70	100
8	PC	20APC3007	Computer Organization Lab	0	0	2	1	30	70	100
9	SC	20ASC3001	Client Side Scripting	1	0	2	1	100	0	100
10	MC	20AMC9902	Constitution of India	3	0	0	0	30	0	30
			<b>Total credits</b>				<b>21.5</b>	<b>370</b>	<b>560</b>	<b>930</b>





**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: II**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	Discrete Mathematical Structures	L	T/CLC	P	C
20ABS9914	II-I		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Apply** the concepts of mathematical logic in various engineering fields.

**CO2: Understand** the concepts related to set theory and algebraic structures.

**CO3: Analyze** the theory of elementary combinatorics by using binomial and multinomial theorems.

**CO4: Evaluate** the solutions of homogeneous and non-homogeneous recurrence relations.

**CO5: Apply** the graph theory in solving computer science problems and finite difference approximation.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Apply	the concepts of mathematical logic	in various engineering fields		L3
2	Understand	the concepts related to set theory and algebraic structures.			L2
3	Analyse	the theory of elementary combinatorics	by using binomial and multinomial theorems		L4
4	Evaluate	the solutions of homogeneous and non homogeneous recurrence relations.			L5
5	Apply	the graph theory solving computer science problems.		and finite difference approximation.	L3

**Unit I: Mathematical Logic:**

**9 hrs**

Introduction, Statements and Notation, Connectives, Well-formed formulas, Tautology, Duality law, Equivalence, Implication, Normal Forms, Functionally complete set of connectives, Inference Theory of Statement Calculus, Predicate Calculus, Inference theory of Predicate Calculus

**Unit II: Set theory:**

**9 hrs**

Basic Concepts of Set Theory, Relations and Ordering, The Principle of Inclusion Exclusion, Pigeon hole principle and its application, Functions composition of functions, Inverse Functions, Recursive Functions, Lattices and its properties. Algebraic structures: Algebraic systems-Examples and General Properties, Semi groups and Monoids, groups, sub groups, homomorphism, Isomorphism.

**Unit III: Elementary Combinatorics:**

**9 hrs**

Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients, The Binomial and Multinomial Theorems.

**Unit IV: Recurrence Relations:**

**9 hrs**

Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence relations, Solving Recurrence Relations by Substitution and Generating functions, The Method of Characteristic roots, Solutions of Inhomogeneous Recurrence Relations.

**Unit V: Graphs:**

**9 hrs**

Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multigraphs and Euler Circuits, Hamiltonian Graphs, Chromatic Numbers, The Four Color Problem equation using finite difference approximation.

### Text books and Reference books:

1. Joe L. Mott, Abraham Kandel and Theodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd Edition, Pearson Education.
2. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 2002.,
3. Kenneth H. Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, McGraw Hill Education (India) Private Limited
4. Graph Theory with Applications to Engineering and Computer Science by Narsingh Deo

**Online Learning Resources:** <http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf>

### Mapping of COs to POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
1	3										
2	2										
3		3									
4		3									
5	3										

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

### CO - PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	15	21.7	3	Apply	L3	PO1	Apply (L3)	3
2	11	15.9	2	Understand	L2	PO1	Apply (L3)	2
3	14	20.2	3	Analyze	L4	PO2	Analyze (L4)	3
4	14	20.2	3	Evaluate	L5	PO2	Analyze (L4)	3
5	15	21.7	3	Apply	L3	PO1	Apply (L3)	3

### CO1: Apply the concepts of mathematical logic in various engineering fields

**Action Verb: Apply (L3)**

PO1 Verbs: Apply (L3)

CO1 Action Verb is equal to PO1 verb . Therefore correlation is high (3).

### CO2: Understand the concepts related to set theory and algebraic structures

**Action Verb: Understand (L2)**

PO1 Verbs: Apply (L3)

CO2 Action Verb is one level below to PO1 verb; Therefore correlation is moderate (2).

### CO3: . Analyze the theory of elementary combinatorics by using binomial and multinomial theorems.

**Action Verb: Analyse (L4)**

PO2 Verb: Analyse (L4)

CO3 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).

### CO4: Evaluate the solutions of homogeneous and non homogeneous recurrence relations.

**Action Verb: Evaluate (L5)**

PO2 Verb: Analyse (L4)

CO4 Action Verb level is one level high to PO2 verb; Therefore correlation is high (3).

### CO5: Apply the graph theory in solving computer science problems and finite difference approximation.

**Action Verb: Apply(L3)**

PO1 Verb: Apply (L3)

CO5 Action verb is equal to PO1 verb; therefore the correlation is high (3).



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
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**Artificial Intelligence and Data Science (AI&DS)**

**Year: II**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	Digital Electronics & Microprocessors	L	T/CLC	P	C
20APC3001	II-I		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

**C01: Understand** the different logic circuits using concepts of Boolean algebra.

**C02: Analyze** the different logic circuit by combining sequential and combinational circuits.

**C03: Evaluate** the different sequential logic circuits for construct complex circuits like counters and registers.

**C04: Apply** the 8086 microprocessors to design application for real world issues.

**C05: Apply** the 8051 micro controllers to construct complex microprocessor working model for real world problems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	the different logic circuits	using concepts of Boolean algebra		L2
C02	Analyze	the different logic circuit	by combining sequential and combinational circuits		L4
C03	Evaluate	the different sequential logic circuits		for construct complex circuits like counters and registers.	L5
C04	Apply	the 8086 microprocessors		to design application for real world issues	L3
C05	Apply	the 8051 micro controller		to construct complex microprocessor working model for real world problems.	L3

**Syllabus:**

**UNIT - I Number Systems & Code Conversion**

Number Systems & Code conversion, Boolean Algebra & Logic Gates, Truth Tables, Universal Gates, Simplification of Boolean functions, SOP and POS methods – Simplification of Boolean functions using K-maps, Signed and Unsigned Binary Numbers.

**UNIT - II Combinational Circuits**

Combinational Logic Circuits: Adders & Subtractors, Multiplexers, Demultiplexers, Encoders, Decoders, Programmable Logic Devices.

**UNIT - III Sequential Circuits**

Sequential Logic Circuits: RS, Clocked RS, D, JK, Master Slave JK, T Flip-Flops, Shift Registers, Types of Shift Registers, Counters, Ripple Counter, Synchronous Counters, Asynchronous Counters, Up-Down Counter.

**UNIT - IV Microprocessors - I**

8085 microprocessor Review (brief details only), 8086 microprocessor, Functional Diagram, register organization 8086, Flag register of 8086 and its functions, Addressing modes of 8086, Pin diagram of 8086, Minimum mode & Maximum mode operation of 8086, Interrupts in 8086.

**UNIT – V Microprocessors - II**

Instruction set of 8086, Assembler directives, Procedures and Macros, Simple programs involving arithmetic, logical, branch instructions, Ascending, Descending and Block move programs, String Manipulation

Instructions. Overview of 8051 microcontroller, Architecture, I/O ports and Memory organization, addressing modes and instruction set of 8051(Brief details only), Simple Programs.

#### Text Books:

1. M. Morris Mano, Michael D. Ciletti, Digital Design, Pearson Education, 5th Edition, 2013
2. Anil K. Maini, Digital Electronics: Principles, Devices and Applications, John Wiley & Sons, Ltd., 2007.
3. N. Senthil Kumar, M. Saravanan, S. Jeevanathan, Microprocessor and Microcontrollers, Oxford Publishers, 2010.
4. Advanced microprocessors and peripherals-A.K Ray and K.M. Bhurchandani, TMH, 2nd edition, 2006.

#### Reference Books:

1. Thomas L. Floyd, Digital Fundamentals – A Systems Approach, Pearson, 2013.
2. Charles H. Roth, Fundamentals of Logic Design, Cengage Learning, 5th, Edition, 2004.
3. D.V.Hall, Microprocessors and Interfacing. TMGH, 2nd edition, 2006.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2		2						2			3	
CO2	3		2						2			2	
CO3	3		3						2	2		2	
CO4	3		3						2	2		2	
CO5	2		2	2						2		2	

#### Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	14	23%	3	CO1: Understand	L2	PO1 PO3 PO9	PO1: Apply(L3) PO2: Identify(L3) PO9: Thumb Rule	2 2 2
2	10	17%	2	CO2: Analyze	L4	PO1 PO3 PO9	PO1: Apply(L3) PO2: Identify(L3) PO9: Thumb Rule	3 3 2
3	12	20%	2	CO3: Evaluate	L3	PO1 PO2 PO9 PO10	PO1: Apply(L3) PO2: Identify(L3) PO9: Thumb Rule PO10: Thumb Rule	3 3 2 2
4	10	17%	2	CO4: Apply	L3	PO1 PO3 PO9 PO10	PO1: Apply(L3) PO3: Develop(L3) PO9: Thumb Rule PO10: Thumb Rule	3 3 2 2
5	14	23%	3	CO5: Analyze	L4	PO1 PO3 PO4 PO10	PO1: Apply(L3) PO3: Develop(L3) PO4: Apply(L3) PO10: Thumb Rule	2 2 2 2
	60	100 %						

#### Justification Statements:

**CO 1: Understand** the different logic circuits using concepts of Boolean algebra.

**Action Verb : Understand (L2)**

**PO1 Verb : Apply(L3)**

CO1 Action verb is less than PO1 verb by one, Therefore the correlation is medium (2)

**PO2 Verb : Identify(L3)**

CO1 Action verb is less than PO2 verb by one. Therefore, the correlation is medium (2)

**PO9: Thumb rule**

To involvement of individual must know all the basic concept to understand team work outcomes. Therefore the correlation is medium (2)

**CO 2: Analyze** the different logic circuit by combining sequential and combinational circuits

**Action Verb : Analyze (L4)**

**PO1: Apply(L3)**

CO2 Action verb is less than PO1 verb. Therefore, the correlation is high (3)

**PO2: Identify(L3)**

CO2 Action verb is less than PO2 verb. Therefore, the correlation is high (3)

**PO9: Thumb rule**

At the time of design sequential and combinational circuits were need to form the team and develop required circuits in long period. Therefore the correlation is medium (2)

**CO 3: Evaluate** the different sequential logic circuits for construct complex circuits like counters and registers.

**Action Verb : Evaluate (L5)**

**PO1: Apply(L3)**

CO3 Action verb is greater than PO1 verb. Therefore, the correlation is High (3)

**PO2: Identify (L3)**

CO3 Action verb is greater than PO2 verb. Therefore, the correlation is High (3)

**PO9: Develop (L3)**

Need to analyze real time application from the whole team for construct complex circuits. Therefore, the correlation is high(3)

**PO10: Thumb rule**

For resolving solutions to complex problem required a strong engineering concepts. Therefore, the correlation is high(3)

**CO 4: Apply** the 8086 microprocessors to design application for real world issues.

**Action Verb :Apply (L3)**

**PO1: Apply(L3)**

CO4 Action verb is same as PO1 verb. Therefore the correlation is high (3)

**PO3: Develop(L3)**

CO4 Action verb is same as PO3 verb. Therefore the correlation is high(3)

**PO9: Thumb rule**

To implement real world application, the individual should have deep knowledge about 8086 microprocessors. Therefore, the correlation is medium. Therefore the correlation is medium(2)

**PO10: Thumb rule**

Once the model ready with 8086 microprocessors, need to narrate about model with understandable manner Therefore the correlation is medium (2)

**CO 5: Analyze** the 8051 micro controller to construct complex microprocessor working model for real world problems.

**Action Verb : Analyze (L4)**

**PO1: Apply(L3)**

CO5 Action verb is greater than PO1 verb. Therefore the correlation is high(3)

**PO3: Develop (L3)**

CO5 Action verb is greater than PO3 verb. Therefore the correlation is high(3)

**PO4: Analyze (L4)**

CO5 Action verb is same as PO4 verb. Therefore the correlation is high(3)

**PO9: Thumb rule**

Once the model ready with 8085 micro controllers, need to narrate about model with understandable manner Therefore the correlation is high(3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: II**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	Database Management Systems	L	T/CLC	P	C
20APC3002	II-I		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the fundamentals of databases to design relational models.

**CO2: Apply** the SQL and PL/SQL concepts to formulate queries.

**CO3: Apply** the E-R model for data base design of real world applications.

**CO4: Analyze** the query processing and optimization for data manipulation.

**CO5: Analyze** the concurrent transactions and recover systems to prevent data loss in system crash.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The fundamentals of databases		To design relational models.	L2
CO2	Apply	the SQL and PL/SQL concepts		To formulate queries.	L3
CO3	Apply	the E-R model		for data base design of real world applications	L3
CO4	Analyze	the query processing and optimization		For data manipulation.	L4
CO5	Analyze	the concurrent transactions and recover systems		to prevent data loss in system crash.	L4

<b>UNIT - I</b>	<b>Introduction, Introduction to Relational Model</b>	9Hrs
Introduction: Database systems applications, Purpose of Database Systems, view of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database users and Administrators, Introduction to Relational Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations		
<b>UNIT - II</b>	<b>Introduction to SQL, Advanced SQL</b>	9 Hrs
Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub-queries, Modification of the Database. Intermediate SQL: Joint Expressions, Views, Transactions, Integrity Constraints, SQL Data types and schemas, Authorization. Advanced SQL: Accessing SQL from a Programming Language, Functions and Procedures, Triggers, Recursive Queries, OLAP, Formal relational query languages.		
<b>UNIT - III</b>	<b>Database Design and the E-R Model, Relational Database Design</b>	9 Hrs
Database Design and the E-R Model: Overview of the Design Process, The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues. Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Functional-Dependency Theory, Algorithms for Decomposition, Decomposition Using Multivalued Dependencies, More Normal Forms.		
<b>UNIT - IV</b>	<b>Query Processing, Query optimization</b>	9 Hrs
Query Processing: Overview, Measures of Query cost, Selection operation, sorting, Join Operation, other operations, Evaluation of Expressions. Query optimization: Overview, Transformation of Relational Expressions, Estimating statistics of Expression results, Choice of Evaluation Plans, Materialized views, Advanced Topics in Query Optimization.		
<b>UNIT - V</b>	<b>Transaction Management, Concurrency control and Recovery System</b>	10Hrs
Transaction Management: Transactions: Concept, A Simple Transactional Model, Storage Structures, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Isolation and Atomicity, Transaction Isolation Levels, Implementation of Isolation Levels, Transactions as SQL Statements. Concurrency Control: Lock-based Protocols, Deadlock Handling, Multiple granularity, Timestamp-		



based Protocols, and Validation-based Protocols.  
Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Nonvolatile Storage, Early Lock Release and Logical Undo Operations.

**Textbooks:**

1. A. Silberschatz, H.F.Korth, S.Sudarshan, "Database System Concepts", 6/e, TMH 2019

**Reference Books:**

1. Database Management System, 6/e Ramez Elmasri, Shamkant B. Navathe, PEA
2. Database Principles Fundamentals of Design Implementation and Management, Carlos Coronel, Steven Morris, Peter Robb, Cengage Learning.
3. Database Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke, TMH

**Online Learning Resources:**

[https://onlinecourses.nptel.ac.in/noc21\\_cs04/preview](https://onlinecourses.nptel.ac.in/noc21_cs04/preview)

**Mapping of course outcomes with program outcomes**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3											
CO2	3	3									2		
CO3	3	3	3	2	3			2	2		2		
CO4	3	3	3	3	3			3				2	
CO5		3	3	3	3			2	2		2		

**Correlation matrix**

**Justification Statements :**

**CO1: Understand the fundamentals of databases to design relational models.**

**Action Verb : Understand(L2)**

Unit No.	CO					Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	13	14%	2	CO1 : Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	19	20%	2	CO2 : Apply	L3	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	3 3 2
3	18	19%	2	CO3 : Apply	L3	PO1 PO2 PO3 PO4 PO5 PO8 PO9 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO8: Thumb rule PO9: Thumb rule PO11: Thumb rule	3 3 3 2 3 2 2 2
4	18	19%	2	CO4 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO8	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO8: Thumb rule	3 3 3 3 3 3
5	25	27%	3	CO5 : Analyze	L4	PO2 PO3 PO4 PO5 PO8 PO9 PO11	PO2: Analyze(L4) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO8: Thumb rule PO9: Thumb rule PO11: Thumb rule	3 3 3 3 2 2 2
	93	100 %						

**PO1 Verb : Apply(L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

**PO2 Verb : Review(L2)**

CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

**CO2: Apply the SQL and PL/SQL concepts to formulate queries.**

**Action Verb : Apply (L3)**

**P01: Apply(L3)**

CO2 Action verb is same level as P01 verb. Therefore the correlation is high (3)

**P02: Review (L2)**

CO2 Action verb is greater than P02 verb. Therefore the correlation is high (3)

**P011: Thumb rule**

For some of DB applications, PL/SQL concepts are used to formulate queries. Therefore the correlation is medium (2)

**CO3: Apply the E-R model for data base design of real world applications.**

**Action Verb : Apply(L3)**

**P01: Apply(L3)**

CO3 Action verb is same level as P01 verb. Therefore the correlation is high (3)

**P02:Review (L2)**

CO3 Action verb is higher level as P02 verb. Therefore the correlation is high (3)

**P03: Develop (L3)**

CO3 Action verb is same level as P03 verb. Therefore the correlation is high (3)

**P04: Analyze(L4)**

CO3 Action verb is less than P04 verb by one level. Therefore the correlation is medium (2)

**P05: Apply(L3)**

CO3 Action verb is same level as P05 verb. Therefore the correlation is high (3)

**P08 : Thumb rule**

Since ethical principles should be followed to create a database. Therefore the correlation is medium(2)

**P09 : Thumb rule**

Team work is required between DBA and Database designer to create a database. Hence the correlation is medium (2)

**P011: Thumb rule**

For some of DB applications, ER model concepts are used to create designs. Therefore the correlation is medium(2)

**CO4: Analyze the query processing and optimization for data manipulation.**

**Action Verb : Analyze(L4)**

**P01: Apply(L3)**

CO4 Action verb is less than P01 verb by one level. Therefore the correlation is medium (2)

**P02: Analyze (L4)**

CO4 Action verb is same level as P02 verb. Therefore the correlation is high (3)

**P03: Develop (L3)**

CO4 Action verb is greater than P03 verb. Therefore the correlation is high (3)

**P04: Analyze (L4)**

CO4 Action verb is same as P04 verb. Therefore the correlation is high (3)

**P05: Apply(L3)**

CO4 Action verb is greater than P05 verb. Therefore the correlation is high (3)

**P08: Thumb rule**

Since ethical principles shall be followed in data manipulation. Therefore the correlation is high(3)

**CO5: Analyze the concurrent transactions and recover systems to prevent data loss in system crash.**

**Action Verb : Analyze (L4)**

**P02: Analyze (L4)**

CO5 Action verb is same level as P02 verb. Therefore the correlation is high (3)

**P03: Develop (L3)**

CO5 Action verb is greater than P03 verb. Therefore the correlation is high (3)

**P04: Analyze (L4)**

CO5 Action verb is same level as P04 verb. Therefore the correlation is high (3)

**P05: Apply(L3)**

CO5 Action verb is greater than P05 verb. Therefore the correlation is high (3)

**P08 : Thumb rule**

Since ethical principles should be followed for transaction management. Therefore the correlation is medium(2)

**P09 : Thumb rule**

Team work is required for transaction management and recovery of failure transactions. Hence the correlation is medium (2)

**P011: Thumb rule**

In real time transaction management is continuously updating. Therefore the correlation is medium (2)





**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: II**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	Object Oriented Programming through Java	L	T/CLC	P	C
20APC3004	II-I		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

CO1: **Understand** the OOP concepts to apply basic java programming.

CO2: **Apply** the inheritance, packages, and interfaces to organize various java resources.

CO3: **Analyze** the exception handling to develop efficient and error free codes.

CO4: **Apply** the concepts of multithreading and collection frameworks to solve real world scenarios

CO5: **Apply** the concepts of applets and swings for making web and GUI based applications.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The fundamentals of OOP concepts		to design java programs.	L2
CO2	Apply	the inheritance, packages, and interfaces		to organize various java resources	L3
CO3	Analyze	the exception handling		to develop efficient and error free codes	L4
CO4	Apply	the concepts of multithreading and collection frameworks		to solve real world scenarios.	L3
CO5	Apply	the concepts of applets and swings		for making web and GUI based applications.	L3

<b>UNIT - I</b>	9Hrs
<b>Object Oriented Thinking:</b> History of Java, Java Buzzwords, Overview of OOP CLASSES AND Objects: Classes, Objects, Simple Java Program, Methods, Constructors, this Keyword, Garbage Collection, Data Types, Variables, Arrays, Operators, Control Statements Overloading of Methods and Constructors, Parameter Passing, Recursion, String Class and String handling methods.	
<b>UNIT - II</b>	9 Hrs
<b>Inheritance:</b> Inheritance Basics, Using Super, Multilevel Hierarchy, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Using final with Inheritance, Object Class. <b>Packages:</b> Packages, Access Protection, Importing Packages. <b>Interfaces:</b> Defining an Interface, Implementing Interface, Applying Interface, Variables in Interfaces, Interfaces can be extended.	
<b>UNIT - III</b>	8Hrs
<b>Exception Handling:</b> Exception Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built in Exceptions, Creating Own Exception Sub Classes. <b>Input and Output Operations:</b> I/O basics, reading console input, writing console output, the PrintWriter class, reading and writing files, automatically closing a file. <b>Generic Programming :</b> Generic classes, generic methods, Bounded Types, Restrictions and Limitations.	
<b>UNIT - IV</b>	8 Hrs
<b>Multithreading:</b> Java Thread Model, The Main Thread, Thread Life Cycle, Creating Thread and Multiple Threads, isAlive() and join(), Thread Priorities, Synchronization, Inter thread Communication, Suspending, Resuming and Stopping Threads. <b>Collection Framework:</b> Collection Overview, Collection Interfaces: The Collection Interface, the List Interface, the Queue Interface, Collection Classes: Array List Class, Linked List Class, String Tokenizer, Scanner.	
<b>UNIT - V</b>	10Hrs
<b>Applets:</b> Applet Basics, Life Cycle of an Applet, Simple Applet Display Methods, The HTML APPLET tag, Passing Parameters to Applets. <b>Swing:</b> Introduction to Swing Model-View, Controller design pattern button, layout management, Swing Components.	
<b>Textbooks:</b>	

Herbert Schildt, Java. The complete reference, TMH. 9th Edition, 2014  
 Cay. S. Horstmann and Gary Cornell Core Java 2, Vol 2, Advanced Features, Pearson Education, 7th Edition, 2004

**Reference Books:**

1. J.Nino and F.A. Hosch, An Introduction to programming and OO design using Java, John Wiley & sons.
2. Y. Daniel Liang, Introduction to Java programming, Pearson Education 6th Edition
3. R.A. Johnson- Thomson, An introduction to Java programming and object oriented application development.
4. P. Radha Krishna, Object Oriented Programming through Java, University Press.

**Online Learning Resources:**

[www.javatpoint.com](http://www.javatpoint.com)

**Mapping of course outcomes with program outcomes**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3										1	1
CO2		3	3	2	3					3	3	1	1
CO3	2	3	3	3	3							1	1
CO4	3	3		2	3		2					1	1
CO5		3	3		3					3	3	1	1

**Correlation matrix**

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	16	19%	2	CO1 :Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	18	21%	3	CO2 :Apply	L3	PO2 PO3 PO4 PO5 PO10 PO11	PO2: Review (L2) PO3: Develop (L3) PO4: Analyze(L4) PO5: Apply(L3) PO10: Thumb Rule PO11: Thumb Rule	3 3 2 3 3 3
3	19	22%	3	CO3 :Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3)	2 3 3 3 3
4	18	21%	3	CO4 :Apply	L3	PO1 PO2 PO4 PO5 PO7	PO1: Apply(L3) PO2: Review (L2) PO4: Analyze(L4) PO5: Apply(L3) PO7: Thumb Rule	3 3 2 3 2
5	15	17%	2	CO5 :Apply	L3	PO2 PO3 PO5 PO10 PO11	PO2: Review (L2) PO3: Develop (L3) PO5: Apply(L3) PO10: Thumb Rule PO11: Thumb Rule	3 3 3 3 3
	85	100%						

**Justification Statements :**

**CO1: Understand the OOP concepts to apply basic java programming.**

**Action Verb : Understand(L2)**

**PO1 Verb : Apply(L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

**PO2 Verb : Review(L2)**

CO1 Action verb is same as PO2 verb. Therefore the correlation is high (3)

**CO2: Apply the inheritance, packages, and interfaces to organize various java resources**

**Action Verb : Apply (L3)**

**PO2: Review (L2)**

CO2 Action verb is greater than PO1 verb. Therefore the correlation is high (3)

**PO3: Develop (L3)**

CO2 Action verb is same level as PO3 verb. Therefore the correlation is high (3)

**PO4: Analyze (L4)**

CO2 Action verb is less than PO4 verb by one level. Therefore the correlation is medium (2)

**PO5: Apply (L3)**

CO2 Action verb is same level as PO5 verb. Therefore the correlation is high (3)

**PO10: Thumb rule**

Create some Java programs to solve real world problems. Therefore the correlation is high (3)

**PO11: Thumb rule**

Learn java programs to solve. Therefore the correlation is high (3)

**CO3: Analyze the exception handling to develop efficient and error free codes****Action Verb : Analyze(L4)****PO1: Apply(L3)**

CO3: CO3 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

**PO2: Review (L2)**

CO3 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

**PO3: Develop (L3)**

CO3 Action verb is greater than PO3 verb by one level. Therefore the correlation is high (3)

**PO4: Analyze (L4)**

CO3 Action verb is same as PO4 verb. Therefore the correlation is high(3)

**PO5: Apply (L3)**

CO3 Action verb is greater than PO5 verb by one level. Therefore the correlation is high(3)

**CO4: Apply the concepts of multithreading and collection frameworks to solve real world scenarios.****Action Verb : Apply (L3)****PO1: Apply(L3)**

CO4 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

**PO2: Review (L2)**

CO4 Action verb is greater than PO2 verb by one level. Therefore the correlation is high(3)

**PO4: Analyze (L4)**

CO4 Action verb is less than PO4 verb by one level. Therefore the correlation is medium (2)

**PO5: Apply (L3)**

CO4 Action verb is same level as PO5 verb. Therefore the correlation is high (3)

**PO7: Thumb rule**

To solve some problems we use multithreading and collection frame works. Therefore the correlation is medium(2)

**CO5: Apply the concepts of applets and swings for making web and GUI based applications.****Action Verb :Apply (L3)****PO2: Review (L2)**

CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

**PO3: Develop (L3)**

CO5 Action verb is same level as PO3 verb. Therefore the correlation is high (3)

**PO5: Apply(L3)**

CO5 Action verb is same level as PO5 verb. Therefore the correlation is high (3)

**PO10: Thumb rule**

Java is used to design simple and enterprise applications so need for project management. Therefore the correlation is high(3)

**PO11: Thumb rule**

It is a programming language so new version available so we need to learn. Therefore the correlation is high(3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: II**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	Computer Organization	L	T/CLC	P	C
20APC3006	II-I		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the operational concepts and instruction set related to modern processors.

**CO2: Evaluate** the Arithmetic operations for understanding execution process.

**CO3: Understand** the hardware requirements of primary and secondary memories to store the data.

**CO4: Analyze** the Input/Output interfaces to connect multiple devices.

**CO5: Apply** the pipeline concepts to execute parallel tasks.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the Operational concepts and instruction set related		to modern processors.	L2
CO2	Evaluate	the Arithmetic operations		for understanding execution process.	L5
CO3	Understand	The hardware requirements of primary and secondary memories		to store the data.	L2
CO4	Analyze	the Input/Output interfaces		to connect multiple devices.	L4
CO5	Apply	the pipeline concepts		to execute parallel tasks.	L3

<b>UNIT - I</b>	<b>Basic Structure of Computer, Machine Instructions and Programs</b>	9 Hrs
Basic Structure of Computer: Computer Types, Functional Units, Basic operational Concepts, Bus Structure, Software, Performance, Multiprocessors and Multicomputer. Machine Instructions and Programs: Numbers, Arithmetic Operations and Programs, Instructions and Instruction Sequencing, Addressing Modes, Basic Input/output Operations, Stacks and Queues, Subroutines, Additional Instructions.		
<b>UNIT - II</b>	<b>Arithmetic, Basic Processing Unit</b>	9Hrs
Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations. Basic Processing Unit: Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control, and Multi programmed Control.		
<b>UNIT - III</b>	<b>The Memory System</b>	9 Hrs
The Memory System: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage.		
<b>UNIT - IV</b>	<b>Input/Output Organization</b>	9 Hrs
Input/Output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces.		
<b>UNIT - V</b>	<b>Pipelining, Large Computer Systems</b>	9 Hrs
Pipelining: Basic Concepts, Data Hazards, Instruction Hazards, Influence on Instruction Sets. Large Computer Systems: Forms of Parallel Processing, Array Processors, The Structure of General-Purpose multiprocessors, Interconnection Networks.		
<b>Textbooks:</b>		
1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", 5th Edition, McGraw Hill Education, 2013.		
<b>Reference Books:</b>		
1. M.Morris Mano, "Computer System Architecture", 3rd Edition, Pearson Education. 2. Themes and Variations, Alan Clements, "Computer Organization and Architecture", CENGAGE Learning. 3. SmrutiRanjanSarangi, "Computer Organization and Architecture", McGraw Hill Education. John P.Hayes, "Computer Architecture and Organization", McGraw Hill Education		

<b>Online Learning Resources:</b>
<a href="https://nptel.ac.in/courses/106/103/106103068/">https://nptel.ac.in/courses/106/103/106103068/</a>

### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3									2		
CO2	3	3	3			2					2	2	
CO3	2	3						2	2				
CO4	3	3	3	3	3			2			2		1
CO5	3	3						2	2			2	

### Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	09	20%	2	CO1 :Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	2 3 2
2	09	20%	2	CO2 : Evaluate	L5	PO1 PO2 PO3 PO6 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO6: Thumb rule PO11: Thumb rule	3 3 3 2 2
3	09	20%	2	CO3 : Understand	L2	PO1 PO2 PO8 PO9	PO1: Apply(L3) PO2: Review(L2) PO8: Thumb rule PO9: Thumb rule	2 3 2 2
4	09	20%	2	CO4 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO8 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO8: Thumb rule PO11: Thumb rule	3 3 3 3 3 2 2
5	09	20%	2	CO5 : Apply	L3	PO1 PO2 PO8 PO9	PO1: Apply(L3) PO2: Review (L2) PO8: Thumb rule PO9: Thumb rule	3 3 2 2
	45	100 %						

### Justification Statements :

**CO1: Understand the operational concepts and instruction set related to modern processors.**

**Action Verb : Understand(L2)**

**PO1 Verb : Apply(L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

**PO2 Verb : Review(L2)**

CO1 Action verb is same as PO2 verb. Therefore the correlation is high (3)

**PO11: Thumb rule**

Identify the deficiencies and demonstrate the need of updating the computer components to meet desired requirements. Therefore the correlation is medium (2)

**CO2: Evaluate the Arithmetic operations for understanding execution process**

**Action Verb : Evaluate (L5)**

**PO1: Apply(L3)**

CO2 Action verb is greater than level PO1 verb by two level. Therefore the correlation is high (3)

**PO2: Review (L2)**

CO2 Action verb is greater than PO2 verb. Therefore the correlation is high(3)

**PO3: Develop (L3)**

CO2 Action verb is greater than PO3 verb. Therefore the correlation is high(3)

**PO6: Thumb rule**

For some of computer applications, Various arithmetic operations are evaluated for understanding execution process of computer systems. Therefore, the correlation is Medium (2)

**PO11: Thumb rule**

Identify the deficiencies and demonstrate the need of updating the computer instruction set to meet desired requirements. Therefore the correlation is medium(2)

**CO3: Understand the hardware requirements of primary and secondary memories to store the data.**

**Action Verb : Understand (L2)**

**PO1: Apply(L3)**

CO3 Action verb is less than PO1 verb level by one level. Therefore the correlation is moderate (2)

**PO2: Review (L2)**

CO3 Action verb is same as PO2 verb. Therefore the correlation is high (3)

**PO8 : Thumb rule**

Since ethical principles should be followed to while creating the primary and secondary memories. Therefore the correlation is medium(2)

**PO9 : Thumb rule**

Team work is required to understand and demonstrate the secondary memories in computer system. Hence the correlation is medium (2)

**CO4: Analyze the Input/Output interfaces to connect multiple devices.Action Verb : Analyze(L4)**

**Action Verb : Analyze (L4)**

**PO1: Apply(L3)**

CO4 Action verb is greater than PO1 by one level. Therefore the correlation is high (3)

**PO2: Analyze (L4)**

CO4 Action verb is same as PO2 verb. Therefore the correlation is High(3)

**PO3: Develop (L3)**

CO4 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

**PO4: Analyze (L4)**

CO4 Action verb is same as PO4 verb. Therefore the correlation is high (3)

**PO5: Apply(L3)**

CO4 Action verb is greater than PO5 verb. Therefore the correlation is high (3)

**PO8: Thumb rule**

Since ethical principles shall be followed in creating quality input and output interfaces. Therefore the correlation is medium(2)

**PO11: Thumb rule**

Identify the deficiencies and demonstrate the need of updating the input and output interfaces to meet desired requirements. Therefore the correlation is medium(2)

**CO5: Apply the pipeline concepts to execute parallel tasks.**

**Action Verb : Apply (L3)**

**PO1: Apply(L3)**

CO5 Action verb is same as PO1. Therefore the correlation is high (3)

**PO2: Review (L2)**

CO5 Action verb is greater than PO2 verb. Therefore the correlation is high(3)

**PO8 : Thumb rule**

Since ethical principles should be followed in solving problems caused in pipeline hazards. Therefore the correlation is medium(2)

**PO9 : Thumb rule**

Team work is required to provide the solutions caused due to pipeline hazards. Hence the correlation is medium (2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: II**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	Database Management System Lab	L	T/CLC	P	C
20APC3003	II-I		0	0	3	1.5

**Course Outcomes:**

After studying the course, student will be able to

**CO 1: Apply** the DDL, DML Commands for manipulating the data.

**CO 2: Evaluate** the simple mathematical operations using PL/SQL.

**CO 3: Apply** the Triggers to automate the actions on database

**CO 4: Apply** the cursors to access system memory in PL/SQL Programs

**CO 5: Apply** the Entity-Relationship for real time applications.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Apply	the DDL, DML Commands		for manipulating the data.	L3
CO2	Evaluate	the simple mathematical operations	using PL/SQL		L5
CO3	Apply	the Triggers		to automate the actions on database	L3
CO4	Apply	the cursors		to access system memory in PL/SQL Programs.	L3
CO5	Apply	the Entity-Relationship		for real time applications	L3

**List of Experiments:**

**Week-1: CREATION OF TABLES**

1. Create a table called Employee with the following structure.

Name	Type
Empno	Number
Ename	Varchar2(20)
Job	Varchar2(20)
Mgr	Number
Sal	Number

- Add a column commission with domain to the Employee table.
  - Insert any five records into the table.
  - Update the column details of job
  - Rename the column of Employ table using alter command.
  - Delete the employee whose empno is 19. **(CO1)**
2. Create department table with the following structure.

Name	Type
Deptno	Number
Deptname	Varchar2(20)
location	Varchar2(20)

- a. Add column designation to the department table.
  - b. Insert values into the table.
  - c. List the records of emp table grouped by deptno.
  - d. Update the record where deptno is 9.
  - e. Delete any column data from the table **(CO1)**
3. Create a table called Customer table

Name	Type
------	------



Cust name	Varchar2(20)
Cust street	Varchar2(20)
Cust city	Varchar2(20)

- Insert records into the table.
- Add salary column to the table.
- Alter the table column domain.
- Drop salary column of the customer table.
- Delete the rows of customer table whose ust\_city is 'hyd'. **(C01)**

4. Create a table called branch table. **(C01)**

Name	Type
Branch name	Varchar2(20)
Branch city	Varchar2(20)
asserts	Number

- Increase the size of data type for asserts to the branch.
  - Add and drop a column to the branch table.
  - Insert values to the table.
  - Update the branch name column
  - Delete any two columns from the table **(C01)**

6. Create a table called sailor table

Name	Type
Sid	Number
Sname	Varchar2(20)
rating	Varchar2(20)

- Add column age to the sailor table.
- Insert values into the sailor table.
- Delete the row with rating>8.
- Update the column details of sailor.
- Insert null values into the table. **(C01)**

7. Create a table called reserves table

Name	Type
Boat id	Integer
sid	Integer
day	Integer

- Insert values into the reserves table.
- Add column time to the reserves table.
- Alter the column day data type to date.
- Drop the column time in the table.
- Delete the row of the table with some condition. **(C01)**

**Week-2: QUERIES USING DDL AND DML**

- Create a user and grant all permissions to the user.
  - Insert the any three records in the employee table and use rollback. Check the result.
  - Add primary key constraint and not null constraint to the employee table.
  - Insert null values to the employee table and verify the result. **(C01)**
- Create a user and grant all permissions to the user.
  - Insert the any three records in the employee table and use rollback. Check the result.
  - Add primary key constraint and not null constraint to the employee table.
  - Insert null values to the employee table and verify the result. **(C01)**
- Create a user and grant all permissions to the user.
  - Insert values in the department table and use commit.
  - Add constraints like unique and not null to the department table.
  - Insert repeated values and null values into the table. **(C01)**
- Create a user and grant all permissions to the user.
  - Insert values into the table and use commit.



- c. Delete any three records in the department table and use rollback.
- d. Add constraint primary key and foreign key to the table.
- 5. a. Create a user and grant all permissions to the user. **(C01)**
- b. Insert records in the sailor table and use commit.
- c. Add save point after insertion of records and verify save point.
- d. Add constraints not null and primary key to the sailor table.
- e. Create a user and grant all permissions to the user.
- f. Use revoke command to remove user permissions.
- g. Change password of the user created.
- h. Add constraint foreign key and not null. **(C01)**
- 6. a. Create a user and grant all permissions to the user.
- b. Update the table reserves and use savepoint and rollback.
- c. Add constraint primary key , foreign key and not null to the reserves table
- d. Delete constraint not null to the table column **(C01)**

### **Week-3:QUERIES USING AGGREGATE FUNCTIONS**

- 1. a. By using the group by clause, display the enames who belongs to deptno 10 along with average salary.
- b. Display lowest paid employee details under each department.
- c. Display number of employees working in each department and their department number.
- d. Using built-in functions, display number of employees working in each department and their department name from dept table. Insert deptname to dept table and insert deptname foreach row, do the required thing specified above.
- e. List all employees which start with either B or C.
- f. Display only these ename of employees where the maximum salary is greater than or equal to 5000. **(C01)**
- 2. a. Calculate the average salary for each different job.
- b. Show the average salary of each job excluding manager.
- c. Show the average salary for all departments employing more than three people.
- d. Display employees who earn more than the lowest salary in department 30
- e. Show that value returned by sign (n)function.
- f. How many days between day of birth to current date **(C01)**
- 3. a. Show that two substring as single string.
- b. List all employee names, salary and 15% rise in salary.
- c. Display lowest paid emp details under each manager
- d. Display the average monthly salary bill for each deptno.
- e. Show the average salary for all departments employing more than two people.
- f. By using the group by clause, display the eid who belongs to deptno 05 along with average salary. **(C01)**
- 4. a. Count the number of employees in department20 **(C01)**
- b. Find the minimum salary earned by clerk.**
  - a. Find minimum, maximum, average salary of all employees.
  - b. List the minimum and maximum salaries for each job type.
  - c. List the employee names in descending order.
  - d. List the employee id, names in ascending order by empid. **(C01)**
- 5. a. Find the sids ,names of sailors who have reserved all boats called "INTERLAKE"
- b. Find the age of youngest sailor who is eligible to vote for each rating level with at least twosuch sailors.
- c. Find the sname, bid and reservation date for each reservation.
- d. Find the ages of sailors whose name begin and end with B and has at least 3characters.
- e. List in alphabetic order all sailors who have reserved redboat.
- f. Find the age of youngest sailor for each rating level. **(C01)**
- 6. a. List the Vendors who have delivered products within 6 months from order date.
- b. Display the Vendor details who have supplied both Assembled and Subparts.
- c. Display the Sub parts by grouping the Vendor type (Local or Nonlocal).
- d. Display the Vendor details in ascending order.
- e. Display the Sub part which costs more than any of the Assembled parts.
- f. Display the second maximum cost Assembled part **(C01)**

### **Week-4: PROGRAMS ON PL/SQL**

- 1. a. Write a PL/SQL program to swap two numbers. **(C02)**
- b. Write a PL/SQL program to find the largest of three numbers.
- 2. a. Write a PL/SQL program to find the total and average of 6 subjects and display the grade.
- b. Write a PL/SQL program to find the sum of digits in a given number. **(C02)**
- 3. a. Write a PL/SQL program to display the number in reverse order.
- b. Write a PL/SQL program to check whether the given number is prime or not. **(C02)**
- 4. a. Write a PL/SQL program to find the factorial of a given number.
- b. Write a PL/SQL code block to calculate the area of a circle for a value of radius varying from 3 to 7.

Store the radius and the corresponding values of calculated area in an empty table named areas, consisting of two columns radius and area. **(CO2)**

5. a. Write a PL/SQL program to accept a string and remove the vowels from the string. (When 'hello' passed to the program it should display 'Hll' removing e and o from the world Hello).
- b. Write a PL/SQL program to accept a number and a divisor. Make sure the divisor is less than or equal to 10. Else display an error message. Otherwise Display the remainder in words. **(CO2)**

#### **Week-5: PROCEDURES AND FUNCTIONS**

1. Write a function to accept employee number as parameter and return Basic +HRA together as single column. **(CO2)**
2. Accept year as parameter and write a Function to return the total net salary spent for a given year. **(CO2)**
3. Create a function to find the factorial of a given number and hence find NCR. **(CO2)**
4. Write a PL/SQL block to print prime Fibonacci series using local functions. **(CO2)**
5. Create a procedure to find the lucky number of a given birth date. **(CO2)**
6. Create function to the reverse of given number **(CO2)**

#### **Week-6: TRIGGERS**

1. Create a row level trigger for the customers table that would fire for INSERT or UPDATE or DELETE operations performed on the CUSTOMERS table. This trigger will display the salary difference between the old values and new values **(CO3)**

CUSTOMERS table:

ID	NAME	AGE	ADDRESS	SALARY
1	Alive	24	Khammam	2000
2	Bob	27	Kadappa	3000
3	Catri	25	Guntur	4000
4	Dena	28	Hyderabad	5000
5	Eeshwar	27	Kurnool	6000
6	Farooq	28	Nellore	7000

2. Creation of insert trigger, delete trigger, update trigger practice triggers using the passenger database. Passenger( Passport\_ id INTEGER PRIMARY KEY, Name VARCHAR (50) Not NULL, Age Integer Not NULL, Sex Char, Address VARCHAR (50) Not NULL);
  - a. Write a Insert Trigger to check the Passport\_id is exactly six digits or not.
  - b. Write a trigger on passenger to display messages '1 Record is inserted', '1 record is deleted', '1 record is updated' when insertion, deletion and updation are done on passenger respectively. **(CO3)**
3. Insert row in employee table using Triggers. Every trigger is created with name any trigger have same name must be replaced by new name. These triggers can be raised before insert, update or delete rows on data base. The main difference between a trigger and a stored procedure is that the former is attached to a table and is only fired when an INSERT, UPDATE or DELETE occurs. **(CO3)**
4. Convert employee name into uppercase whenever an employee record is inserted or updated. Trigger to fire before the insert or update. **(CO3)**
5. Trigger before deleting a record from emp table. Trigger will insert the row to be deleted into table called delete\_emp and also record user who has deleted the record and date and time of delete. **(CO3)**
6. Create a transparent audit system for a table CUST\_MSTR. The system must keep track of the records that are being deleted or updated **(CO3)**

#### **Week-7: PROCEDURES**

1. Create the procedure for palindrome of given number. **(CO3)**
2. Create the procedure for GCD: Program should load two registers with two Numbers and then apply the logic for GCD of two numbers. GCD of two numbers is performed by dividing the greater number by the smaller number till the remainder is zero. If it is zero, the divisor is the GCD if not the remainder and the divisors of the previous division are the new set of two numbers. The process is repeated by dividing greater of the two numbers by the smaller number till the remainder is zero and GCD is found.
3. Write the PL/SQL programs to create the procedure for factorial of given number. **(CO3)**
4. Write the PL/SQL programs to create the procedure to find sum of N natural number. **(CO3)**
5. Write the PL/SQL programs to create the procedure to find Fibonacci series. **(CO3)**
6. Write the PL/SQL programs to create the procedure to check the given number is perfect or not **(CO3)**

#### **Week-8: CURSORS**

1. Write a PL/SQL block that will display the name, dept no, salary of first highest paid employees. Update the balance stock in the item master table each time a transaction takes place in the item transaction table. The change in item master table depends on the item id is already present in the item master then update operation is performed to decrease the balance stock by the quantity specified in the item transaction in case the item id is not present in the item master table then the record is inserted in the item master table. **(CO4)**
2. Write a PL/SQL block that will display the employee details along with salary using cursors. **(CO4)**
3. To write a Cursor to display the list of employees who are working as Managers or Analyst. **(CO4)**
4. To write a Cursor to find employee with given job and deptno. **(CO4)**
5. Write a PL/SQL block using implicit cursor that will display message, the salaries of all the employees in the 'employee' table are updated. If none of the employee's salary is updated we get a message 'None of the salaries were updated'. Else we get a message like for example, 'Salaries for 1000 employees are updated' if there are 1000 rows in 'employee' table **(CO4)**

### **Week-9: CASE STUDY: BOOK PUBLISHING COMPANY**

A publishing company produces scientific books on various subjects. The books are written by authors who specialize in one particular subject. The company employs editors who, not necessarily being specialists in a particular area, each take sole responsibility for editing one or more publications.

A publication covers essentially one of the specialist subjects and is normally written by a single author. When writing a particular book, each author works with one editor, but may submit another work for publication to be supervised by other editors. To improve their competitiveness, the company tries to employ a variety of authors, more than one author being a specialist in a particular subject for the above case study, do the following:

1. Analyze the data required.
2. Normalize the attributes.

Create the logical data model using E-R diagrams(C05)

### **Week-10: CASE STUDY GENERAL HOSPITAL**

A General Hospital consists of a number of specialized wards (such as Maternity, Pediatric, Oncology, etc.). Each ward hosts a number of patients, who were admitted on the recommendation of their own GP and confirmed by a consultant employed by the Hospital. On admission, the personal details of every patient are recorded. A separate register is to be held to store the information of the tests undertaken and the results of a prescribed treatment. A number of tests may be conducted for each patient. Each patient is assigned to one leading consultant but may be examined by another doctor, if required. Doctors are specialists in some branch of medicine and may be leading consultants for a number of patients, not necessarily from the same ward. For the above case study, do the following.

1. Analyze the data required.
2. Normalize the attributes.

Create the logical data model using E-R diagrams(C05)

### **Week-11: CASE STUDY: CAR RENTAL COMPANY**

A database is to be designed for a car rental company. The information required includes a description of cars, subcontractors (i.e. garages), company expenditures, company revenues and customers. Cars are to be described by such data as: make, model, year of production, engine size, fuel type, number of passengers, registration number, purchase price, purchase date, rent price and insurance details. It is the company policy not to keep any car for a period exceeding one year. All major repairs and maintenance are done by subcontractors (i.e. franchised garages), with whom CRC has long-term agreements. Therefore the data about garages to be kept in the database includes garage names, addresses, range of services and the like. Some garages require payments immediately after a repair has been made; with others CRC has made arrangements for credit facilities. Company expenditures are to be registered for all outgoings connected with purchases, repairs, maintenance, insurance etc. Similarly the cash inflow coming from all sources: Car hire, car sales, insurance claims must be kept of file. CRC maintains a reasonably stable client base. For this privileged category of customers special credit card facilities are provided. These customers may also book in advance a particular car. These reservations can be made for any period of time up to one month. Casual customers must pay a deposit for an estimated time of rental, unless they wish to pay by credit card. All major credit cards are accepted. Personal details such as name, address, telephone number, driving license, number about each customer are kept in the database. For the above case study, do the following:

1. Analyze the data required.
2. Normalize the attributes.

Create the logical data model using E-R diagrams(C05)

### **Week-12: CASE STUDY: STUDENT PROGRESS MONITORING SYSTEM**

A database is to be designed for a college to monitor students' progress throughout their course of study. The students are reading for a degree (such as BA, BA (Hons.) M.Sc., etc) within the framework of the modular system. The college provides a number of modules, each being characterized by its code, title, credit value, module leader, teaching staff and the department they come from. A module is coordinated by a module leader who shares teaching duties with one or more lecturers. A lecturer may teach (and be a module leader for) more than one module. Students are free to choose any module they wish but the following rules must be observed: Some modules require pre-requisites modules and some degree programs have compulsory modules. The database is also to contain some information about students including their numbers, names, addresses, degrees they read for, and their past performance i.e. modules taken and examination results.

For the above case study, do the following: (C05)

1. Analyze the data required.
2. Normalize the attributes.
3. Create the logical data model i.e., ER diagrams.
4. Comprehend the data given in the case study by creating respective tables with primary keys and foreign keys wherever required.
5. Insert values into the tables created (Be vigilant about Master- Slave tables).
6. Display the Students who have taken M.Sc course
7. Display the Module code and Number of Modules taught by each Lecturer.
8. Retrieve the Lecturer names who are not Module Leaders.
9. Display the Department name which offers 'English' module.
10. Retrieve the Prerequisite Courses offered by every Department (with Department names).

11. Present the Lecturer ID and Name who teaches 'Mathematics'. 12. Discover the number of years a Module is taught. 13. List out all the Faculties who work for 'Statistics' Department. 14. List out the number of Modules taught by each Module Leader. 15. List out the number of Modules taught by a particular Lecturer. 16. Create a view which contains the fields of both Department and Module tables.(Hint- The fields like Module code, title, credit, Department code and its name). Update the credits of all the prerequisite courses to 5. Delete the Module 'History' from the Module table.
<b>References:</b>
1. Ramez Elmasri, Shamkant, B. Navathe, "Database Systems", Pearson Education, 6th Edition, 2013. 2. Peter Rob, Carles Coronel, "Database System Concepts", Cengage Learning, 7th Edition, 2008.
<b>Online Learning Resources/Virtual Labs:</b>
<a href="http://www.scoopworld.in">http://www.scoopworld.in</a> <a href="http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php">http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php</a>

#### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	3		3							1	
CO2	1	3			3							1	
CO3	3	2		3	3							2	2
CO4	3	2		3	3								
CO5			3		3	2					2		

#### Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: Apply	L3	PO1 PO2 PO3 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO5: Apply(L3)	3 2 3 3
2	CO2: Evalute	L5	PO1 PO2 PO5	PO1:Apply(L3) PO3:Formulate(L6) PO5:Create(L6)	1 3 3
3	CO3: Apply	L3	PO1 PO2 PO4 PO5	PO1:Apply(L3) PO2:Review(L2) PO4:Design(L6) PO5:Create(L6)	3 2 3 3
4	CO4: Apply	L3	PO1 PO2 PO4 PO5	PO1:Apply(L3) PO2:Review(L2) PO4:Design(L6) PO5:Create(L6)	3 2 3 3
5	CO5: Apply	L3	PO3 PO5 PO6 PO11	PO3:Design(L6) PO5:Create(L6) PO6:Thumb rule PO11:Thumb rule	3 3 3 3

#### Justification Statements :

**CO1: Apply** the DDL,DML Commands for manipulating the data

**Action Verb: Apply(L3)**

**PO1 Verb: Apply(L3)**

CO1 Action verb is same as PO1 verb. Therefore, the correlation is high (3)

**PO2 Verb: Review(L2)**

CO1 Action verb is less than PO2 verb by one level. Therefore, the correlation is medium (2)

**PO3 Verb: Develop(L3)**

CO1 Action verb is same as PO3 verb. Therefore, the correlation is high (3)

**PO5 Verb: Apply(L3)**

CO1 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

**C02: Evaluate** the simple mathematical operations using PL/SQL.

**Action Verb: Evaluate (L5)**

**P01 Verb: Apply (L3)**

C02 Action verb is less than P02 verb by two levels. Therefore, the correlation is low (1)

**P02 Verb : Formulate(L6)**

C02 Action verb is greater than as P03 verb. Therefore, the correlation is high (3)

**P05 Verb: Create(L6)**

C02 Action verb is greater than as P05 verb. Therefore, the correlation is high (3)

**C03: Apply** the Triggers to automate the actions on database

**Action Verb: Apply(L3)**

**P01 Verb: Apply (L3)**

C03 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P02 Verb: Review(L2)**

C03 Action verb is less than P02 verb by one level. Therefore, the correlation is Medium(2)

**P04 Verb: Design (L6)**

C03 Action verb is greater than as P04 verb. Therefore, the correlation is high (3)

**P05 Verb: Create (L6)**

C03 Action verb is greater than as P05 verb. Therefore, the correlation is high (3)

**C04: Apply** the cursors to access system memory in PL/SQL Programs.

**Action Verb: Apply (L3)**

**P01 Verb: Apply (L3)**

C04 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P02 Verb: Review(L2)**

C04 Action verb is less than P02 verb by one level. Therefore, the correlation is Medium(2)

**P04 Verb: Design (L6)**

C04 Action verb is greater than as P04 verb. Therefore, the correlation is high (3)

**P05 Verb: Create (L6)**

C04 Action verb is greater than as P05 verb. Therefore, the correlation is high (3)

**C05: Apply** the Entity-Relationship for real time applications

**Action Verb: Apply (L3)**

**P03 Verb: Design (L6)**

C05 Action verb is greater than as P03 verb. Therefore, the correlation is high (3)

**P05 Verb: Create (L6)**

C05 Action verb is greater than as P05 verb. Therefore, the correlation is high (3)

**P06 Verb:Thumb rule**

By designing a solution for a problem it is easy to provide solution for any problem. So the correlation is medium(2)

**P011: Verb:Thumb rule**

Modeling is a continuous learning activity for the user, the correlation is medium(2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI**

**(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: II**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB	L	T/CLC	P	C
20APC3005	II-I		0	0	4	2

**Course Outcomes:**

**C01: Understand** the java compiler and learn how to use eclipse or net beans IDE.

**C02: Apply** the class concepts for developing simple java applications.

**C03: Apply** the oops concepts for implementing java programs.

**C04: Analyze** the concepts of multithreading and collection frameworks for writing simple programs.

**C05: Create** the applets and GUI based applications using swings.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	the java compiler and learn how to use eclipse or net beans IDE.			L2
C02	Apply	the class concepts		for developing simple java applications.	L3
C03	Apply	the oops concepts		for implementing java programs.	L3
C04	Analyze	the concepts of multithreading and collection frameworks		for writing simple programs.	L4
C05	Create	the applets and GUI based applications	using swings.		L6

**List of Experiments**

**Week-1: (Unit-1)**

Installation of Java software, study of any integrated development environment, Use Eclipse or Net bean platform and acquaint with the various menus. Create a test project, add a test class and run it.

Practice Java Basic Programs on Classes and Objects.(C01)

**Week-2: (Unit-1)**

Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff. If the type of the EB connection is domestic, calculate the amount to be paid as follows:

First 100 units - Rs. 1 per unit; 101-200 units - Rs. 2.50 per unit; 201 -500 units - Rs. 4 per unit;

501 units - Rs. 6 per unit. If the type of the EB connection is commercial, calculate the amount to be paid as follows: First 100 units - Rs. 2 per unit; 101-200 units - Rs. 4.50 per unit; 201 -500 units - Rs. 6 per unit; > 501 units - Rs. 7 per unit.

Write a java program to illustrate the concept of class with method overloading. C) Write a java program to illustrate the concept of class with Constructors overloading. (C02)

**Week-3:(Unit-2)**

a) Write a program to create a class named shape. It should contain 2 methods, draw() and erase() that prints "Drawing Shape" and "Erasing Shape" respectively. For this class, create three sub

classes, Circle, Triangle and Square and each class should override the parent class functions - draw () and erase (). The draw() method should print "Drawing Circle", "Drawing Triangle" and "Drawing Square" respectively. The erase() method should print "Erasing Circle", "Erasing Triangle" and "Erasing Square" respectively. Create objects of Circle, Triangle and Square in the following way and observe the polymorphic nature of the class by calling draw() and erase() method using each object. Shape c=new Circle(); Shape t=new Triangle(); Shape s=new Square();

b) Write a Java Program to demonstrate inheritance & usage of super (C02)

#### **Week-4:(Unit-2)**

Write a Java Program to implement multilevel inheritance. (C03)

Write a Java program to implement the method overriding (C03)

Write a Java program to implement dynamic method dispatch. (C03)

#### **Week-5:(Unit-2)**

Write a Java program to implement abstract class. (C03)

Write a Java Program to implement Packages. (C03)

Write a Java Program to implement Access Protection in Packages. (C03)

#### **Week-6:(Unit-2)**

Write a Java program to demonstrate interfaces. (C03)

Write a Java program to implement the multiple inheritance using interfaces. (C03)

#### **Week-7:(Unit-3)**

Write a Java program to implement the exception handling mechanism. (C03)

Write a Java program to implement the nested try statement. (C03)

Write a Java program to implement your own exception class. (C03)

#### **Week-8:(Unit-3)**

Write a Java Program to demonstrate the following String Handlings. (C03)

String Length & Concatenation.

Character Extraction.

String Comparison.

Searching and modifying String.

Write a Java Program to demonstrate String Buffer Class.

#### **Week-9:(Unit-4)**

Write a Java program for multi-thread implementation. (C04)

Write a Java program to implement producer consumer problem using inter-thread communication mechanism. (C04)

#### **Week-10:(Unit-4)**

Practice any two Programs on Collections. (C04)

Practice any two Programs on String Tokenizer & Scanner. (C04)

#### **Week-11:(Unit-5)**

Write a Java Program to develop an applet that displays a simple message. (C05)

Develop an applet that receives an integer in one text field, and computes its factorial Value and returns it in another text field, when the button named –Compute! is clicked. (C05)

Write a java program to handle keyboard events. (C05)

Write a java program to handle Mouse events (C05)

#### **Week-12:(Unit-5)**

Write a Java Program to demonstrate AWT Label & Button. (C05)

Write a Java Program to demonstrate JLabel, JTextField & JButton. (C05)

Write a program to design a calculator using event driven programming paradigm of java (C05)

#### **Reference Books:**

1. Herbert Schildt. Java. The complete reference, TMH. 9<sup>th</sup> Edition.
2. H.M. Dietel and P.J. Dietel, Java How to Program 6<sup>th</sup> Edition, Pearson Education/PHI
3. Y. Daniel Liang, Introduction to Java programming, Pearson Education, 6<sup>th</sup> Edition.
4. Cay Horstmann, Big Java, 2<sup>nd</sup> edition, Wiley Student Edition, Wiley India Private Limited.

**Mapping of course outcomes with program outcomes**

CO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02
C01		3			2							3	
C02		3	3	2	3							2	
C03			3	2	3							2	2
C04		3	3	3	3							2	2
C05			3		3							2	

**Correlation matrix**

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for P01 to P011)	Level of Correlation (0-3)
1	C01 :Understand	L2	P02 P05	P02: Review(L2) P05: Apply(L3)	3 2
2	C02 :Apply	L3	P02 P03 P04 P05	P02: Review(L2) P03: Develop (L3) P04: Analyze(L4) P05: Apply(L3)	3 3 2 3
3	C03: Apply	L3	P03 P04 P05	P03: Develop(L3) P04: Analyze(L4) P05: Apply(L3)	3 2 3
4	C04: Analyze	L4	P02 P03 P04 P05	P02: Analyze (L4) P03: Develop(L3) P04: Analyze(L4) P05: Apply(L3)	3 3 3 3
5	C05 :Create	L6	P03 P05	P03: Design (L6) P05: Create(L6)	3 3

**Justification Statements :**

**C01: Understand** the java compiler and learn how to use eclipse or net beans IDE.

**Action Verb : Understand(L2)**

P02: Review(L2)

C01 Action verb is same P02 verb. Therefore the correlation is High(3)

P05: Apply(L3)

C01 Action verb is less than P05 verb by one level. Therefore the correlation is medium (2)

**C02: Apply** the class concepts for developing simple java applications.

**Action Verb : Apply (L3)**

P02: Review(L2)

C02 Action verb is greater than P02 verb. Therefore the correlation is High(3)

**P03: Develop (L3)**

C02 Action verb is same level as P03 verb. Therefore the correlation is high (3)

**P04: Analyze (L4)**

C02 Action verb is less than P04 verb by one levels. Therefore the correlation is medium (2)

**P05: Apply (L3)**

C02 Action verb is same level as P05 verb. Therefore the correlation is high (3)

**C03: Apply** the oops concepts for implementing java programs.

**Action Verb : Apply(L3)**

P03: Develop (L3)

C03 Action verb is same level as P03 verb. Therefore the correlation is high (3)

P04: Analyze (L4)

C03 Action verb is less than P04 verb by one level. Therefore the correlation is medium(2)



P05: Apply (L3)

C03 Action verb is same as P05 verb. Therefore the correlation is high(3)

**C04: Analyze** the concepts of multithreading and collection frameworks for writing simple programs.

**Action Verb :Analyze (L4)**

P02: Analyze (L4)

C04 Action verb is same P02 verb. Therefore the correlation is high (3)

P03: Develop (L3)

C04 Action verb is greater than P03 verb. Therefore the correlation is high (3)

P04: Analyze (L4)

C04 Action verb is same as P04 verb. Therefore the correlation is high (3)

P05: Apply (L3)

C04 Action verb is greater than P05 verb. Therefore the correlation is high (3)

**C05: Create** the applets and GUI based applications using swings.

**Action Verb : Create (L6)**

P03: Design (L6)

C05 Action verb is same level as P03 verb. Therefore the correlation is high (3)

P05: Create(L6)

C05 Action verb is same as P05 verb. Therefore the correlation is high (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: II**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	Computer Organization Lab	L	T/CLC	P	C
20APC3007	II-I		0	0	2	1

### Course Outcomes (CO):

After studying the course, student will be able to

**CO 1: Analyze** the numbers systems to perform arithmetic operations.

**CO 2: Design** the half adder and full adder using combinational circuit.

**CO 3: Apply** the sequential circuits to develop 4-bit shift register and decade counter.

**CO 4: Apply** the concepts of Boolean algebra to minimize Boolean expression.

**CO 5: Apply** the booth algorithm to perform operation on binary numbers.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Analyze	The numbers systems		to perform arithmetic operations	L4
CO2	Design	The half and full adder	Using combinational circuit	To design the logic gates	L6
CO3	Apply	The sequential circuits		to develop 4-bit shift register	L3
CO4	Apply	the concepts of Boolean algebra		to minimize Boolean expression	L3
CO5	Apply	The booth algorithm		to perform operation on binary numbers	L3

### List of Experiments:

#### Exercises in Digital Electronics:

- Implement Logic gates using NAND and NOR gates **(CO1)**
- Design a Full adder using gates**(CO2)**
- Design and implement the 4:1 MUX, 8:1 MUX using gates /ICs. **(CO2)**
- Design and Implement a 3 to 8 decoder using gates**(CO2)**
- Design a 4 bit comparator using gates/IC**(CO3)**
- Design and Implement a 4 bit shift register using Flip flops**(CO3)**
- Design and Implement a Decade counter**(CO3)**

#### Microprocessors (8086 Assembly Language Programming)

- 8 Bit Addition and Subtraction. **(CO4)**
- 16 Bit Addition. **(CO4)**
- BCD Addition. **(CO4)**
- BCD Subtraction. **(CO4)**
- 8 Bit Multiplication. **(CO4)**
- 8 Bit Division. **(CO4)**
- Searching for an Element in an Array. **(CO4)**
- Sorting in Ascending and Descending Orders. **(CO4)**
- Finding Largest and Smallest Elements from an Array. **(CO4)**

#### Exercises in Computer Organization

- Implement a C program to perform Binary Addition & Subtraction. **(CO4)**
- Implement a C program to perform Multiplication of two binary numbers**(CO4)**
- Implement a C program to perform Multiplication of two binary numbers (signed) using Booth's Algorithms. **(CO5)**
- Implement a C program to perform division of two binary numbers (Unsigned) using restoring

division algorithm. **(C05)**

- Implement a C program to perform division of two binary numbers (Unsigned) using non-restoring division algorithm. **(C05)**

#### References:

- Switching theory and logic design –A. Anand Kumar PHI, 2013
- Advanced microprocessor & Peripherals-A. K. Ray and K. M. Bherchandavi, TMH, 2nd edition.
- Switching and Finite Automatic theory-Zvi Kohavi, Niraj K.Jha Cambridge, 3rd edition
- Digital Design –Morris Mano, PHI, 3rd edition
- Microprocessor and Interfacing –Douglas V. Hall, TMGH 2nd edition.

#### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	3	3	3	3								1	1
C02	3	3	3	3	3						3	1	1
C03	3	3	3	3	3							2	
C04	3	3	3	3	3						3	2	2
C05	3	3	3	3	3							2	1

#### Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	C01: Analyze	L4	PO1 PO2 PO3 PO4	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Interpret (L2)	3 3 3 3
2	C02: Design	L6	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Formulate (L6) PO3: Design(L6) PO4: Analyze (L4) PO5: Create (L6) PO11: Thumb rule	3 3 3 3 3 3
3	C03: Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review (L2) PO3: Develop(L3) PO4: Interpret (L2) PO5: Apply (L3)	3 3 3 3 3
4	C04: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop(L3) PO4: Interpret (L3) PO5: Apply (L3) PO11: Thumb rule	3 3 3 3 3 3
5	C05: Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review (L2) PO3: Develop(L3) PO4: Interpret (L2) PO5: Apply (L3)	3 3 3 3 3

#### Justification Statements :

**CO 1: Analyze** the numbers systems to perform arithmetic operations.

**Action Verb: Analyze(L4)**

**PO1 Verb: Apply (L3)**

C01 Action verb is less than PO1 verb by one level. Therefore, the correlation is high (3)

**P02 Verb: Review(L2)**

CO1 Action verb is same as P02 verb. Therefore, the correlation is high (3)

**P03 Verb: Develop(L3)**

CO1 Action verb is same as P03 verb. Therefore, the correlation is high (3)

**P04: Interpret (L2)**

CO1 Action verb is same as P04 verb. Therefore, the correlation is high (3)

**CO 2: Design** the half adder and full adder using combinational circuit.

**Action Verb: CO2: Apply (L3)**

**P01: Apply (L3)**

CO2 Action verb is greater than as P01 verb. Therefore, the correlation is high (3)

**P02: Review(L2)**

CO2 Action verb is greater than as P02 verb. Therefore, the correlation is high (3)

**P03: Develop (L3)**

CO2 Action verb is greater than as P03 verb. Therefore, the correlation is high (3)

**P04: Interpret (L2)**

CO2 Action verb is same as P04 verb. Therefore, the correlation is high (3)

**P05: Apply (L3)**

CO2 Action verb is greater than as P05 verb. Therefore, the correlation is high (3)

**CO 3: Apply** the sequential circuits to develop 4-bit shift register and decade counter.

**Action Verb: Design (L6)**

**P01: Apply (L3)**

CO3 Action verb is greater than as P01 verb. Therefore, the correlation is high (3)

**P02: Formulate(L6)**

CO3 Action verb is same as P02 verb. Therefore, the correlation is high (3)

**P03: Design (L6)**

CO3 Action verb is same as P03 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

CO3 Action verb is greater than as P04 verb. Therefore, the correlation is high (3)

**P05: create (L6)**

CO3 Action verb is same as P05 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

The combinational circuit is the trending approach in the current days Therefore, the correlation is high (3)

**CO 4: Apply** the concepts of Boolean algebra to minimize Boolean expression.

**Action Verb: Apply (L3)**

**P01: Apply (L3)**

CO4 Action verb is greater than as P01 verb. Therefore, the correlation is high (3)

**P02: Review(L2)**

CO4 Action verb is greater than as P02 verb. Therefore, the correlation is high (3)

**P03: Develop (L3)**

CO4 Action verb is greater than as P03 verb. Therefore, the correlation is high (3)

**P04: Interpret (L3)**

CO4 Action verb is same as P04 verb. Therefore, the correlation is high (3)

**P05: Apply (L3)**

CO4 Action verb is greater than as P05 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

The sequential circuit is the trending approach in the current days Therefore, the correlation is high (3)

**CO 5: Apply** the booth algorithm to perform operation on binary numbers.

**Action Verb: Apply (L3)**

**P01: Apply (L3)**

CO5 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P02: Review(L2)**

CO5 Action verb is same as P02 verb. Therefore, the correlation is high (3)

**P03: Develop (L3)**

CO5 Action verb is same as P03 verb. Therefore, the correlation is high (3)

**P04: Interpret (L2)**

CO5 Action verb is less than P04 verb by one level. Therefore, the correlation is high (3)

**P05: Apply (L3)**

CO5 Action verb is same as P05 verb. Therefore, the correlation is high (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: II**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	Client-Side Scripting	L	T/CLC	P	C
20ASC3001	II-I		1	0	2	2

**Course Outcomes:**

After studying the course, student will be able to

**CO 1: Understand** The basic concepts of JavaScript programming for writing simple script in any web browser.

**CO 2: Apply** the different methods of JavaScript for solving complex problems.

**CO 3: Analyze** the web pages for real time applications by various events and forms in JavaScript.

**CO 4: Apply** the several objects for client-side model in JavaScript.

**CO 5: Evaluate** the functionalities of cookies and browser data in JavaScript.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The basic concepts of JS		for writing simple script in any web browser	L2
CO2	Apply	The different methods in JS		for solving complex problems	L3
CO3	Analyze	The web pages		for real time applications by various events and forms in JavaScript	L4
CO4	Apply	The several objects		for client-side model in JavaScript	L3
CO5	Evaluate	the functionalities of cookies and browser data in JavaScript			L5

UNIT - I	Basics of JavaScript Programming	3+6 Hrs
<p>Features of JavaScript, Object Name, Property, Method, Dot Syntax, Main Event, Values and Variables, Operators and Expressions – Primary Expressions, Object and Array Initializers, Function Definition Expression, Property Access Expressions, Invocation Expressions, If Statement, if...else, if...elseif, Nested if Statement, Switch... Case Statement, Loop Statement – for Loop, for...in Loop, while Loop, do...while Loop, continue Statement, Querying and Setting Properties and Deleting Properties, Property Getters and Setters.</p> <ul style="list-style-type: none"> <li>• WAP to print hello world</li> <li>• WAP to use comments in JavaScript.</li> <li>• WAP to add a noscript block.</li> <li>• Write a Script in &lt;head&gt;...&lt;/head&gt; section.</li> <li>• Write a Script in &lt;body&gt;...&lt;/body&gt; section.</li> <li>• Write a Script in &lt;body&gt;...&lt;/body&gt; and &lt;head&gt;...&lt;/head&gt; sections.</li> <li>• Write a Script using arithmetic, Comparison, Logical, Bitwise, and Assignment operators</li> <li>• Write code to understand how the Conditional Operator and typeof operator works in JavaScript.</li> <li>• Write code to understand the working of if statement, if...else statement, and if...else if... statement.</li> <li>• Implement switch-case statement.</li> <li>• Implement while loop, do-while and for loop in JavaScript.</li> <li>• WAP to print the web browser's Navigator object using for loop.</li> <li>• WAP To implement break, continue and label in JavaScript.</li> <li>• Write code to call the function that displays the text message on clicking a button.</li> </ul>		
UNIT - II	Array, Function and String	3+6 Hrs

<p>Array – Declaring an Array, Initializing an Array, Defining an Array Elements, Looping an Array, Adding an Array Element, Sorting an Array Element, Combining an Array Elements into a String, Changing Elements of an Array, Objects as Associative Arrays, Function – Defining a Function, Writing a Function, Adding an Arguments, Scope of Variable and Arguments, Calling a Function – Calling a Function With or Without an Argument, Calling Function from HTML, Function Calling another Function, Returning the Value from a Function, String – Manipulate a String, Joining a String, Retrieving a Character from given Position, Retrieving a Position of Character in a String, Dividing Text, Copying a Sub-string, Converting String to Number and Numbers to String, Changing the Case of String, Finding a Unicode of a Character – <code>charCodeAt()</code>, <code>fromCharCode()</code>.</p> <ul style="list-style-type: none"> <li>• Write code to call the function that displays the text message on clicking a button.</li> <li>• WAP to call a function that takes two parameters, name and age. Print the same.</li> <li>• Define a function that takes two parameters and concatenates them before returning the resultant in the calling program.</li> </ul>		
<b>UNIT - III</b>	<b>Form and Event Handling</b>	<b>3+6 Hrs</b>
<p>Building Blocks of a Form, Properties and Methods of Form, Button, Text, Text Area, Checkbox, Radio Button, Select Element, Form Events – Mouse Event, Key Events, Form Objects and Elements, Changing Attribute Value Dynamically, Changing Option List Dynamically, Evaluating Checkbox Selection, Changing a Label Dynamically, Manipulating Form Elements, Intrinsic JavaScript Functions, Disabling Elements, Read Only Elements.</p> <ul style="list-style-type: none"> <li>• Write code to implement the following events – <code>onclick</code>, <code>onsubmit</code>, <code>onmouseover</code> and <code>onmouseout</code>.</li> <li>• Design a Registration form (include email id and password) and perform validation to all its fields.</li> </ul>		
<b>UNIT - IV</b>	<b>Objects</b>	<b>3+6 Hrs</b>
<p>Window Object, Math, Number, and Date Objects, Handling Strings Using Regular Expressions. Implement Number, Date, Math, Boolean, Strings, Arrays, RegEx, and HTML DOM objects with all its properties and methods.</p>		
<b>UNIT - V</b>	<b>Cookies and Browser Data</b>	<b>3+6 Hrs</b>
<p>Cookies – Basic of Cookies, Reading a Cookie Value, Writing a Cookie Value, Creating a Cookies, Deleting a Cookies, Setting the Expiration Date of Cookie, Browser – Opening a Window, Giving the New Window Focus, Window Position, Changing the Content of Window, Closing a Window, Scrolling a Web Page, Multiple Windows at Once, Creating a Web Page in New Window, JavaScript in URLs, JavaScript Security, Timers, Browser Location and History.</p> <ul style="list-style-type: none"> <li>• Set a customer name in an input cookie.</li> <li>• WAP to get all the cookies.</li> <li>• Extend the expiry date of a cookie by 1 Month.</li> <li>• Delete a cookie by setting its expiry date to one month behind the current date.</li> <li>• Do a page redirect using JavaScript at client side.</li> <li>• Show an appropriate message to your site visitors before redirecting them to a new page. WAP with a time delay to load a new page.</li> <li>• Redirect your site visitors onto a different page based on their browsers.</li> <li>• Use an alert box to give a warning message.</li> <li>• Implement a confirmation dialog box to take user's consent on any option.</li> <li>• Use a prompt dialog box.</li> <li>• Use of <code>void</code> is to purposely generate the undefined value.</li> <li>• Demonstrates how to create an Object.</li> <li>• Create an object with a User-Defined Function.</li> <li>• Write code to add a function along with an object.</li> <li>• Demonstrate with keyword in JavaScript.</li> </ul>		
<b>Textbooks:</b>		
<ol style="list-style-type: none"> <li>1. Javascript Beginners Guide, John Pollock, TMH, 4th Edition</li> <li>2. JavaScript. Demystified, JIM KEOGH, McGraw-Hill.</li> </ol>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. JavaScript™ For Dummies,® 4th Edition, by Emily Vander Veer, Published by Wiley Publishing, Inc © 2005.</li> <li>2. JavaScript for impatient programmers (beta), by Dr. Axel Rauschmayer © 2019.</li> <li>3. Javascript: Beginners Guide on Javascript Programming, by Nick Goddard © 2016.</li> </ol>		

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3			2						2	3	
CO2	3	3		2	3							2	
CO3	3	3	3	3	3					3		2	
CO4	3	3	3	2	3						2	2	
CO5	3	3	3	3	2						3	2	

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1 PO2 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO5: Apply(L3) PO11: Thumb rule	2 3 2 2
2	CO2: Apply	L3	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Identify(L3) PO4: Analyze(L4) PO5: Apply(L3)	3 3 2 3
3	CO3:Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO10	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO10: Thumb rule	3 3 3 3 3 3
4	CO4: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb rule	3 3 3 2 3 2
5	CO5: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Create(L6) PO11: Thumb rule	3 3 3 3 2 3

**Justification Statements:**

**CO1: Understand** The basic concepts of JavaScript programming for writing simple script in any web browser.

**Action Verb : Understand (L2)****PO1: Apply(L3)**

CO1 Action verb is less than PO1 verb by one, Therefore the correlation is medium (2)

**PO2: Review(L2)**

CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

**PO5: Apply(L3)**

CO1 Action verb is less than PO2 verb by one, Therefore the correlation is medium (2)

**PO11: Thumb rule**

To update the new feature in an application, need to upgrade for long period. Therefore, the correlation is medium (2)

**CO 2: Apply** the different methods of JavaScript for solving complex problems.

**Action Verb : Apply (L3)**

**P01: Apply(L3)**

CO2 Action verb is same level as P01 verb. Therefore, the correlation is high (3)

**P02: Identify(L3)**

CO2 Action verb is same level as P01 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

CO3 Action verb is less than P04 verb. Therefore the correlation is medium(2)

**P05: Apply(L3)**

CO3 Action verb is same as P05 verb. Therefore, the correlation is High (3)

**CO 3: Analyze** the web pages for real time applications by various events and forms in JavaScript.

**Action Verb : Analyze (L4)**

**P01: Apply(L3)**

CO3 Action verb is greater than P01 verb. Therefore, the correlation is High (3)

**P02: Review (L2)**

CO3 Action verb is greater than P02 verb. Therefore, the correlation is High (3)

**P03: Develop (L3)**

CO3 Action verb is greater than P03 verb. Therefore the correlation is high (3)

**P04: Analyze (L4)**

CO3 Action verb is same as P04 verb. Therefore the correlation is high (3)

**P05: Apply(L3)**

CO3 Action verb is greater than P05 verb. Therefore, the correlation is High (3)

**P010: Thumb rule**

The web site should understand by user, so need to provide proper documents. Therefore, the correlation is high(3)

**CO4: Apply** the several objects for client-side model in JavaScript.

**Action Verb : Apply (L3)**

**P01: Apply(L3)**

CO4 Action verb is same as P01 verb. Therefore the correlation is high (3)

**P02: Review(L2)**

CO4 Action verb is greater than P02 verb. Therefore the correlation is high (3)

**P03: Develop(L2)**

CO4 Action verb is same as P03 verb. Therefore the correlation is high (3)

**P04: Analyze(L4)**

CO4 Action verb is less than P04 verb by one level. Therefore the correlation is medium(2)

**P05: Apply(L3)**

CO4 Action verb is same level as P01 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

The design application needs to upgrade for future specific requirement. Therefore the correlation is medium (2)

**CO 5: Evaluate** the functionalities of cookies and browser data in JavaScript.

**Action Verb : Evaluate (L5)**

**P01: Apply(L3)**

CO5 Action verb is greater than P01 verb. Therefore the correlation is high(3)

**P02: Review (L2)**

CO5 Action verb is greater than P02 verb. Therefore the correlation is high(3)

**P03: Develop (L3)**

CO5 Action verb is greater than P03 verb. Therefore the correlation is high(3)

**P04: Analyze (L4)**

CO5 Action verb is greater than P04 verb. Therefore the correlation is high(3)

**P05: Create(L6)**

CO5 Action verb is less than P05 verb by one level. Therefore the correlation is high (2)

**P011: Thumb rule**

The team should be analyze the different kind of cookies. Improve the knowledge towards cookies Therefore the correlation is high(3)





**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: II**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	CONSTITUTION OF INDIA	L	T/CLC	P	C
20AMC9902	II-I		3	0	0	0

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the historical background of the Constitution making and its importance for building a democratic India.

**CO2: Remember** the basic features of Indian Constitution

**CO3: Understand** the fundamental rights and duties for becoming a good citizen of India.

**CO4: Understand** the Powers and functions of Governor, President, and Judiciary.

**CO5: Understand** the functions of local administration bodies.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the historical background of the Constitution making and its importance	for building a democratic India.		L2
CO2	Remember	the basic features of Indian Constitution			L1
CO3	Understand	the fundamental rights and duties	for becoming a good citizen of India.		L2
CO4	Understand	the Powers and functions	of Governor, President, and Judiciary.		L2
CO5	Understand	the functions of local administration bodies			L2

<b>UNIT - I</b>	
History of Making of the Indian Constitution - History Drafting Committee, (Composition & Working)	
<b>UNIT - II</b>	
Philosophy of the Indian Constitution - Preamble Salient Features	
<b>UNIT - III</b>	
Contours of Constitutional Rights & Duties - Fundamental Rights - Right to Equality - Right to Freedom - Right against Exploitation - Right to Freedom of Religion - Cultural and Educational Rights - Right to Constitutional Remedies - Directive Principles of State Policy - Fundamental Duties.	
<b>UNIT - IV</b>	
Organs of Governance - Parliament - Composition - Qualifications and Disqualifications - Powers and Functions - Executive, President, Governor - Council of Ministers -Judiciary, Appointment and Transfer of Judges, Qualifications - Powers and Functions.	
<b>UNIT - V</b>	
Local Administration - District's Administration head: Role and Importance - Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation - Panchayati raj: Introduction, PRI: Zilla Panchayat - Elected officials and their roles, CEO Zilla Panchayat: Position and role - Block level: Organizational Hierarchy (Different departments) - Village level: Role of Elected and Appointed officials - Importance of grass root democracy.	
<b>Textbooks:</b>	
1. The Constitution of India, 1950 (Bare Act), Government Publication. 2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015. 3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014. 4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.	

**CO-PO mapping justification:**

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	4	14	2	Understand	L2	PO6, PO11	Thumb Rule Thumb Rule	2 2
2	4	14	1	Remember	L1	PO6, PO7	Thumb Rule Thumb Rule	1 1
3	8	26	2	Understand	L2	PO8, PO11	Thumb Rule Thumb Rule	2 2
4	8	26	2	Understand	L2	PO6, PO11	Thumb Rule Thumb Rule	2 2
5	6	20	2	Understand	L2	PO6, PO11	Thumb Rule Thumb Rule	2 2
	30							

**CO1:** Understand the historical background of the Constitution making and its importance for building a democratic India.

**Action Verb: Understand (L2)**

CO1 Action Verb is Understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

**CO2:** Remember the basic features of Indian Constitution

**Action Verb: Remember (L1)**

CO2 Action Verb is Remember of BTL 1. Using Thumb rule, L1 correlates PO6 to PO11 as low (1).

**CO3:** Understand the fundamental rights and duties for becoming a good citizen of India.

**Action Verb: Understand (L2)**

CO3 Action Verb is Understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

**CO4:** Understand the Powers and functions of Governor, President, and Judiciary.

**Action Verb: Understand (L2)**

CO4 Action Verb is Understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

**CO5:** Understand the functions of local administration bodies.

**Action Verb: Understand (L2)**

CO5 Action Verb is Understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI**

**(AUTONOMOUS)**

**B. Tech - Artificial Intelligence and Data Science (AI&DS)**

**(Effective for the batches admitted from 2020-21)**

**Semester IV (Second year)**

Sl. No	Category	Course Code	Course Title	Hour per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P				
1	PC	20APC3008	Formal Languages and Automata Theory	4	2	0	3	30	70	100
2	PC	20APC3009	Computer Networks	4	2	0	3	30	70	100
3	PC	20APC3011	Data warehousing and Mining	4	2	0	3	30	70	100
4	PC	20APC3013	Operating Systems	4	2	0	3	30	70	100
5	HS	20AHSMB01	Managerial Economics and Financial Analysis	2	0	0	3	30	70	100
6	HS	20AHS9905	Universal Human Values	4	2	0	3	30	70	100
7	PC	20APC3010	Computer Networks Lab	0	0	3	1.5	30	70	100
8	PC	20APC3012	Data warehousing and Mining Lab	0	0	3	1.5	30	70	100
9	PC	20APC3014	Operating Systems Lab	0	0	3	1.5	30	70	100
10	SC	20ASC3002	Server Side Scripting	1	0	2	2	100	0	100
			<b>Total credits</b>				<b>24.5</b>	<b>370</b>	<b>630</b>	<b>1000</b>

**Community Service Project (Mandatory) for 6 weeks duration during summer vacation.**

(To visit the selected community to conduct survey (Socio-economic & domain survey) and conduct sensitization/awareness program/activities at the end of IV- semester before commencement of V-semester and complete immersion programme also during V-Semester and submit report in V - semester. Assessment will be done at the end of V-Semester)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year:II**

**Semester:II**

**Branch of Study: AIDS**

Course Code	Year & Sem	Formal Languages and Automata Theory	L	T/CLC	P	C
20APC3008	II-II		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

C01: **Understand** the Finite State Machines to recognize formal languages

C02: **Analyze** the Regular grammar from Finite Automata by using Regular Languages.

C03: **Apply** the normalization methods for simplification of Context Free Grammar.

C04: **Analyze** the concept of push down automata and its applications.

C05: **Evaluate** the Turing Machines to solve undecidability problems like PCP, MPCP.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	The Finite State Machines to recognize formal languages			L2
C02	Analyze	The Regular grammar from Finite Automata	by using Regular Languages.		L4
C03	Apply	The normalization methods		for simplification of Context Free Grammar.	L3
C04	Analyze	the concept of push down automata and its applications.			L4
C05	Evaluate	The Turing Machines		to solve undecidability problems like PCP, MPCP.	L5

<b>UNIT - I</b>	<b>Introduction to Finite Automata</b>	<b>9 Hrs</b>
<b>Introduction:</b> Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages. <b>Finite Automata:</b> An Informal picture of Finite Automata, Deterministic Finite Automata (DFA), Non Deterministic Finite Automata (NFA), Finite Automata with Epsilon transitions ( $\epsilon$ -NFA or NFA- $\epsilon$ ), Finite Automata with output, Conversion of one machine to another, Minimization of Finite Automata, Myhill-Nerode Theorem.		
<b>UNIT - II</b>	<b>Regular Language</b>	<b>9Hrs</b>
<b>Regular Languages:</b> Regular Expressions (RE), Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic laws for Regular Expressions, The Arden's Theorem, Using Arden's theorem to construct RE from FA, Pumping Lemma for RLs, Applications of Pumping Lemma, Equivalence of Two FAs, Equivalence of Two REs, Construction of Regular Grammar from RE, Constructing FA from Regular Grammar, Closure properties of RLs, Decision problems of RLS, Applications of REs and FAs		
<b>UNIT - III</b>	<b>Context Free Grammars and Languages</b>	<b>9 Hrs</b>
<b>Context Free Grammars and Languages:</b> Definition of Context Free Grammars (CFG), Derivations and Parse trees, Ambiguity in CFGs, Removing ambiguity, Left recursion and Left factoring, Simplification of CFGs, Normal Forms, Linear grammars, Closure properties for CFLs, Pumping Lemma for CFLs, Decision problems for CFLs, CFG and Regular Language.		
<b>UNIT - IV</b>	<b>Push Down Automata</b>	<b>9 Hrs</b>
<b>Push Down Automata (PDA):</b> Informal introduction, The Formal Definition, Graphical notation, Instantaneous description, The Languages of a PDA, Equivalence of PDAs and CFGs, Deterministic PushDown Automata, Two Stack PDA.		
<b>UNIT - V</b>	<b>Turing Machines and Undecidability</b>	<b>9 Hrs</b>
<b>Turing Machines and Undecidability:</b> Basics of Turing Machine (TM), Transitional Representation of TMs, Instantaneous description, Non Deterministic TM, Conversion of Regular Expression to TM, Two stack PDA and TM, Variations of the TM, TM as an integer function, Universal TM, Linear Bounded Automata, TM Languages, Unrestricted grammar, Properties of Recursive and Recursively enumerable languages, Undecidability, Reducibility, Undecidable problems about TMs, Post's		

Correspondence Problem(PCP), Modified PCP													
<b>Textbooks:</b>													
1. Introduction to Automata Theory, Formal Languages and Computation, Shyamalendu Kandar, Pearson, 2013 2. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.													
<b>Reference Books:</b>													
1. J.P. Trembley and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw Hill Book Co. 2. Michael Sipser, Introduction to The Theory of Computation, Thomson Course Technology. 3. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia. John E. Hopcroft and J.D. Ullman, Introduction to Automata Theory, Languages and Computation, Narosa Pub, 2021 4. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer. 5. John Martin, Introduction to Languages and The Theory of Computation, Tata McGraw Hill.													
<b>Online Learning Resources:</b>													
<a href="https://www.youtube.com/channel/UCb8HLf1c_-m0MovWMWdg_bA">https://www.youtube.com/channel/UCb8HLf1c_-m0MovWMWdg_bA</a>													

#### Mapping of course outcomes with program outcomes

CO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02
CO1	2	3	2	3	2	1							
CO2	3	3	3	3	3								
CO3	3	3	3	2	3					2	2		
CO4	3	3	3	3	3					3	3	2	
CO5	3	3	3	3	3	3		3				2	2

#### Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	15	21%	3	CO1: Understand	L2	PO1 PO2 PO3 PO4 PO5 PO6	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Interpret(L2) PO5: Apply(L3) PO6: Thumb Rule	2 3 2 3 2 1
2	15	21%	3	CO2: Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3 3
3	15	21%	3	CO3: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb Rule	3 3 3 2 3 2
4	11	15%	2	CO4: Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb Rule	3 3 3 3 3 3
5	16	22%	3	CO5: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO6 PO8	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO6: Thumb Rule PO8: Thumb Rule	3 3 3 3 3 3 3
	72	100 %						

## **Justification Statements :**

**C01: Understand the Finite State Machines to recognize formal languages.**

**Action Verb: Understand (L2)**

**P01: Apply (L3)**

C01 Action verb is less than P01 verb by one level. Therefore the correlation is medium(2)

**P02: Review(L2)**

C01 Action verb is same level as P02 verb. Therefore, the correlation is high (3)

**P03: Develop(L3)**

C01 Action verb is less than P03 verb by one level. Therefore the correlation is medium(2)

**P04: Interpret (L2)**

C01 Action verb is same level as P04 verb. Therefore, the correlation is high (3)

**P05: Apply(L3)**

C01 Action verb is less than P05 verb by one level. Therefore the correlation is medium(2)

**P06: Thumb Rule**

Finite State Machines are used to design languages and those are useful to engineers for working with different types of grammar. Therefore, the correlation is low(1)

**C02: Analyze the Regular grammar from Finite Automata by using Regular Languages.**

**Action Verb : Analyze (L4)**

**P01: Apply (L3)**

C02 Action verb is greater than P01 verb. Therefore the correlation is high (3)

**P02: Analyze(L4)**

C02 Action verb is same level as P02 verb. Therefore the correlation is high (3)

**P03: Develop(L3)**

C02 Action verb is greater than P03 verb. Therefore the correlation is high (3)

**P04: Analyze(L4)**

C02 Action verb is same level as P04 verb. Therefore the correlation is high (3)

**P05: Apply(L3)**

C02 Action verb is greater than P05 verb. Therefore the correlation is high (3)

**C03: Apply the normalization methods for simplification of Context Free Grammar.**

**Action Verb: Apply(L3)**

**P01: Apply(L3)**

C03 Action verb is same level as P01 verb. Therefore the correlation is high (3)

**P02: Review(L2)**

C03 Action verb is greater than P02 verb. Therefore the correlation is high (3)

**P03: Develop(L3)**

C02 Action verb is greater than P03 verb. Therefore the correlation is high (3)

**P04: Analyze(L4)**

C02 Action verb is less than P04 verb by one level. Therefore the correlation is medium(2)

**P05: Apply(L3)**

C02 Action verb is greater than P05 verb. Therefore the correlation is high (3)

**P011: Thumb rule**

Normalization methods are used to reduce the productions in grammar. Therefore the correlation is medium(2)

**C04: Analyze the concept of push down automata and its applications.**

**Action Verb: Analyze(L4)**

**P01: Apply (L3)**

C04 Action verb is greater than P01 verb. Therefore the correlation is high (3)

**P02: Analyze(L4)**

C04 Action verb is same level as P02 verb. Therefore the correlation is high (3)

**P03: Develop(L3)**

C04 Action verb is greater than P03 verb. Therefore the correlation is high (3)

**P04: Analyze(L4)**

C04 Action verb is same level as P04 verb. Therefore the correlation is high (3)

**P05: Apply(L3)**

C04 Action verb is greater than P05 verb. Therefore the correlation is high (3)

**P011: Thumb rule**

Learning of push down automata is required for recognition of strings, tokens, patterns. Therefore the correlation is high (3)

**C05: Evaluate the Turing Machines to solve undecidability problems like PCP, MPCP.**

**Action Verb : Evaluate (L5)**

**P01: Apply (L3)**

C05 Action verb is greater than P01 verb. Therefore, the correlation is high (3)

**P02: Analyze (L4)**

C05 Action verb is greater than P02 verb. Therefore, the correlation is high (3)

**P03: Develop(L3)**

C05 Action verb is greater than P03 verb. Therefore, the correlation is high (3)

**P04: Analyze(L4)**

C05 Action verb is greater than P04 verb. Therefore, the correlation is high (3)

**P05: Apply(L3)**

C05 Action verb is greater than P05 verb. Therefore, the correlation is high (3)

**P06: Thumb Rule**

Turing Machines are used to design and solve complex problems useful to engineers for working with different types of problems. Therefore, the correlation is high (3)

**P08 : Thumb rule**

Since ethical principles should be followed to solve undecidability problems by using Turing machines. Therefore the correlation is high (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: II**

**Semester: II**

**Branch of study: AIDS**

Course Code	Year & Sem	Computer Networks	L	T/CLC	P	C
20APC3009	II-II		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

C01: **Understand** the basics of data communications and networking by using OSI model.

C02: **Apply** the Data link Layer functionalities to solve real world problems.

C03: **Analyze** the various routing algorithms and protocols.

C04: **Analyze** the Transport Layer services by using TCP and UDP protocols.

C05: **Understand** the various services protocols offered by application layer.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	understand	the basics of data communications and networking by using OSI model.			L2
C02	Apply	The Data link Layer functionalities		to solve real world problems.	L3
C03	Analyze	the various routing algorithms and protocols.			L4
C04	Analyze	the Transport Layer services	by using TCP and UDP protocols		L4
C05	understand	The various services protocols offered by application layer			L2

<b>UNIT - I</b>	9 Hrs
<b>Introduction:</b> Data Communications, Networks, Network Types, Internet History, Standards and Administration. <b>Network Models:</b> Protocol Layering, TCP/IP Protocol Suite, The OSI Model <b>Introduction to Physical Layer:</b> Data and Signals, Transmission Impairment, Data Rate Limits, Performance. <b>Transmission Media:</b> Introduction, Guided Media, Unguided Media, Switching: Introduction, Circuit Switched Networks, Packet Switching	
<b>UNIT - II</b>	9Hrs
<b>The Data Link Layer:</b> Introduction, Link layer addressing, Error detection and Correction: Cyclic codes, Checksum, Forward error correction, Data link control: DLC Services, Data link layer protocols, HDLC, Point to Point Protocol. <b>Media Access control:</b> Random Access, Controlled Access, Channelization, Connecting devices and virtual LANs: Connecting Devices.	
<b>UNIT - III</b>	9 Hrs
<b>The Network Layer:</b> Network layer design issues, Routing algorithms, Congestion control algorithms, Quality of service, Internetworking. <b>The network layer in the Internet:</b> IPV4 Addresses, IPV6, Internet Control protocol, OSPF, BGP, IP, ICMPv4, IGMP.	
<b>UNIT - IV</b>	9 Hrs
<b>The Transport Layer:</b> The Transport Service, Elements of Transport Protocols, Congestion Control, The internet transport protocols: UDP, TCP, Performance problems in computer networks, Network performance measurement.	
<b>UNIT - V</b>	9 Hrs
<b>The Application Layer:</b> Introduction, Client-Server Programming, WWW and HTTP, FTP, e-mail, TELNET, Secure Shell, Domain Name System, SNMP.	
<b>Textbooks:</b>	
1. "Data communications and networking", Behrouz A. Forouzan, Mc Graw Hill Education, 5th edition, 2012. 2. "Computer Networks", Andrew S. Tanenbaum, Wetherall, Pearson, 5th edition, 2010.	



**Reference Books:**

1. Data Communication and Networks, Bhushan Trivedi, Oxford
2. "Internetworking with TCP/IP – Principles, protocols, and architecture - Volume 1, Douglas E. Comer, 5th edition, PHI
3. "Computer Networks", 5E, Peterson, Davie, Elsevier.
4. "Introduction to Computer Networks and Cyber Security", Chawan- Hwa Wu, Irwin, CRC Publications.
5. "Computer Networks and Internets with Internet Applications", Comer.

**Online Learning Resources:**

<https://www.youtube.com/watch?v=O--rkQNKqls&list=PLbRMhDVUMngf-peFloB7kyiA40EptH1up>

**Mapping of course outcomes with program outcomes**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1										2	
CO2	3	2				1						2	
CO3	3	3		3	3	1						2	
CO4	3	3		3	3							3	2
CO5	2	1										1	

**Correlation matrix**

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	15	23%	3	CO1 :Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Analyze (L4)	2 1
2	10	15%	2	CO2 : Apply	L3	PO1 PO2 PO6	PO1: Apply(L3) PO2: Analyze (L4) PO6:Thumb rule	3 2 1
3	15	23%	3	CO3 : Analyze	L4	PO1 PO2 PO4 PO5 PO6	PO1: Apply(L3) PO2: Analyze L4) PO4: Analyze (L4) PO5:Apply(L3) PO6:Thumb rule	3 3 3 3 1
4	11	17%	2	CO4 :Analyze	L4	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Analyze (L4) PO4: Analyze (L4) PO5:Apply(L3)	3 3 3 3
5	15	23%	3	CO5 : Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Analyze (L4)	2 1
	66	100%						

**Justification Statements :**

**CO1:** understand the basics of data communications and networking by using OSI model.

**Action Verb : Understand(L2)**

**P01 Verb : Apply(L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

**P02 Verb : Analyze(L4)**

CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

**CO2:** Apply Data link Layer functionalities to solve real world problems.

**Action Verb : Apply (L3)**

**P01: Apply(L3)**

CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

**P02: Analyze(L4)**

CO2 Action verb is less than PO2 verb by One levels. Therefore the correlation is medium (2)

**P06: Thumb rule**

Data link Layer functionalities are useful for realtime applications. Therefore the correlation is (1)

**CO3:** Analyze various routing algorithms and protocols.

**Action Verb : Analyze(L4)**

**P01: Apply(L3)**

C03 Action verb is greater than P01 verb. Therefore the correlation is high (3)

**P02: Analyze(L4)**

C03 Action verb is same level as P02 verb. Therefore the correlation is high (3)

**P04: Analyze(L4)**

C03 Action verb is same level as P04 verb. Therefore the correlation is high (3)

**P05: Apply(L3)**

C03 Action verb is greater than P05 verb. Therefore the correlation is high (3)

**P06 : Thumb rule**

Various routing algorithms are useful for finding distance between routers in real life. Therefore the correlation is (1)

**C04:** Analyze the Transport Layer services by using TCP and UDP protocols.

**Action Verb : Analyze(L4)**

**P01: Apply(L3)**

C04 Action verb is greater than P01 verb by one level. Therefore the correlation is high (3)

**P02: Analyze(L4)**

C04 Action verb is same level as P02 verb. Therefore the correlation is high (3)

**P04: Analyze(L4)**

C04 Action verb is same level as P04 verb. Therefore the correlation is high (3)

**P05: Apply(L3)**

C04 Action verb is greater than P05 verb by one level. Therefore the correlation is high (3)

**C05:** Understand various services protocols offered by application layer.

**Action Verb : Understand(L2)**

**P01 Verb : Apply(L3)**

C05 Action verb is less than P01 verb by one level. Therefore the correlation is medium (2)

**P02 Verb : Analyze(L4)**

C05 Action verb is less than P02 verb by two levels. Therefore the correlation is low (1)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: II**

**Semester: II**

**Branch of study: AIDS**

Course Code	Year & Sem	Data Warehousing and Mining	L	T/CLC	P	C
20APC3011	III-II		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

C01: **Understand** the fundamental concepts of data mining and data warehousing.

C02: **Analyze** the data warehouse architecture and OLAP Technology.

C03: **Evaluate** the performance of association rule mining and classification algorithm.

C04: **Analyze** the various clustering methods to form clusters.

C05: **Apply** the data mining techniques to extract data.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	the fundamental concepts of data mining and data warehousing			L2
C02	Analyze	the data warehouse architecture and OLAP Technology			L4
C03	Evaluate	The performance of association rule mining and classification algorithm			L5
C04	Analyze	The various clustering methods		to form clusters	L4
C05	Apply	The data mining techniques		to extract data	L3

<b>UNIT - I</b>	9 Hrs
<b>Introduction:</b> Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Major issues in Data Mining. <b>Data Preprocessing:</b> Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.	
<b>UNIT - II</b>	9 Hrs
<b>Data Warehouse and OLAP Technology for Data Mining:</b> Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Further Development of Data Cube Technology, From Data Warehousing to Data Mining. <b>Data Cube Computation and Data Generalization:</b> Efficient Methods for Data Cube Computation, Further Development of Data Cube and OLAP Technology, Attribute-Oriented Induction.	
<b>UNIT - III</b>	9 Hrs
<b>Mining Frequent Patterns, Associations and Correlations:</b> Basic Concepts, Efficient and Scalable Frequent Itemset Mining Methods, Mining various kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint- Based Association Mining, <b>Classification and Prediction:</b> Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction, Accuracy and Error measures, Evaluating the accuracy of a Classifier or a Predictor, Ensemble Methods	
<b>UNIT - IV</b>	9 Hrs
<b>Cluster Analysis:</b> Introduction, Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High- Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis	
<b>UNIT - V</b>	9 Hrs
<b>Mining Streams, Time Series and Sequence Data:</b> Mining Data Streams, Mining Time- Series Data, Mining Sequence Patterns in Transactional Databases, Mining Sequence Patterns in Biological Data, Graph Mining, Social Network Analysis and Multi relational Data Mining, <b>Mining Object, Spatial, Multimedia, Text and Web Data:</b> Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web.	

**Textbooks:**

1. Data Mining: Concepts and Techniques, Jiawei Han and Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, Second Edition, 2012.
2. Introduction to Data Mining – Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson Education.

**Reference Books:**

1. Data Mining Techniques, Arun K Pujari, Second Edition, Universities Press.
2. Data Warehousing in the Real World, Sam Aanhory & Dennis Murray Pearson Edn Asia.
3. Insight into Data Mining, K.P. Soman, S. Diwakar, V. Ajay, PHI, 2008.

**Online Learning Resources:**

[https://www.youtube.com/watch?v=ykZ-\\_UGcYWg&list=PLLspfyOYoQcl6Nno3gPkq0h5YSe81hsc](https://www.youtube.com/watch?v=ykZ-_UGcYWg&list=PLLspfyOYoQcl6Nno3gPkq0h5YSe81hsc)

**Mapping of course outcomes with program outcomes**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3											
CO2	3	3		3	3								
CO3	3	3		3	3						3		
CO4	3	3	3	3	3			3					
CO5	3	3	3	2	3						2		

**Correlation matrix**

Unit No.	CO					Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan (Hrs)	%	Correlation	Co's Action verb	BTL			
1	13	20%	2	CO1 : Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	11	17%	2	CO2 : Analyze	L4	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3
3	16	25%	3	CO3 : Evaluate	L5	PO1 PO2 PO4 PO5 PO11	PO1: Apply(L3) PO2: Identify(L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb rule	3 3 3 3 3
4	13	20%	2	CO4 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO8	PO1: Apply(L3) PO2: Identify(L3) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO8: Thumb rule	3 3 3 3 3 3
5	10	15%	2	CO5 : Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply (L3) PO2: Identify(L3) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb Rule	3 3 3 2 3 2
	63	100 %						

**Justification Statements :**

**CO1: Understand the fundamental concepts of data mining and data warehousing.**

**Action Verb: Understand(L2)**

**P01 Verb: Apply(L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

**P02 Verb : Review(L2)**

CO1 Action verb is same level as PO2 verb . Therefore the correlation is high(3)

**C02: Analyze the data warehouse architecture and OLAP Technology.**

**Action Verb : Analyze (L4)**

**P01: Apply(L3)**

C02 Action verb is greater than P01 verb .Therefore the correlation is high (3)

**P02: Review (L2)**

C02 Action verb is greater than P02 verb .Therefore the correlation is high (3)

**P04: Analyze (L4)**

C02 Action verb is same as P04 verb. Therefore the correlation is high (3)

**P05: Apply(L3)**

C02 Action verb is greater than P05 verb .Therefore the correlation is high (3)

**C03: Evaluate the performance of association rule mining and classification algorithm.**

**Action Verb : Evaluate(L5)**

**P01: Apply(L3)**

C03 Action verb is greater than P01 verb .Therefore the correlation is high (3)

**P02: Identify(L3)**

C03 Action verb is greater than P02 verb .Therefore the correlation is high (3)

**P04: Analyze (L4)**

C03 Action verb is greater than P04 verb .Therefore the correlation is high (3)

**P05: Apply(L3)**

C03 Action verb is greater than P05 verb .Therefore the correlation is high (3)

**P011: Thumb rule**

In association mining we need to create association rule. Therefore the correlation is high (3)

**C04: Analyze the various clustering methods to form clusters.**

**Action Verb : Analyze(L4)**

**P01: Apply(L3)**

C04 Action verb is greater than P01 verb .Therefore the correlation is high (3)

**P02: Identify(L3)**

C04 Action verb is greater than P02 verb .Therefore the correlation is high (3)

**P03: Develop (L3)**

C04 Action verb is greater than P03 verb .Therefore the correlation is high (3)

**P04: Analyze (L4)**

C04 Action verb is same as P04 verb. Therefore the correlation is high (3)

**P05: Apply(L3)**

C04 Action verb is greater than P05 verb .Therefore the correlation is high (3)

**P08: Thumb rule**

Since ethical principles shall be followed in data manipulation. Therefore the correlation is medium(2)

**C05: Apply the data mining techniques to extract data.**

**Action Verb : Apply (L3)**

**P01: Apply(L3)**

C04 Action verb is same as P01 verb. Therefore the correlation is high (3)

**P02: Identify(L3)**

C05 Action verb is same as P02 verb. Therefore the correlation is high (3)

**P03: Develop (L3)**

C05 Action verb is same as P03 verb. Therefore the correlation is high (3)

**P04: Analyze (L4)**

C05 Action verb is less than as P04 verb by one level. Therefore the correlation is medium(2)

**P05: Apply(L3)**

C05 Action verb is same as P05 verb. Therefore the correlation is high (3)

**P011: Thumb rule**

We will apply these mining techniques to create solution. Therefore the correlation is medium(2)



# ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI

(AUTONOMOUS)

## Artificial Intelligence and Data Science (AI&DS)

Year: II

Semester: II

Branch of study: AIDS

Course Code	Year & Sem	Operating Systems (common to CSE,CIC,AIDS,AIIML,CSE(DS))	L	T/CLC	P	C
20APC3013	II-II		4	2	0	3

### Course Outcomes:

After studying the course, student will be able to

C01: **Understand** the basic concepts of Operating Systems and its services.

C02: **Apply** the concepts of process synchronization and CPU scheduling by drawing Gantt chart

C03: **Analyze** the methods to handle deadlock and memory management

C04: **Evaluate** the various disk scheduling algorithms and file system interfaces

C05: **Understand** the issues and goals of protection various security

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	the basic concepts of Operating Systems and its services			L2
C02	Apply	the concepts of process synchronization & CPU scheduling	by drawing Gantt chart		L3
C03	Analyze	the methods to handle deadlock and memory management			L4
C04	Evaluate	the various disk scheduling algorithms and file system interfaces			L5
C05	Understand	the various security issues and goals of protection			L2

<b>UNIT - I</b>	9 Hrs
<b>Operating Systems Overview:</b> Operating system functions, Operating system structure, operating systems Operations, protection and security, Computing Environments, Open- Source Operating Systems <b>System Structures:</b> Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, operating system structure, operating system debugging, System Boot. <b>Processes:</b> Process concept, process Scheduling, Operations on processes, Inter process Communication, Examples of IPC systems.	
<b>UNIT - II</b>	10Hrs
<b>Threads:</b> overview, Multi-core Programming, Multithreading Models, Thread Libraries, Implicit Threading, Threading Issues. <b>Process Synchronization:</b> The critical-section problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic problems of synchronization, Monitors, Synchronization examples, Alternative approaches. <b>CPU Scheduling:</b> Scheduling-Criteria, Scheduling Algorithms, Thread Scheduling, Multiple-Processor Scheduling, Real-Time CPU Scheduling, Algorithm Evaluation.	
<b>UNIT - III</b>	8Hrs
<b>Memory Management:</b> Swapping, contiguous memory allocation, segmentation, paging, structure of the page table. <b>Virtual memory:</b> demand paging, page-replacement, Allocation of frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory <b>Deadlocks:</b> System Model, deadlock characterization, Methods of handling Deadlocks, Deadlock prevention, Detection and Avoidance, Recovery from deadlock.	
<b>UNIT - IV</b>	9Hrs
<b>Mass-storage structure:</b> Overview of Mass-storage structure, Disk structure, Disk attachment, Disk scheduling, Swap-space management, RAID structure, Stable-storage implementation. <b>File system Interface:</b> The concept of a file, Access Methods, Directory and Disk structure, File system mounting, File sharing, Protection. <b>File system Implementation:</b> File-system structure, File-system Implementation, Directory Implementation, Allocation Methods, Free-Space management.	
<b>UNIT - V</b>	8Hrs
<b>I/O systems:</b> I/O Hardware, Application I/O interface, Kernel I/O subsystem, Transforming I/O requests to Hardware operations. <b>Protection:</b> Goals of Protection, Principles of Protection, Domain of protection, Access Matrix,	

Implementation of Access Matrix, Access control, Revocation of Access Rights, Capability- Based systems, Language – Based Protection

**Security:** The Security problem, Program threats, System and Network threats, Cryptography as a security tool, User authentication, Implementing security defenses, Firewalling to protect systems and networks, Computer–security classifications.

**Textbooks:**

1. Operating System Concepts, Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Wiley, Eight Edition, 2018

**Reference Books:**

1. Operating systems by A K Sharma, Universities Press,
2. Operating Systems, S.Haldar, A.A.Aravind, Pearson Education.
3. Operating Systems, A.S.Godbole, Second Edition, TMH.
4. Operating Systems, G.Nutt, N.Chaki and S.Neogy, Third Edition, Pearson Education.
5. Operating Systems, R.Elmasri, A.G.Carrick and D.Levine, Mc Graw Hill.
6. Principles of Operating Systems, B.L.Stuart, Cengage learning, India Edition.

**Online Learning Resources:**

<https://nptel.ac.in/courses/106/106/106106144/> <http://peterindia.net/OperatingSystems.html>

**Mapping of course outcomes with program outcomes**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3									2	1	1
CO2	3	3				2					3	1	1
CO3	3	3	3	3	3							2	2
CO4	3	3	3	3	3	2		3			2	2	2
CO5	2	3						3			2	2	2

**Correlation matrix**

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	16	19%	2	CO1 : Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	2 3 2
2	19	22%	3	CO2 :Apply	L3	PO1 PO2 PO6 PO11	PO1: Apply(L3) PO2: Review(L2) PO6: Thumb rule PO11: Thumb rule	3 3 2 3
3	16	19%	2	CO3 : Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3 3
4	18	21%	3	CO4 : Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO6 PO8 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO6: Thumb rule PO8: Thumb rule PO11: Thumb rule	3 3 3 3 3 2 3 2
5	17	19%	2	CO5 : Understand	L2	PO1 PO2 PO8 PO11	PO1: Apply(L3) PO2: Review(L2) PO8: Thumb rule PO11: Thumb rule	2 3 3 2
	86	100 %						

**Justification Statements :**

**CO1: Understand the basic concepts of Operating Systems and its services.**

**Action Verb : Understand(L2)**

**PO1 Verb : Apply(L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

**PO2 Verb : Review(L2)**

C01 Action verb is same as P02 verb. Therefore the correlation is high(3)

**P011: Thumb rule**

In today's world operating system services are updating, those services needs to understand. Therefore the correlation is medium (2)

**C02: Apply the concepts of process synchronization & CPU scheduling by drawing gantt chart**

**Action Verb : Apply (L3)**

**P01: Apply(L3)**

C02 Action verb is same level as P01 verb. Therefore the correlation is high (3)

**P02 Verb : Review(L2)**

C01 Action verb is greater than P02 verb by one level. Therefore the correlation is high (3)

**P06: Thumb rule**

Most of the scheduling algorithm were used to solve some of the societal problems like forming Queue line. Therefore the correlation is Moderate (2)

**P011: Thumb rule**

Scheduling is the one of the daily activity done in many sectors. Therefore the correlation is High(3)

**C03: Analyze the methods to handle deadlock and memory management**

**Action Verb : Analyze (L4)**

**P01: Apply(L3)**

C03 Action verb is greater level as P01 verb. Therefore the correlation is high (3)

**P02: Review (L2)**

C03 Action verb is greater than P02 verb. Therefore the correlation is high (3)

**P03: Develop (L3)**

C03 Action verb is greater than P03 verb by one level. Therefore the correlation is high(3)

**P04: Analyze (L4)**

C03 Action verb is same as P04 verb. Therefore the correlation is high(3)

**P05: Apply(L3)**

C03 Action verb is greater than P05 verb by one level. Therefore the correlation is high(3)

**C04: Evaluate the various disk scheduling algorithms and file system interfaces.**

**Action Verb : Evaluate (L5)**

**P01: Apply(L3)**

C04 Action verb is greater level as P01 verb. Therefore the correlation is high (3)

**P02: Review (L2)**

C04 Action verb is greater level as P02 verb. Therefore the correlation is high (3)

**P03: Develop (L3)**

C04 Action verb is greater than P03 verb. Therefore the correlation is high(3)

**P04: Analyze (L4)**

C04 Action verb is greater than P04 verb by one level. Therefore the correlation is high(3)

**P05: Apply(L3)**

C04 Action verb is greater than P05 verb. Therefore the correlation is high(3)

**P06: Thumb rule**

Disk scheduling and file system interfaces are applied to provide solutions for E-Commerce database access . Therefore the correlation is medium (2)

**P08: Thumb rule**

Since ethical principles shall be followed in file manipulations and data storage. Therefore the correlation is high(3)

**P011: Thumb rule**

File manipulation of data and storage of data is playing major role in current scenario. Therefore, the correlation is medium (2)

**C05: Understand the various security issues and goals of protection**

**Action Verb : Understand (L2)**

**P01: Apply(L3)**

C05 Action verb is less than P01 verb by one level. Therefore, the correlation is medium (2)

**P02: Review (L2)**

C05 Action verb is same as P02 verb. Therefore, the correlation is high(3)

**P08 : Thumb rule**

Ethical principles should be followed for various security issues. Therefore the correlation is high(3)

**P011: Thumb rule**

Security services and principles are keep on updating in the today's world. Therefore, the correlation is medium (2)





**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: II**

**Semester: II**

**Branch of study: AIDS**

Course Code	Year & Sem	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS	L	T/CLC	P	C
20AHSMB01	II-II		3	0	0	3

**Course Outcomes (CO):**

After studying the course, student will be able to

**CO1: Understand** the fundamentals of managerial economics and demand concept.

**CO2: Understand** the production and cost concepts to optimize the output

**CO3: Analyze** the price output relationship in different markets.

**CO4: Evaluate** the capital budgeting techniques to invest in various projects.

**CO5: Analyze** the accounting statements to evaluate the financial performance of business entity.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	fundamentals of managerial economics			L2
CO2	Understand	production and cost concepts		To optimize the output	L2
CO3	Analyze	price output relationship in various markets			L4
CO4	Evaluate	capital budgeting techniques		To invest in various projects	L5
CO5	Analyze	accounting statements		to evaluate the financial performance of business entity	L4

UNIT - I	<b>Managerial economics</b>
Introduction – meaning, nature, significance, functions, and advantages, ME and its role in other fields. Demand - Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing forecasting, Methods.	
UNIT - II	<b>Production and Cost Analysis</b>
Introduction – Nature, meaning, significance, functions and advantages. Production Function- Least-cost combination- Short run and Long run Production Function- Isoquants and Isocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale. Cost & Break-Even Analysis - Cost concepts and Cost behavior- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems)-Managerial significance and limitations of Break-Even Analysis.	
UNIT - III	<b>Business Organizations and Markets</b>
Introduction – Nature, meaning, significance, functions and advantages. Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly-Monopolistic Competition-Oligopoly-Price-Output Determination - Pricing Methods and Strategies.	
UNIT - IV	<b>Capital Budgeting</b>
Introduction to Capital, Sources of Capital. Short-term and Long-term Capital: Working capital, types, Estimating Working capital requirements. Capital Budgeting – Features, Proposals, Time value of money. Methods and Evaluation of Projects – Pay Back Method, Accounting Rate of Return (ARR), Net Present Value (NPV), and Internal Rate Return (IRR) Method (simple problems).	
UNIT - V	<b>Financial Accounting and Analysis</b>
Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions- Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). <b>Financial Analysis</b> - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.	
<b>Textbooks:</b>	
1. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2013.	
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019	
<b>Reference Books:</b>	

1. Ahuja Hl Managerial economics Schand,3/e,2013
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2013.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013.

#### Online Learning Resources:

<https://www.slideshare.net/123ps/managerial-economics-ppt>  
<https://www.slideshare.net/rossanz/production-and-cost-45827016>  
<https://www.slideshare.net/darkyla/business-organizations-19917607>

COs													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2												
CO2		1											
CO3	3												
CO4		3											
CO5		3											

Course Outcome (CO)	Percentage of contact hours over the total planned contact hours	Correlation	CO: Action verb and BTL	Program Outcome(PO)	PO: Action verb and BTL	Level of correlation (0-3)
CO1	16.1%	2	understand	PO1	Apply	2
CO2	22.5%	3	understand	PO2	Analyse	1
CO3	22.5%	3	Analyse	PO1	Apply	3
CO4	16.1%	2	Evaluate	PO2	Analyse	3
CO5	22.5%	3	Analyse	PO2	Analyse	3

#### Justification Statements:

**CO1: Understand the fundamentals of Managerial economics and demand concept.**

**Action Verb: Understand (L2)**

PO1 Verb: Apply (L3)

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)

**CO2: Understand the Concept of Production and cost analysis.**

**Action Verb: Understand (L2)**

PO2: Analyze (L4)

CO2 Action verb is less than PO1 verb by two levels. Therefore, the correlation is low (1)

**CO3: Analyze the price output in various markets.**

**Action Verb: Analyze (L4)**

PO1: Apply (L3)

CO3 Action verb is more than PO1 verb by one level. Therefore, the correlation is high (3)

**CO4: Evaluate the capital budgeting techniques.**

**Action Verb : Evaluate (L5)**

PO2: Analyze

CO3 Action verb is more than PO1 verb by one level. Therefore, the correlation is high (3)

**CO5: Analyse the Accounting statements and evaluate the financial performance of business entity.**

**Action Verb: Analyze (L4)**

PO2: Analyze (L4)

CO5 Action verb is same as PO2 verb. Therefore, the correlation is high (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
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**Artificial Intelligence and Data Science (AI&DS)**

**Year: II**

**Semester: II**

**Branch of study: AIDS**

Course Code	Year & Sem	Universal Human Values	L	T/CLC	P	C
20AHS9905	II-II		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

- CO1: **Understand** the essentials of human values, self-exploration, happiness and prosperity for value added education.
- CO2: **Analyze** the harmony in the human being as sentient 'I' and the material 'Body' in various aspects.
- CO3: **Apply** the nine universal human values in relationships for harmony in the family and orderliness in the society.
- CO4: **Evaluate** the interconnectedness of four orders of nature and holistic perception of harmony at all levels of existence.
- CO5: **Apply** the holistic understanding of harmony on professional ethics through augmenting universal human order.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the essentials of human values, self-exploration, happiness and prosperity for value added education			L2
CO2	Analyze	the harmony in the human being as sentient 'I' and the material 'Body' in various aspects.			L4
CO3	Apply	the nine universal human values in relationships for harmony in the family and orderliness in the society			L3
CO4	Evaluate	the interconnectedness of four orders of nature and holistic perception of harmony at all levels of existence			L5
CO5	Apply	the holistic understanding of harmony on professional ethics through augmenting universal human order.			L3

**UNIT - 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration-what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
- Continuous Happiness and Prosperity- A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
- Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

**Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.**

**UNIT II: Understanding Harmony in the Human Being - Harmony in Myself!**

- Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)

- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
- Programs to ensure Sanyam and Health.

**Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.**

### **UNIT III: Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship.**

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
- Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family

**Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives**

### **UNIT IV: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**

- Understanding the harmony in the Nature
- Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature
- Understanding Existence as Co-existence of mutually interacting units in all- pervasive space
- Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

**Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.**

### **UNIT- V: Implications of the above Holistic Understanding of Harmony on Professional Ethics.**

- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems
- Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations sum up.

**Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions Eg. To discuss the conduct as an engineer or scientist etc.**

## TEXT BOOKS

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

## REFERENCE BOOKS:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantik, 1999.
2. A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"
5. E. F. Schumacher. "Small is Beautiful"
6. Slow is Beautiful –Cecile Andrews
7. J C Kumarappa "Economy of Permanence"
8. Pandit Sunderlal "Bharat Mein Angreji Raj"
9. Dharampal, "Rediscovering India"
10. Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule"
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland(English)
13. Gandhi - Romain Rolland (English)

### Articulation matrix

Course Title	COs	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2
Universal Human Values	CO1								2			2		
	CO2							3	3					
	CO3						2	2	2					
	CO4						3	3	3			3		
	CO5						2	2	2			2		

### Correlation matrix

C O	CO					Program Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO5)	Level of Correlation
	Lesson Plan (Hrs)	%	Correlation	Verb	BTL			
1	7	19.4	2	Understand	2	PO8,PO11	Thumb Rule	2,2
2	8	22.2	3	Analyze	4	PO7,PO8	Thumb Rule	3,3
3	7	19.4	2	Apply	3	PO6,PO7,PO8	Thumb Rule	2,2,2
4	8	22.2	3	Evaluate	5	PO6,PO7,PO8,PO11	Thumb Rule	3,3,3,3
5	7	19.4	2	Apply	3	PO6,PO7,PO8,PO11	Thumb Rule	2,2,2,2

### **Justification Statements:**

**C01: Understand the essentials of human values, self-exploration, happiness and prosperity for value added education.**

**Action Verb: Understand (L2)**

C01 Action Verb is Understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

**C02: Analyze the harmony in the human being as sentient 'I' and the material 'Body' in various aspects.**

**Action Verb: Analyze (L4)**

C02 Action Verb is Analyze of BTL 4. Using Thumb rule, L4 correlates PO6 to PO11 as high (3).

**C03: Apply the nine universal human values in relationships for harmony in the family and orderliness in the society.**

**Action Verb: Apply (L3)**

C03 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2)

**C04: Evaluate the interconnectedness of four orders of nature and holistic perception of harmony at all levels of existence.**

**Action Verb: Evaluate (L5)**

C04 Action Verb is Evaluate of BTL5. Using Thumb rule, L5 correlates PO6 to PO11 as high (3).

**C05: Apply the holistic understanding of harmony on professional ethics through augmenting universal human order.**

**Action Verb: Apply (L3)**

C05 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).



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(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: II**

**SEMESTER: II**

**Branch of study: AIDS**

Course Code	Year & Sem	COMPUTER NETWORKS LAB	L	T/CLC	P	C
20APC3010	II-II		0	0	3	1.5

**Course Outcomes:**

After studying the course, student will be able to

**C01: Understand** the error detection/correction techniques.

**C02: Analyze** the methods to simulate data link layer protocols.

**C03: Apply** the routing algorithm for implementing network layer protocols.

**C04: Analyze** the Dijkstra's algorithm to compute the shortest path through a network.

**C05: Apply** the sending and receiving of packets by using NS2 simulator.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	the error detection/correction techniques			L2
C02	Analyze	the methods		to simulate data link layer protocols	L4
C03	Apply	the routing algorithm		for implementing network layer protocols	L3
C04	Analyze	the Dijkstra's algorithm		to compute the shortest path through a network	L4
C05	Apply	the sending and receiving of packets	by using NS2 simulator		L3

**List of Experiments**

1. Implementation of Error Detection / Error Correction Techniques **(C01)**
2. Implementation of Stop and Wait Protocol and sliding window. **(C01)**
3. Implementation and study of Goback-N and selective repeat protocols **(C01)**
4. Implementation of High Level Data Link Control **(C02)**
5. Write a socket Program for Echo/Ping/Talk commands**(C02)**
6. To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols. **(C02)**
7. Implementation of Link state routing algorithm **(C03)**
8. Implement the data link layer framing methods such as character, character-stuffing and bitstuffing. **(C03)**
9. Write a program to compute CRC code for the polynomials CRC-12, CRC-16 and CRC CCIP**(C03)**
10. Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using the Go-Back-N mechanism. **(C03)**
11. Implement Dijkstra's algorithm to compute the shortest path through a network **(C04)**
12. Take an example subnet of hosts and obtain a broadcast tree for the subnet. **(C04)**
13. Implement distance vector routing algorithm for obtaining routing tables at each node. **(C04)**
14. Write a program for congestion control using Leaky bucket algorithm. **(C05)**
15. Do the following using NS2 Simulator **(C05)**
  - a. NS2 Simulator-Introduction
  - b. Simulate to Find the Number of Packets Dropped
  - c. Simulate to Find the Number of Packets Dropped by TCP/UDP
  - d. Simulate to Find the Number of Packets Dropped due to Congestion
  - e. Simulate to Compare Data Rate & Throughput.
  - f. Simulate to Plot Congestion for Different Source/Destination
  - g. Simulate to Determine the Performance with respect to Transmission of Packets

**Reference Books:**

1. Shivendra S. Panwar, Shiwen Mao, Jeong-dong Ryoo, and Yihan Li, —TCP/IP Essentials A LabBased Approach||, Cambridge University Press, 2004.
2. Cisco Networking Academy, —CCNA1 and CCNA2 Companion Guide||, Cisco Networking Academy Program,

3rd edition, 2003.

3. Ns Manual, Available at: <https://www.isi.edu/nsnam/ns/ns-documentation.html>, 2011.

4. Elloitte Rusty Harold, —Java Network Programming||, 3rd edition, O'REILLY, 2011. Elloitte Rusty Harold, —Java Network Programming||, 3<sup>rd</sup> edition, O'REILLY, 2011.

#### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	2	3										2	2
C02	3	3	3	3								2	2
C03	3	3	3		3			3				2	2
C04	3	3		3	3							2	2
C05	3	3	3	2	3							2	2

#### Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	C01: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	C02: Analyze	L4	PO1 PO2 PO3 PO4	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4)	3 3 3 3
3	C03: Apply	L3	PO1 PO2 PO3 PO5 PO8	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO5: Apply (L3) PO8: Thumb rule	3 3 3 3 3
4	C04: Analyze	L4	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze (L4) PO5: Apply (L3)	3 3 3 3
5	C05: Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3)	3 3 3 2 3

#### Justification Statements :

**C01: Understand** the error detection/correction techniques

**Action Verb: Understand (L2)**

**P01 Verb: Apply (L3)**

C01 Action verb is less than P01 verb by one level. Therefore, the correlation is medium (2)

**P02 Verb: Review(L2)**

C01 Action verb is same as P02 verb. Therefore, the correlation is high (3)

**C02: Analyze** the methods to simulate data link layer protocols .

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

C02 Action verb is greater than as P01 verb. Therefore, the correlation is high (3)

**P02: identify(L3)**

C02 Action verb is greater than as P02 verb. Therefore, the correlation is high (3)

**P03: Develop (L3)**

C02 Action verb is greater than as P03 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

C02 Action verb is same as P04 verb. Therefore, the correlation is high (3)

**C03: Apply** the routing algorithm for implementing network layer protocols.

**Action Verb: Apply (L3)**

**P01: Apply (L3)**



C03 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P02: identify(L3)**

C03 Action verb is same as P02 verb. Therefore, the correlation is high (3)

**P03: Develop (L3)**

C03 Action verb is same as P03 verb. Therefore, the correlation is high (3)

**P05: Apply (L3)**

C03 Action verb is same as P05 verb. Therefore, the correlation is high (3)

**P08: Thumb rule**

While designing Routing algorithms one should follow ethical principles. Therefore, the correlation is high (3)

**C04: Analyze** the Dijkstra's algorithm to compute the shortest path through a network.

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

C04 Action verb is greater than as P01 verb. Therefore, the correlation is high (3)

**P02: identify(L3)**

C04 Action verb is greater than as P02 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

C04 Action verb is same as P04 verb. Therefore, the correlation is high (3)

**P05: Apply (L3)**

C04 Action verb is greater than as P05 verb. Therefore, the correlation is high (3)

**C05: Apply** the socket programming to develop network applications.

**Action Verb: Apply (L3)**

**P01: Apply (L3)**

C05 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P02: identify(L3)**

C05 Action verb is same as P02 verb. Therefore, the correlation is high (3)

**P03: Develop (L3)**

C05 Action verb is same as P03 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

C05 Action verb is less than P04 verb by one level. Therefore, the correlation is medium (2)

**P05: Apply (L3)**

C05 Action verb is same as P05 verb. Therefore, the correlation is high (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: II**

**Semester: II**

**Branch of study: AIDS**

Course Code	Year & Sem	Data Warehousing and Mining Lab	L	T/CLC	P	C
20APC3012	II-II		0	0	3	1.5

**Course Outcomes:**

**CO 1: Apply** the different mining tools to deal with data mining techniques.

**CO 2: Apply** the data mining orange tool kit to visualize results.

**CO 3: Evaluate** the linear regression model using orange environment.

**CO 4: Analyze** the working of algorithms for various data mining tasks.

**CO 5: Analyze** the performance of different classifiers using weka tool.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Apply	the different mining tools		to deal with data mining techniques.	L3
CO2	Apply	the data mining orange tool kit		to visualize results.	L3
CO3	Evaluate	the linear regression model	using orange environment		L5
CO4	Analyze	the working of algorithms		for data mining tasks	L4
CO5	Analyze	the performance of different classifier	using weka tool		L4

**Data Mining Experiments:**

**Weka Programs: (CO1)**

1. Create data in .csv and .arff formats to import in weka
2. Perform Data Preprocessing on a sample dataset - Discretization, Dimensionality Reduction, Data Transformation, Data Normalization
3. Perform Association Rule Mining and generate top 10 rules for supermarket.arff
4. Build a tree classifier on weather data to decide on the playing conditions.
5. Build a Naïve Bayes classifier on weather data to decide on the playing conditions.
6. Evaluate the performance of a classifier in knowledge flow environment.
7. Perform Clustering on any sample dataset on different algorithms and compare the results.
8. Using Experimenter in Simple mode, compare different classifiers with respect to the results generated for iris.arff.
9. Using Experimenter in advanced mode, demonstrate how to analyze the results from an experiment and the importance of statistical significance when interpreting results.
10. Plot Multiple ROC curves on a dataset using J48 and Random Forest Classifiers.
11. Perform training and testing of Naive Bayes incrementally. The results are sent to a TextViewer and predictions are plotted by a Strip Chart component.
12. Demonstrate how to Access a database using WEKA tool.
13. Use Knowledge flow canvas and develop a directed graph for C4.5 execution

**Data Warehousing Experiments:**

**Build Data Warehouse and Explore WEKA (CO2)**

- A. Build a Data Warehouse/Data Mart (using open source tools like Pentaho Data Integration tool, Pentaho Business Analytics; or other data warehouse tools like Microsoft-SSIS, Informatica, Business Objects, etc.).
  - (i). Identify source tables and populate sample data
  - (ii). Design multi-dimensional data models namely Star, snowflake and Fact constellation schemas for any one enterprise (ex. Banking, Insurance, Finance, Healthcare, Manufacturing, Automobile, etc.).
  - (iii). Write ETL scripts and implement using data warehouse tools

- (iv). Perform various OLAP operations such slice, dice, roll up, drill up and pivot
- (v). Explore visualization features of the tool for analysis like identifying trends etc.
- B. Explore WEKA Data Mining/Machine Learning Toolkit
  - (i). Downloading and/or installation of WEKA data mining toolkit,
  - (ii). Understand the features of WEKA toolkit such as Explorer, Knowledge Flow interface, Experimenter, command-line interface.
  - (iii). Navigate the options available in the WEKA (ex. Select attributes panel, Preprocess panel, Classify panel, Cluster panel, Associate panel and Visualize panel)
  - (iv). Study the arff file format
  - (v). Explore the available data sets in WEKA.
  - (vi). Load a data set (ex. Weather dataset, Iris dataset, etc.)
  - (vii). Load each dataset and observe the following:
    - i. List the attribute names and they types
    - ii. Number of records in each dataset
    - iii. Identify the class attribute (if any)
    - iv. Plot Histogram
    - v. Determine the number of records for each class.
    - vi. Visualize the data in various dimensions

#### **Perform data preprocessing tasks and Demonstrate performing association rule mining on data sets (CO3)**

- A. Explore various options available in Weka for preprocessing data and apply (like Discretization Filters, Resample filter, etc.) on each dataset
- B. Load each dataset into Weka and run Aprori algorithm with different support and confidence values. Study the rules generated.
- C. Apply different discretization filters on numerical attributes and run the Apriori association rule algorithm. Study the rules generated. Derive interesting insights and observe the effect of discretization in the rule generation process.

#### **Demonstrate performing classification on data sets (CO3)**

- A. Load each dataset into Weka and run Id3, J48 classification algorithm. Study the classifier output. Compute entropy values, Kappa statistic.
- B. Extract if-then rules from the decision tree generated by the classifier, Observe the confusion matrix and derive Accuracy, F-measure, TP rate, FP rate, Precision and Recall values. Apply cross-validation strategy with various fold levels and compare the accuracy results.
- C. Load each dataset into Weka and perform Naïve-bayes classification and k- Nearest Neighbour classification. Interpret the results obtained.
- D. Plot RoC Curves E. Compare classification results of ID3, J48, Naïve-Bayes and k-NN classifiers for each dataset, and deduce which classifier is performing best and poor for each dataset and justify.

#### **Demonstrate performing clustering on data sets (CO4)**

- A. Load each dataset into Weka and run simple k-means clustering algorithm with different values of k (number of desired clusters). Study the clusters formed. Observe the sum of squared errors and centroids, and derive insights.
- B. Explore other clustering techniques available in Weka.
- C. Explore visualization features of Weka to visualize the clusters. Derive interesting insights and explain.

#### **Demonstrate performing Regression on data sets (CO5)**

- A. Load each dataset into Weka and build Linear Regression model. Study the clusters formed. Use Training set option. Interpret the regression model and derive patterns and conclusions from the regression results.
- B. Use options cross-validation and percentage split and repeat running the Linear Regression Model. Observe the results and derive meaningful results.
- C. Explore Simple linear regression technique that only looks at one variable

#### **Resource Sites:**

1. <http://www.pentaho.com/>
2. <http://www.cs.waikato.ac.nz/ml/weka/>

## Orange Programs

### Datasets to be used: (but not limited to)

1. brownselected.tab
2. heartdisease.tab
3. housing.tab
4. iris.tab
5. titanic.tab
6. zoo.tab

1. Installation of Orange Data mining Tool kit in Windows/Linux environment and creating basic workflows to read, process, and visualize the data. The visualization includes data table and scatter plots. Apply the task for all the 6 datasets and compare the results.
2. Demonstrate the usage of workflows in orange tool kit using widgets. Apply the task for all the 6 datasets and compare the results.
3. Demonstrate the visualization of widgets Box plot, Linear projection, and the data distributions by reading iris and heart disease datasets. Apply the task for all the other 4 datasets and compare the results.
4. Demonstrate the visualization of widgets scatter plot, line plot, bar plot by reading iris and heart disease datasets. Apply the task for all the other 4 datasets and compare the results.
5. Data Exploration using various widgets, understanding the data distributions and saving the results asHTML or PDF, or to a file that includes all workflows that are related to the report items and which you can later open in Orange. Apply the task for all the 6 datasets and compare the results.
6. Demonstrate the usage of loading the spreadsheets from the local computer and applying Data filtering and preprocessing to the given data. Apply the task for all the 6datasets and compare the results.
7. Loading the spreadsheets from the local computer and applying the classification model to the given data. Apply the task for all the 6 datasets and compare the results.
8. Demonstrate the usage of classification by reading heart disease data, and predict which persons have clogged arteries and visualize the results using tree viewer. Observe the information gain, information gain ratio and gini decrease measures.
9. Load a sailing.tab dataset that records the conditions under which a friend skipper went sailing, build a tree and visualize it in the Tree Viewer.
10. Demonstrate the usage of combination of classification tree viewer and scatter plot. Identity the bestvisualization of iris dataset, that is the one best separates the instances from different classes, then connect the tree viewer with scatter plot and visualize the results. Apply the task for all the other datasets and compare the results.
11. Apply principal component analysis on the given dataset as a pre-processing and compare the results. Applythe task for all the 6 datasets and compare the results.
12. Understanding the quality of the models by analysing the prediction results using classificationaccuracy. Apply the task for all the 6 datasets and compare the results.
13. Increasing the robustness of the models by splitting the dataset using cross-validation through the Test & Score widget. Apply the task for all the 6 datasets and compare the results.

**References:** 1.Zupan, Demsar,; Introduction to Data Mining; Introduction to Data Mining Working notes for the hands-on course with Orange Data Mining, May 2018

2. Orange Data Mining Library Documentation Release 3 – Orange Data mining

# Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3										2	
CO2	3	2	3		3						2	2	
CO3	3	2		3								2	
CO4	3	3	3		3							2	2
CO5	3	3	3		3						3	2	2

## Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: Apply	L3	PO1 PO2	PO1: Apply(L3) PO2: Review (L2)	3 3
2	CO2: Apply	L3	PO1 PO2 PO3 PO5 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop(L3) PO5: Apply (L3) PO11: Thumb rule	3 2 3 3 2
3	CO3: Evaluate	L5	PO1 PO2 PO4	PO1: Apply(L3) PO2: Formulate (L6) PO4: Analysis (L4)	3 2 3
4	CO4: Analyze	L4	PO1 PO2 PO3 PO5	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop(L3) PO5: Apply (L3)	3 3 3 3
5	CO5: Analyze	L4	PO1 PO2 PO3 PO5 PO11	PO1:Apply (L3) PO2:Identify (L3) PO3:Develop (L3) PO5:Apply (L3) PO11:Thumb rule	3 3 3 3 3

## Justification Statements:

**CO 1: Apply** the different mining tools to deal with data mining techniques.

**Action Verb: Apply (L3)**

**PO1 Verb: Apply (L3)**

CO1 Action verb is same as PO1 verb. Therefore, the correlation is high (3)

**PO2 Verb: Review (L2)**

CO1 Action verb is more than as PO2 verb. Therefore, the correlation is high (3)

**CO 2: Apply** the data mining orange tool kit to visualize results.

**Action Verb: Apply (L3)**

**PO1: Apply (L3)**

CO2 Action verb is same as PO1 verb. Therefore, the correlation is high (3)

**PO2: Analyze (L4)**

CO2 Action verb is less than as PO2 verb. Therefore, the correlation is moderate (2)

**PO3: Develop (L3)**

CO2 Action verb is same as PO3 verb. Therefore, the correlation is high (3)

**PO5: Apply (L3)**

CO2 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

**PO11: Thumb rule**

Using orange to visualize real world solutions the correlation is moderate (2)

**CO 3: Evaluate** the linear regression model using orange environment.

**Action Verb: Evaluate (L5)**

**PO1: Apply (L3)**

C01 Action verb is more than as P01 verb. Therefore, the correlation is high (3)

**P02: Formulate (L6)**

C01 Action verb is less than P02 verb by one level. Therefore, the correlation is moderate (2)

**P04: Analysis (L4)**

C01 Action verb is more than P04 verb by one level. Therefore, the correlation is high (3)

**CO 4: Analyze** the working of algorithms for various data mining tasks.

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

C02 Action verb is more than as P01 verb. Therefore, the correlation is high (3)

**P02: identify (L3)**

C02 Action verb is more than as P02 verb. Therefore, the correlation is high (3)

**P03: Develop (L3)**

C02 Action verb is more than as P03 verb. Therefore, the correlation is high (3)

**P05: Apply (L3)**

C02 Action verb is more than as P05 verb. Therefore, the correlation is high (3)

**CO 5: Analyze** the performance of different classifiers using weka tool.

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

C02 Action verb is more than as P01 verb. Therefore, the correlation is high (3)

**P02: identify (L3)**

C02 Action verb is more than as P02 verb. Therefore, the correlation is high (3)

**P03: Develop (L3)**

C02 Action verb is more than as P03 verb. Therefore, the correlation is high (3)

**P05: Apply (L3)**

C02 Action verb is more than as P05 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

Weka is used to analyze different classifier present in real world the correlation is high (3)



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**Artificial Intelligence and Data Science (AI&DS)**

**Year: II**

**Semester: II**

**Branch of study: AIDS**

Course Code	Year & Sem	Operating Systems Lab	L	T/CLC	P	C
20APC3014	II-II		0	0	3	1.5

**Course Outcomes:**

**CO 1: Understand** the basic commands in UNIX operating systems.

**CO 2: Apply** the concepts of CPU scheduling algorithms to solve real time problems.

**CO 3: Apply** the concepts of process synchronization methods.

**CO 4: Analyze** the solutions for virtual memory and Deadlocks.

**CO 5: Analyze** various file system interfaces.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the basic commands in UNIX operating system			L2
CO2	Apply	the concepts of CPU scheduling algorithms		to solve real time problems	L3
CO3	Apply	the concepts of process synchronization methods			L3
CO4	Analyze	the solutions		for virtual memory and Deadlocks	L4
CO5	Analyze	various file system interfaces			L4

**List of Experiments to be implemented in C/Java**

1. Practicing of Basic UNIX Commands.(C01)
2. Write programs using the following UNIX operating system calls Fork, exec, getpid, exit, wait, close, stat, opendir and readdir(C01)
3. Simulate UNIX commands like cp, ls, grep, etc., (C01)
4. Simulate the following CPU scheduling algorithms: a) Round Robin b) SJF c) FCFS d) Priority(C02)
5. Simulate all file allocation strategies: a) Sequential b) Indexed c) Linked(C02)
6. Simulate MVT and MFT(C02)
7. Simulate all File Organization Techniques a) Single level directory b) Two level c) Hierarchical d) DAG(C02)
8. Simulate Bankers Algorithm for Deadlock Avoidance(C03)
9. Simulate Bankers Algorithm for Deadlock Prevention(C03)
10. Simulate all page replacement algorithms a) FIFO b) LRU c) LFU Etc. ...(C04)
11. Simulate Paging Technique of memory management(C04)
12. Control the number of ports opened by the operating system with a) Semaphore b) monitors(C04)
13. Simulate how parent and child processes use shared memory and address space(C04)
14. Simulate sleeping barber problem(C04)
15. Simulate dining philosopher's problem(C04)
16. Simulate producer and consumer problem using threads (use java) (C04)
17. Simulate little's formula to predict next burst time of a process for SJF scheduling algorithm. (C04)
18. Develop a code to detect a cycle in wait-for graph(C05)
19. Develop a code to convert virtual address to physical address(C05)
20. Simulate how operating system allocates frame to process(C05)
21. Simulate the prediction of deadlock in operating system when all the processes announce their resource requirement in advance. (C05)

**References:**

1. "Operating System Concepts", Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Eighth Edition, John Wiley.
2. "Operating Systems: Internals and Design Principles", Stallings, Sixth Edition-2009, Pearson Education

3. "Modern Operating Systems", Andrew S Tanenbaum, Second Edition, PHI.
4. "Operating Systems", S.Haldar, A.A.Aravind, Pearson Education.
5. "Principles of Operating Systems", B.L.Stuart, Cengage learning, India Edition.2013-2014
6. "Operating Systems", A.S.Godbole, Second Edition, TMH.
7. "An Introduction to Operating Systems", P.C.P. Bhatt, PHI.

Online Learning Resources/Virtual Labs:

<https://www.cse.iitb.ac.in/~mythili/os/>  
<http://peterindia.net/OperatingSystems.html>

#### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	3				3							2	
C02	3	3	3		3						3	2	
C03	3	3	3		3								
C04	2	2		3	3								
C05	2				3								

#### Correlation matrix

Unit No.	CO's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	C01: Understand	L2	PO5	PO1: Apply(L3) PO5: Create (L6)	3 3
2	C02: Apply	L3	PO1 PO2 PO3 PO5 PO11	PO1: Apply(L3) PO2: Formulate (L6) PO3: Develop(L6) PO5: Create (L6) PO11:Thumb Rule	3 3 3 3 3
3	C03: Apply	L3	PO1 PO2 PO3 PO5	PO1: Apply(L3) PO2: Formulate (L6) PO3: Develop(L6) PO5: Create (L6)	3 3 3 3
4	C04: Analyze	L4	PO1 PO2 PO4 PO5	PO1:Apply(L3) PO2: Identify (L3) PO4: Analyze (L4) PO5: Create (L6)	2 2 3 3
5	C05: Analyze	L4	PO1 PO5	PO1: Apply(L3) PO5: Create (L6)	2 3

#### Justification Statements :

**C01: Understand** the basic commands in UNIX operating systems.

**Action Verb: Understand (L2)**

**PO1 Verb: Apply (L3)**

C01 Action verb is same as PO1 verb. Therefore, the correlation is high (3)

**PO5 Verb: Create (L3)**

C01 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

**C02: Apply** the concepts of CPU scheduling algorithms to solve real time problems

**Action Verb: Apply (L3)**

**PO1 Verb: Apply (L3)**

C02 Action verb is same as PO1 verb. Therefore, the correlation is high (3)

**PO2 Verb: Formulate(L6)**

C02 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)

**PO3 Verb: Develop (L6)**

C02 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)

**PO5 Verb: Create (L6)**

C02 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)



**P011 Verb: Thumb rule**

Algorithms analysis is learning process to find the solution better manner the correlation is high (3)

**C03: Apply** the concepts of process synchronization methods.

**Action Verb: Apply(L3)**

**P01 Verb: Apply (L3)**

C03 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P02 Verb: Formulate(L6)**

C03 Action verb is greater than as P02 verb. Therefore, the correlation is high (3)

**P03 Verb: Develop (L6)**

C03 Action verb is greater than as P03 verb. Therefore, the correlation is high (3)

**P05 Verb: Create (L6)**

C03 Action verb is greater than as P05 verb. Therefore, the correlation is high (3)

**C04: Analyze** the solutions for virtual memory and Deadlocks.

**Action Verb: Analyze (L4)**

**P01 Verb: Apply (L3)**

C04 Action verb is less than as P01 verb by one level. Therefore, the correlation is medium (2)

**P02 Verb: Identify(L3)**

C04 Action verb is less than as P02 verb by one level. Therefore, the correlation is medium (2)

**P04 Verb: Analyze (L4)**

C04 Action verb is same as P04 verb. Therefore, the correlation is high (3)

**P05 Verb: Create (L6)**

C04 Action verb is greater than as P05 verb. Therefore, the correlation is high (3)

**C05: Analyze** various file system interfaces.

**Action Verb: Analyze (L4)**

**P01 Verb: Apply (L3)**

C05 Action verb is less than as P01 verb by one level. Therefore, the correlation is medium (2)

**P05 Verb: Create (L6)**

C05 Action verb is greater than as P05 verb. Therefore, the correlation is high (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: II**

**Semester: II**

**Branch of study: AIDS**

Course Code	Year & Sem	Server Side Scripting	L	T/CLC	P	C
20ASC3002	II-II		1	0	2	2

**Course Outcomes:**

**CO1: Understand** the perquisitions to connect MYSQL and Apache dynamically through PHP paradigm.

**CO2: Analyze** the working mechanism of different data media and cookies ,sessions in web browser.

**CO3: Understand** the SQL commands to get database connectivity with PHP

**CO4: Create** the simple mailing list using XML & JSON.

**CO5: Analyze** the performance of Apache and database tuning for optimization, securing webserver.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the perquisitions		to connect MYSQL and Apache dynamically through PHP paradigm	L2
CO2	Analyze	the working mechanism of different data media and cookies ,sessions in web browser			L4
CO3	Understand	the SQL commands		to get database connectivity with PHP	L2
CO4	Create	the simple mailing list	using XML & JSON		L6
CO5	Analyze	the performance of Apache and database tuning		for optimization, securing webserver	L4

UNIT - I	10 Hrs
<p>Getting Up and Running: Installation Quick Start Guide with XAMPP5 - Installing and Configuring MySQL - Installing and Configuring Apache - Installing and Configuring PHP -</p> <p>PHP Language Structure: The Building Blocks of PHP - Flow Control Functions in PHP - Working with Functions - Working with Arrays - Working with Objects</p> <ol style="list-style-type: none"> <li>1. Installation of XAMPP server</li> <li>2. Write PHP code to print Hello World program</li> <li>3. Demonstrate 8 basic data types in PHP.</li> <li>4. Demonstrate the scope of variables declared in PHP code.</li> <li>5. Demonstrate Arithmetic, Comparison, Logical (or Relational), Assignment and Conditional (or ternary) Operators.</li> <li>6. Demonstrate if, elseif ...else and switch statements.</li> <li>7. Demonstrate for, while, do – while, and for each loop.</li> <li>8. Write code to create and access numeric arrays.</li> <li>9. Demonstrate the usage of associative arrays.</li> <li>10. Implement Multi-dimensional arrays</li> <li>11. Create a multidimensional array of movies organized by genre. This should take the form of an associative array with genres as keys, such as Science Fiction, Action, Adventure, and so forth. Each of the array's elements should be an array containing movie names, such as Alien, Terminator 3, Star Wars, and so on. After creating your arrays, loop through them, printing the name of each genre and its associated movies.</li> <li>12. Create a function that accepts four string variables and returns a string that contains an HTML table element, enclosing each of the variables in its own cell.</li> <li>13. Create a class called baseCalc() that stores two numbers as properties. Next, create a calculate()</li> </ol>	

<p>method that prints the numbers to the browser.</p> <p>14. Create classes called addCalc(), subCalc(), mulCalc(), and divCalc() that inherit functionality from baseCalc() but override the calculate() method and print appropriate totals to the browser.</p>		
<b>UNIT - II</b>		10 Hrs
<p>Working with Strings, Dates, and Time - Working with Forms - Working with Cookies and User Sessions - Working with Files and Directories - Working with Images</p> <ol style="list-style-type: none"> <li>1. Create a feedback form that accepts a user's full name and an email address. Use case-conversion functions to capitalize the first letter of each name the user submits and print the result back to the browser. Check that the user's email address contains the @ symbol and print a warning otherwise.</li> <li>2. Create an array of doubles and integers. Loop through the array, converting each element to a floating-point number with a precision of 2. Right-align the output within a field of 20 characters.</li> <li>3. Create a birthday countdown script. Given form input of month, day, and year, output a message that tells the user how many days, hours, minutes, and seconds until the big day.</li> <li>4. Create a calculator script that enables the user to submit two numbers and choose an operation (addition, multiplication, division, or subtraction) to perform on them.</li> <li>5. Use hidden fields with the script you created in activity 1 to store and display the number of requests that the user submitted.</li> <li>6. Create a script that uses session functions to track which pages in your environment the user has visited.</li> <li>7. Create a new script that will list for the user all the pages he/she has visited within your environment, and when.</li> <li>8. Create a form that accepts a user's first and second name. Create a script that saves this data to a file.</li> <li>9. Create a script that reads the data file you created in the first activity. In addition to writing its contents to the browser (adding a tag to each line), print a summary that includes the number of lines in the file and the file's size.</li> <li>10. Draw a New Image, shapes and lines.</li> <li>11. Create a New Image with Color Fills.</li> <li>12. Draw A Basic Pie Chart and 3D Pie Chart</li> <li>13. Creating a New Image from an Existing Image.</li> <li>14. Creating an Image from User Input.</li> <li>15. Creating an Image with Custom Font and Text</li> </ol>		
<b>UNIT - III</b>	<b>PHP with database connectivity</b>	10 Hrs
<p>Understanding the Database Design Process - Learning Basic SQL Commands - Using Transactions and Stored Procedures in MySQL - Interacting with MySQL Using PHP</p> <p>Write PHP code</p> <ol style="list-style-type: none"> <li>1. to open and close a database connection.</li> <li>2. to select a database. to select a database.</li> <li>3. to create a table</li> <li>4. to drop a database.</li> <li>5. to drop a table</li> <li>6. to insert record into employee table.</li> <li>7. take input using HTML Form and insert records into table.</li> <li>8. to display all the records from employee table.</li> <li>9. to display all the records from employee table using mysql_fetch_assoc() function.</li> <li>10. to display all the records from employee table using MYSQL_NUM argument.</li> <li>11. to release cursor memory at the end of SELECT statement.</li> <li>12. to display 10 records per page.</li> <li>13. to take user input of employee ID and update employee salary.</li> <li>14. to take user input of employee ID and delete an employee record from employee table.</li> <li>15. Use SELECT INTO OUTFILE query for creating table backup.</li> </ol>		
<b>UNIT - IV</b>		10 Hrs

Managing a Simple Mailing List - Creating an Online Address Book - Creating a Simple Discussion Forum - Creating an Online Storefront - Creating a Shopping Cart Mechanism - Creating a Simple Calendar - Restricting Access to Your Applications - Logging and Monitoring Web Server Activity - Application Localization - Working with XML and JSON

1. Common Functions in an Included File
2. Subscribe and Unsubscribe with manage.php
3. Send Mail to Your List of Subscribers
4. Modify the manage.php script to display the user's email as part of the response message for any action that is taken.
5. Modify the sendmyemail.php script to add additional form fields that will correspond to section headings in the message string itself. Remember that when the form is submitted, those strings will have to be concatenated into one message string that is sent to the mail() function.

<b>UNIT - V</b>	5 Hrs
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Apache Performance Tuning and Virtual Hosting - Setting Up a Secure Web Server - Optimizing and Tuning MySQL - Performing Software Upgrades - Using Application Frameworks

#### Textbooks:

1. Sams Teach Yourself PHP, MySQL and Apache All in One, by Julie C. Meloni, Pearson Education, Inc © 2012.

#### Reference Books:

1. Beginning PHP6, Apache, MySQL Web Development, by Timothy Boronczyk, Elizabeth Naramore,
2. Jason Gerner, Yann Le Scouarnec, Jeremy Stolz, Michael K. Glass, Wiley Publishing, Inc © 2009
3. PHP 6 and MySQL 6 Bible, by Steve Suehring, Tim Converse, Joyce Park, Wiley Publishing, Inc © 2009.
4. PHP & MySQL Web Development All-in-One Desk Reference For Dummies, by Janet Valade with Tricia Ballad and Bill Ballad, Wiley Publishing, Inc © 2008.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3			2							3	
CO2	3	3			3						3	2	
CO3	3	3	3	2						2		2	
CO4	3		3	3	3						3	2	
CO5	3	3	3	3	3			3				2	

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1 PO2 PO5	PO1: Apply(L3) PO2: Review(L2) PO5: Apply(L3)	2 3 2
2	CO2: Analyze	L4	PO1 PO2 PO5 PO11	PO1: Apply(L3) PO2: Identify(L3) PO5: Apply(L3) PO11: Thumb rule	3 3 3 3
3	CO3: Apply	L3	PO1 PO2 PO3 PO4 PO10	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO10: Thumb rule	3 3 3 2 2
4	CO4: Create	L6	PO1 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO3: Develop (L3) PO4: Analyze (L4) PO5: Create(L6) PO11: Thumb rule	3 3 3 3 3
5	CO5: Analyze	L4	PO1 PO2 PO3 PO4	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4)	3 3 3 3

			<b>PO5</b>	<b>PO5: Apply(L3)</b>	<b>3</b>
			<b>PO8</b>	<b>PO8: Thumb rule</b>	<b>3</b>

#### Justification Statements:

**CO1: Understand** the perquisitions to connect MYSQL and Apache dynamically through PHP paradigm.

**Action Verb : Understand (L2)**

**P01: Apply(L3)**

C01 Action verb is less than P02 verb by one, Therefore the correlation is medium (2)

**P02: Review(L2)**

C01 Action verb is same level as P01 verb. Therefore, the correlation is high (3)

**P05: Apply(L3)**

C01 Action verb is less than P02 verb by one, Therefore the correlation is medium (2)

**CO2: Analyze** the working mechanism of different data media and cookies ,sessions in web browser.

**Action Verb : Analyze(L4)**

**P01: Apply(L3)**

C02 Action verb is greater than P01 verb. Therefore, the correlation is high (3)

**P02: Identify(L3)**

C02 Action verb is greater than P02 verb. Therefore, the correlation is high (3)

**P05: Apply(L3)**

C02 Action verb is greater than P05 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

The applications can be designed specifically for all kind of users and also increase session time out as per client requirement.so need to update frequently. Therefore the correlation is medium (2)

**CO3:Apply** the SQL commands to get database connectivity with PHP

**Action Verb : Apply(L3)**

**P01: Apply(L3)**

C03 Action verb is same P01 verb , Therefore the correlation is high(3)

**P02: Review(L2)**

C03 Action verb is greater level by P02 verb. Therefore, the correlation is high (3)

**P03: Develop (L3)**

C03 Action verb is same as P03 verb. Therefore the correlation high(3)

**P04: Analyze(L4)**

C04 Action verb is less than P04 verb by one level. Therefore the correlation is medium(2)

**P010: Thumb rule**

Effective communication is needed between user and database administrator to maintain log details. Therefore, the correlation is medium (2)

**CO4: Create** the simple mailing list using XML & JSON.

**Action Verb : Create(L6)**

**P01: Apply(L3)**

C04 Action verb is greater than P01 verb. Therefore the correlation is high (3)

**P03: Develop(L3)**

C04 Action verb is greater than P03 verb. Therefore the correlation is high (3)

**P04: Analyze(L4)**

C04 Action verb is greater than P04 verb. Therefore the correlation is high (3)

**P05: Create(L6)**

C04 Action verb is same level as P05 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

The developer need to upgrade all server concepts and JSON concepts for future developments. Therefore the correlation is high(3)

**CO5: Analyze** the performance of Apache and database tuning for optimization, securing webserver.

**Action Verb : Analyze (L4)**

**P01: Apply(L3)**

C05 Action verb is greater than P01 verb. Therefore the correlation is high(3)

**P02: Review (L2)**

C05 Action verb is greater than P02 verb. Therefore the correlation is high(3)

**P03: Develop (L3)**

C05 Action verb is greater than P03 verb. Therefore the correlation is high (3)

**P04: Analyze (L4)**

C05 Action verb is same as P04 verb. Therefore the correlation is high(3)

**P05: Apply(L3)**

C05 Action verb is greater than P05 verb. Therefore the correlation is high (3)

**P08: Thumb rule**

The team should follow some ethics for evaluate and Improving the performance .Therefore the correlation is high(3)

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI**

**(AUTONOMOUS)**

**B. Tech - Artificial Intelligence and Data Science (AI&DS)**  
**(Effective for the batches admitted from 2020-21)**

**Semester V (Third year)**

SI. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P				
1	PC	20APC3015	Principles of Data Science	4	2	0	3	30	70	100
2	PC	20APC3017	Artificial Intelligence	4	2	0	3	30	70	100
3	PC	20APC3019	Big data Technologies	4	2	0	3	30	70	100
4	OE-1	20AOE9925	Deterministic and Stochastic Statistical Methods	4	2	0	3	30	70	100
		20AOE0303	Optimization Techniques							
		20AOE0552	Internet of Things	3	0	0				
5	PE-1	20APE3001 20APE3002 20APE3003	Design And Analysis of Algorithms Computer Graphics Adhoc & Sensor Networks	4	2	0	3	30	70	100
6	PC LAB	20APC3018	Artificial Intelligence Lab	0	0	3	1.5	30	70	100
7	PC LAB	20APC3016	Principles of Data Science Lab	0	0	3	1.5	30	70	100
8	SC	20ASC3003	Conversational AI/ AI Chat Bot	1	0	2	2	100	0	100
9	Mandatory Course (AICTE Suggested)	20AMC9901	Biology for Engineers	3	0	0	0	30	0	30
10	CSP	20CSP3001	Evaluation of Community Service Project	0	0	0	1.5	100	0	100
<b>Total credits</b>							<b>21.5</b>	<b>440</b>	<b>490</b>	<b>930</b>



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: III**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	Principles of Data Science	L	T/CLC	P	C
20APC3015	III-I		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

**C01: Understand** the different levels of Data and Steps in Data Science.

**C02: Apply** the basics of probability models for data exploration.

**C03: Analyze** the basics of statistics models for data exploration.

**C04: Analyze** the different data visualization techniques.

**C05: Analyze** the suitable model for real time applications.

	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
<b>C01</b>	<b>Understand</b>	The Different levels of Data and Steps in Data Science			L2
<b>C02</b>	<b>Apply</b>	The basics of probability models		for data exploration	L3
<b>C03</b>	<b>Analyze</b>	The basics of statistics models		for data exploration	L4
<b>C04</b>	<b>Analyze</b>	The different data visualization techniques			L4
<b>C05</b>	<b>Analyze</b>	the suitable model		for real time applications	L4

<b>UNIT - I</b>	<b>Introduction to Data Science</b>	
Structured versus unstructured data, Quantitative and qualitative data, The four levels of data: Nominal level, Ordinal level, Interval level, and Ratio level, The five steps of Data Science: Ask an interesting question, obtain the data, explore the data, model the data, communicate and visualize the results, Explore the data.		
<b>UNIT - II</b>	<b>Mathematics</b>	
<b>Mathematics:</b> Vectors and matrices, Arithmetic symbols, Graphs, Logarithms/exponents, Set theory, Linear algebra. Probability: Basic definitions, Probability, Bayesian versus Frequentist, Compound events, Conditional Probability, The rules of probability, Collectively exhaustive events, Bayes theorem, Random variables.		
<b>UNIT - III</b>	<b>Statistics</b>	
<b>Statistics:</b> Obtaining data, Sampling data, Measuring Statistics, The Empirical rule, Point estimates, Sampling distributions, Confidence intervals, Hypothesis tests.		
<b>UNIT - IV</b>	<b>Identifying effective and ineffective visualizations</b>	
<b>Identifying effective and ineffective visualizations:</b> Scatter plots, Line graphs, Bar charts, Histograms, Box plots. Graphs and Statistics lie: Correlation versus causation, Simpson's paradox, Verbal Communication, The why/how/what strategy of presenting.		
<b>UNIT - V</b>	<b>Applications of Data Science</b>	
<b>Applications of Data Science-</b> Technologies for visualisation, Bokeh (Python), recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.		
<b>Textbooks:</b>		
1. Sinan Ozdemir, "Principles of Data Science", Packt, 2016. 2. "Algorithms for Data Science", 1st edition, Steele, Brian, Chandler, John, Reddy, Swarna, springers Publications, 2016		
<b>Reference Books:</b>		
1. Cathy O'Neil and Rachel Schutt, "Doing Data Science, Straight Talk From The Frontline", O'Reilly, 2014. 2. G. Jay Kerns, "Introduction to Probability and Statistics Using R", First Edition. 3. Nina Zumel, John Mount, "Practical Data Science with R", Manning Publications, 1st Edition, 2014.		



4. Doing Data Science: Straight Talk From The Frontline, 1st edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013
5. Mining of Massive Datasets, 2nd edition, Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, v2.1, Cambridge University Press, 2014

#### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	2	1										2	
C02	3	3				2					3	2	
C03	3	3	3	3	3				3		3	2	
C04	3	3	3	3	3						3	2	2
C05		3	3	3	3				3		3	2	2

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	14	23%	3	CO1 :Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Analyze(L4)	2 1
2	10	17%	2	CO2 : Apply	L3	PO1 PO2 PO6 PO11	PO1: Apply(L3) PO2: Identify(L3) PO6: Thumb rule PO11: Thumb rule	3 3 2 2
3	12	20%	2	CO3 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO9 PO11	PO1: Apply(L3) PO2: Identify(L3) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO9: Thumb rule PO11: Thumb rule	3 3 3 3 3 3 3
4	10	17%	2	CO4 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Identify(L3) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO11: Thumb rule	3 3 3 3 3 3
5	14	23%	3	CO5 : Analyze	L4	PO2 PO3 PO4 PO5 PO9 PO11	PO2: Identify(L3) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO9: Thumb rule PO11: Thumb rule	3 3 3 3 3 3
	60	100 %						

#### Correlation matrix

#### Justification Statements :

**CO1: Understand** the different levels of Data and Steps in Data Science

**Action Verb : Understand(L2)**

**PO1 Verb : Apply(L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

**PO2 Verb : Analyze(L4)**

CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

**C02: Apply the basics of probability models for data exploration**

**Action Verb : Apply (L3)**

**P01: Apply(L3)**

C02 Action verb is same level as P01 verb. Therefore the correlation is high (3)

**P02: Identify(L3)**

C02 Action verb is same level as P02 verb. Therefore the correlation is high (3)

**P06: Thumb rule**

For some of data exploration applications, Various probabilistic models were applied to address societal and environmental concerns. Therefore, the correlation is Medium (2)

**P011: Thumb rule**

For some of data exploration applications, new probability models should be explored for applying on new trends of data. Therefore the correlation is Medium (2)

**C03: Analyze the basics of statistics models for data exploration.**

**Action Verb : Analyze (L4)**

**P01: Apply(L3)**

C03 Action verb is greater than P01 verb level by one level. Therefore the correlation is high (3)

**P02: Identify(L3)**

C03 Action verb is greater than P02 verb level by one level. Therefore the correlation is high (3)

**P03: Develop(L3)**

C03 Action verb is greater than P03 verb level by one level. Therefore the correlation is high (3)

**P04: Analyze(L4)**

C03 Action verb is same as P04 verb. Therefore the correlation is high (3)

**P05: Apply(L3)**

C03 Action verb is greater than P05 verb level by one level. Therefore the correlation is high (3)

**P09 : Thumb rule**

Team work is required create multiple probability models for data exploration. Hence the correlation is high (3)

**P011 : Thumb rule**

For some of data exploration applications, new statistical models should be explored for applying on new trends of data. Therefore the correlation is high (3)

**C04: Analyze the different data visualization techniques.**

**Action Verb : Analyze(L4)**

**P01: Apply(L3)**

C04 Action verb is greater than P01 verb level by one level. Therefore the correlation is high (3)

**P02: Identify(L3)**

C04 Action verb is greater than P02 verb level by one level. Therefore the correlation is high (3)

**P03: Develop(L3)**

C04 Action verb is greater than P03 verb level by one level. Therefore the correlation is high (3)

**P04: Analyze(L4)**

C04 Action verb is same as P04 verb. Therefore the correlation is high (3)

**P05: Apply(L3)**

C04 Action verb is greater than P05 verb level by one level. Therefore the correlation is high (3)

**P011 : Thumb rule**

For some of data exploration applications, new visualization techniques should be explored for applying on new trends of data. Therefore the correlation is high(3)

**C05: Analyze the suitable model for real time applications.**

**Action Verb : Analyze(L4)**

**P02: Identify(L3)**

C05 Action verb is greater than P02 verb level by one level. Therefore the correlation is high (3)

**P03: Develop(L3)**

C05 Action verb is greater than P03 verb level by one level. Therefore the correlation is high (3)

**P04: Analyze(L4)**

C05 Action verb is same as P04 verb. Therefore the correlation is high (3)

**P05: Apply(L3)**

C05 Action verb is greater than P05 verb level by one level. Therefore the correlation is high (3)

**P09 : Thumb rule**

Team work is required build model for real time applications. Hence the correlation is high(3)

**P011 : Thumb rule**

For some of data exploration applications, models should be created for new trends of data.  
Therefore the correlation is high(3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: III**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	Artificial Intelligence	L	T/CLC	P	C
20APC3017	III-I		4	0	0	3

**Course Outcomes:**

After studying the course, student will be able to

C01: **Understand** the basic concepts of artificial intelligence and intelligent agents

C02: **Apply** the searching techniques for solving searching problems.

C03: **Analyze** the concepts of Reinforcement Learning and NLP Models.

C04: **Evaluate** Natural Language Interfaces and perception mechanisms for Machines understanding.

C05: **Analyze** the robotic designing modules and philosophy constraints for artificial intelligence.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	The basics concepts of artificial intelligence and intelligent agents			L2
C02	Apply	the searching techniques		For Solving searching problems	L3
C03	Analyze	The concepts of Reinforcement Learning and NLP Models			L4
C04	Evaluate	Natural Language Interfaces and perception mechanisms		For Machines understanding	L5
C05	Analyze	the robotic designing modules and philosophy constraints		for artificial intelligence.	L4

<b>UNIT - I</b>	9 Hrs
<b>Introduction:</b> What is AI, Foundations of AI, History of AI, The State of Art. <b>Intelligent Agents:</b> Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The Structure of Agents.	
<b>UNIT - II</b>	9Hrs
<b>Solving Problems by searching:</b> Problem Solving Agents, Example problems, Searching for Solutions, Uninformed Search Strategies, Informed search strategies, Heuristic Functions, Beyond Classical Search: Local Search Algorithms and Optimization Problems, Local Search in Continues Spaces, Searching with Nondeterministic Actions, Searching with partial observations, online search agents and unknown environments.	
<b>UNIT - III</b>	9 Hrs
<b>Reinforcement Learning:</b> Introduction, Passive Reinforcement Learning, Active Reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, applications of RL <b>Natural Language Processing:</b> Language Models, Text Classification, Information Retrieval, Information Extraction.	
<b>UNIT - IV</b>	9 Hrs
<b>Natural Language for Communication:</b> Phrase structure grammars, Syntactic Analysis, Augmented Grammars and semantic Interpretation, Machine Translation, Speech Recognition <b>Perception:</b> Image Formation, Early Image Processing Operations, Object Recognition by appearance, Reconstructing the 3D World, Object Recognition from Structural information, Using Vision.	
<b>UNIT - V</b>	9 Hrs
<b>Robotics:</b> Introduction, Robot Hardware, Robotic Perception, Planning to move, planning uncertain movements, Moving, Robotic software architectures, application domains <b>Philosophical foundations:</b> Weak AI, Strong AI, Ethics and Risks of AI, Agent Components, Agent Architectures, Are we going in the right direction, What if AI does succeed.	

<b>Textbooks:</b>
Stuart J. Russell, Peter Norvig, "Artificial Intelligence A Modern Approach", 3 <sup>rd</sup> Edition, Pearson Education, 2019.
<b>Reference Books:</b>
Nilsson, Nils J., and Nils Johan Nilsson. Artificial intelligence: a new synthesis. Morgan Kaufmann, 1998.
Johnson, Benny G., Fred Phillips, and Linda G. Chase. "An intelligent tutoring system for the accounting cycle: Enhancing textbook homework with artificial intelligence." Journal of Accounting Education 27.1 (2009): 30-39.
<b>Online Learning Resources:</b>
<a href="http://peterindia.net/AILinks.html">http://peterindia.net/AILinks.html</a>

**Mapping of course outcomes with program outcomes**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3											
CO2	3	2	3	2	3							2	2
CO3	3	3	3	3	3	3		3					3
CO4		3	3		3	3		3					3
CO5	3	3	3			3		3	3		3	1	1

**Correlation matrix**

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	10	19%	2	CO1 :Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	13	25%	3	CO2 :Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO4: Analyze (L4) PO5:Apply(L3)	3 2 3 2 3
3	10	19%	2	CO3 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO6 PO8	PO1: Apply (L3) PO2: Analyze (L4) PO3: Develop (L3) PO4: Analyze (L4) PO5:Apply(L3) PO6: Thumb Rule PO8: Thumb Rule	3 3 3 3 3 3 3
4	9	17%	2	CO4 :Evaluate	L5	PO2 PO3 PO5 PO6 PO8	PO2: Review(L2) PO3: Develop (L3) PO5: Apply(L3) PO6: Thumb Rule PO8: Thumb Rule	3 3 3 3 3
5	11	20%	3	CO5 :Analyze	L4	PO1 PO2 PO3 PO6 PO8 PO9 PO11	PO1:Apply(L3) PO2:Analyze(L4) PO3: Develop(L3) PO6:Thumb Rule PO8: Thumb Rule PO9:Thumb Rule PO11: Thumb Rule	3 3 3 3 3 3 3
	53	100 %						

**Justification Statements :**

CO1: Understand the basic concepts of artificial intelligence and intelligent agents

Action Verb : Understand(L2)

PO1 : Apply(L3)

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

**PO2 : Review(L2)**

CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

**CO2: Apply the searching techniques for solving searching problems.**

**Action Verb : Apply (L3)**

**PO1: Apply(L3)**

CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

**PO2: Analyze (L4)**

CO2 Action verb is less than PO2 verb by one level. Therefore the correlation is medium(2)

**PO3: Develop (L3)**

CO2 Action verb is same level as PO3 verb. Therefore the correlation is high (3)

**PO4: Analyze (L4)**

CO2 Action verb is less than PO4 verb by one level. Therefore the correlation is medium(2)

**PO5:Apply(L3)**

CO2 Action verb is same level as PO5 verb. Therefore the correlation is high (3)

**CO3:Analyze the concepts of Reinforcement Learning and NLP Models.**

**Action Verb : Analyze (L4)**

**PO1: Apply (L3)**

CO3 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

**PO2: Analyze (L4)**

CO3 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

**PO3: Develop (L3)**

CO3 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

**PO4: Analyze (L4)**

CO3 Action verb is same level as PO4 verb. Therefore the correlation is high (3)

**PO5:Apply(L3)**

CO3 Action verb is greater than PO5 verb. Therefore the correlation is high (3)

**PO6 : Thumb rule**

Apply contextual knowledge is used for society to address the security issues so correlation is high(3)

**PO8 : Thumb rule**

The ethical knowledge is used to perform operations . Hence the correlation is high (3)

**CO4: Evaluate Natural Language Interfaces and perception mechanisms for Machines understanding.**

**Action Verb : Evaluuate(L5)**

**PO2: Review(L2)**

CO4 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

**PO3: Develop(L3)**

CO4 Action verb is same level as PO3 verb. Therefore the correlation is high (3)

**PO5: Apply(L3)**

CO4 Action verb is same level as PO5 verb. Therefore the correlation is high (3)

**PO6 : Thumb rule**

To address the security issues we apply contextual knowledge. so correlation is high(3)

**PO8 : Thumb rule**

The ethical knowledge is used to perform operations . Hence the correlation is high (3)

**CO5: Analyze the robotic designing modules and philosophy constraints for artificial intelligence.**

**Action Verb : Analyze(L4)**

**P01:Apply(L3)**

C05 Action verb is greater than P01 verb. Therefore the correlation is high (3)

**P02:Analyze(L4)**

C05 Action verb is greater than P02 verb. Therefore the correlation is high (3)

**P03: Develop(L3)**

C05 Action verb is greater than P03 verb. Therefore the correlation is high (3)

**P06:Thumb Rule**

Apply contextual knowledge is used for society to address the security issues so correlation is medium (2)

**P08: Thumb Rule**

Since ethical principles should be followed to create a robot. Therefore the correlation is medium (2)

**P09 : Thumb rule**

Team work is required to create robots. Hence the correlation is medium (2)

**P011: Thumb rule**

For some of AI applications, AI concepts are used to create robots designs. Therefore the correlation is medium (2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: III**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	BIG DATA TECHNOLOGIES	L	T/CLC	P	C
20APC3019	III-I		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

**C01: Understand** the fundamental Concepts and modern technology of big data.

**C02: Apply** the different technologies and frame works for handling big data.

**C03: Analyze** the huge data using map reduce and Hbase technologies.

**C04: Evaluate** the map reduce application using testing and debugging.

**C05: Analyze** the data base application various using Hive and NoSQL.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	the fundamental elements and modern technology of big data			L2
C02	Apply	the Different technologies and frame works for		for handling big data	L3
C03	Analyze	the Huge data	using map reduce and Hbase technologies		L4
C04	Evaluate	the Map reduce application	using testing and debugging		L5
C05	Analyze	the Data base application various	using Hive and NoSQL		L4

<b>UNIT - I</b>	
<b>Getting an Overview of Big Data:</b> Introduction to Big Data, Structuring Big Data, Elements of Big Data, Big Data Analytics. Exploring the use of Big Data in Business Context Use of Big Data in Social Networking, Use of Big Data Preventing Fraudulent Activities, Use of Big Data in Retail Industry	
<b>UNIT - II</b>	
Introducing Technologies for Handling Big Data Distributed and Parallel Computing for Big Data, Introducing Hadoop, Cloud Computing and Big Data, In-memory Computing Technology for Big Data. Understanding Hadoop Ecosystem Hadoop Ecosystem, Hadoop Distributed File System, Map Reduce, Hadoop YARN, Introducing HBase, Combining HBase and HDFS, Hive, Pig and Pig Latin, Sqoop, ZooKeeper, Flume, Oozie.	
<b>UNIT- III</b>	
Understanding Map Reduce Fundamentals and H Base The Map Reduce Framework, Techniques to Optimize Map Reduce Jobs, Uses of Map Reduce, Role of H Base in Big Data Processing. Processing Your Data with Map Reduce Recollecting the Concept of Map Reduce Framework, Developing Simple Map Reduce Application, Points to Consider while Designing Map Reduce.	
<b>UNIT - IV</b>	
Customizing Map Reduce Execution and Implementing Map Reduce Program Controlling Map Reduce Execution with Input Format, Reading Data with Custom Record Reader, Organizing Output Data with Output Formats, Customizing Data with Record Writer, Customizing the Map Reduce Execution in Terms of YARN, Implementing a Map Reduce Program for Sorting Text Data. Testing and Debugging Map Reduce Application Debugging Hadoop Map Reduce Locally,	



## Performing Unit Testing for Map Reduce Applications.

### UNIT - V

**Exploring Hive:** Introducing Hive, Hive Service, Built-In Functions in Hive, Hive DDL, Data Manipulation in Hive, Data Retrieval Queries, Using JOINS in Hive.

NoSQL Data Management Introduction to NoSQL, Types of NoSQL Data Models, Schema-Less Databases, Materialized Views, Distribution Models, Sharding.

### Textbooks:

1. Big Data Black Book, DT Editorial services ,Dreamtech Press

### Reference Books:

1. Data Science for Business by F. Provost and T. Fawcett, O'Reilly Media.
2. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced
3. Hadoop: The Definitive Guide by Tom White, O'Reilly Media.
4. Big Data and Business Analytics by Jay Liebowitz, Auerbach Publications, CRC Press.

### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2											
CO2	3	3		2	3						2		
CO3	3	3		3							3		
CO4	3	3		3							3		
CO5	3	3		3							3	1	

### Correlation matrix

Unit no	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	10	19%	2	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Identify(L3)	2 2
2	12	22%	3	CO2: Apply	L3	PO1 PO2 PO4 PO5 PO11	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze (L4) PO5: Select(L3) PO11: Thumb rule	3 3 2 3 2
3	10	19%	2	CO3: Analyze	L4	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO4: Analysis (L4) PO11: Thumb rule	3 3 3 3
4	11	20%	2	CO4: Evaluate	L5	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Identify (L3) PO4: Analysis(L4) PO11: Thumb rule	3 3 3 3
5	11	20%	2	CO5: Analyze	L4	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Identify(L3) PO4: Analysis(L4) PO11: Thumb rule	3 3 3 3
	54	100 %						

### Justification Statements:

**CO1: Understand** the fundamental Concepts and modern technology of big data.

**Action Verb: Understand (L2)**

**PO1 Verb: Apply (L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is Moderate(2)

**P02 Verb: Identify (L3)**

CO1 Action verb is less than PO2 verb by one level. Therefore, the correlation is Moderate(2)

**CO2: Apply** the different technologies and frame works for handling big data.

**Action Verb: Apply (L3)**

**P01: Apply (L3)**

CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high(3)

**P02: Identify (L3)**

CO2 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

CO2 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)

**P05: Select (L3)**

CO2 Action verb is same level as PO5 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

For use some different technologies to handling big data. Therefore, the correlation is moderate(2)

**CO3: Analyze** the huge data using map reduce and Hbase technologies.

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

CO3 Action verb more than PO1 verb. Therefore, the correlation is high (3)

**P02: Analyze (L4)**

CO3 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

**P04: Analysis (L4)**

CO3 Action verb is same level as PO4 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

For use map reduce and H base technologies to handling big data. Therefore, the correlation is high (3)

**CO4: Evaluate** the map reduce application using testing and debugging.

**Action Verb: Evaluate (L5)**

**P01: Apply(L3)**

CO4 Action verb is more than PO1 verb. Therefore, the correlation is high (3)

**P02: Identify (L3)**

CO4 Action verb is more than PO2 verb. Therefore, the correlation is high (3)

**P04: Analysis (L4)**

CO4 Action verb is more than PO4 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

For use map reduce applications to test and debug big data. Therefore, the correlation is high (3)

**CO5: Analyze** the data base application various using Hive and NoSQL.

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

CO5 Action verb is more than PO1 verb. Therefore, the correlation is high (3)

**P02: Identity (L3)**  
CO5 Action verb is more than PO2 verb. Therefore, the correlation is high (3)

**P04: Analysis (L4)**

CO5 Action verb is same as PO4 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

For use to create data base application using Hive and NoSQL technologies to handling big data. Therefore, the correlation is high (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
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**Artificial Intelligence and Data Science (AI&DS)**

**Year: III**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	Deterministic and Stochastic Statistical Methods	L	T/CLC	P	C
20AOE9925	III-I		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Analyze** the representation of given data using problem solving techniques.

**CO2: Apply** the single variable distributions to random variables.

**CO3: Apply** the stochastic methods and markov chains to random variables.

**CO4: Analyze** the theory of multivariate distributions and Bayesian Inference.

**CO5: Analyze** the constrained and unconstrained optimization techniques in machine learning and data science

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Analyze	the representation of given data	using problem solving techniques.		L4
2	Apply	the single variable distributions to random variables.			L3
3	Apply	the stochastic methods and markov chains to random variables.			L3
4	Analyze	the theory of multivariate distributions and Bayesian Inference.			L4
5	Analyze	the constrained and unconstrained optimization techniques	in machine learning and data science.		L4

**UNIT-I Data Representation**

**9 hrs**

Distance measures, Projections, Notion of hyper-planes, half-planes. Principal Component Analysis- Population Principal Components, sample principal coefficients, covariance, matrix of dataset, Dimensionality reduction, Singular value decomposition, Gram Schmidt process.

**UNIT-II Single Variable Distribution**

**9 hrs**

Random variables (discrete and continuous), probability density functions, properties, mathematical expectation- Probability distribution- Binomial, Poisson approximation to the binomial distribution and normal distribution- their properties- Uniform distribution- exponential distribution.

**UNIT-III Stochastic Processes And Markov Chains:**

**9 hrs**

Introduction to Stochastic processes-Markov process. Transition Probability, Transition Probability Matrix, First order and Higher order Markov process, step transition probabilities, Markov chain, Steady state condition, Markov analysis.

**UNIT-IV Multivariate Distribution Theory**

**10 hrs**

Multivariate Normal distribution – Properties, Distributions of linear combinations, independence, marginal distributions, conditional distributions, Partial and Multiple correlation coefficient. Moment generating function.

**BAYESIAN INFERENCE AND ITS APPLICATIONS:** Statistical tests and Bayesian model comparison, Bit, Surprisal, Entropy, Source coding theorem, Joint entropy, Conditional entropy, Kullback- Leibler divergence.

**UNIT-V Optimization**

**8 hrs**

Unconstrained optimization, Necessary and sufficiency conditions for optima, Gradient descent methods, Constrained optimization, KKT conditions, Introduction to non-gradient techniques, Introduction to least squares optimization, Optimization view of machine learning. Data Science Methods: Linear regression as an exemplar function approximation problem, linear classification problems.

**Textbooks:**

1. Mathematics for Machine Learning by A. Aldo Faisal, Cheng Soon Ong, and Marc Peter Deisenroth
2. Dr. B. S. Grewal, Higher Engineering Mathematics, 45th Edition, Khanna Publishers.
3. Operations Research, S. D. Sharma

**Reference Books:**

1. Operations Research, An Introduction, Hamdy A. Taha, Pearson publishers.
2. A Probabilistic Theory of Pattern Recognition by Luc Devroye, Laszlo Györfi, Gabor Lugosi.

**Online Learning Resources:**

<https://www.math.brown.edu/swatson2/classes/data1010/pdf/data1010.pdf>

**Mapping of COs to POs**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
1		3									
2	3										
3	3										
4		3									
5		3									

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

**CO-PO mapping justification:**

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	19	27.1	3	Analyze	L4	PO2	Analyze (L4)	3
2	14	20	3	Apply	L3	PO1	Apply (L3)	3
3	10	14.2	2	Apply	L3	PO1	Apply (L3)	3
4	12	17.14	2	Analyze	L4	PO2	Analyze (L4)	3
5	15	21.4	3	Analyze	L4	PO2	Analyze (L4)	3

**CO1:** Analyze the representation of given data using problem solving techniques.

Action Verb: Analyze (L4)

PO2 Verb: Analyze (L4)

CO1 Action Verb is equal to PO2 verb Therefore correlation is high (3).

**CO2:** Apply the single variable distributions to random variables.

Action Verb: Apply (L3)

PO1 Verb: Apply (L3)

CO2 Action Verb is equal to PO1 verb; Therefore correlation is high (3).

**CO3:** Apply the stochastic methods and markov chains to random variables.

Action Verb: Apply (L2)

PO1 Verb: Apply (L3)

CO3 Action Verb is equal to PO1 verb; Therefore correlation is high (3).

**C04:** Analyze the theory of multivariate distributions and Bayesian Inference.

**Action Verb:** Analyze (L4)

P02 Verb: Analyze (L4)

CO4 Action Verb is equal to P02 verb; Therefore correlation is high (3).

**C05:** Analyze the constrained and unconstrained optimization techniques in machine learning and data science.

**Action Verb:** Analyze (L4)

P02 Verb: Analyze (L4)

CO5 Action verb is equal to P02 verb; therefore the correlation is high (3).



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
Artificial Intelligence and Data Science (AI&DS)**

**Year: III**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	Optimization Techniques	L	T/CLC	P	C
20AOE0303	III-I		4	2	0	3

**Course Outcomes:**

**After studying the course, student will be able to**

**C01: Apply** the knowledge of vector design for optimizing the problems involved with single and multiple variables

**C02: Apply** the mathematical procedure for solving the LPP and transportation models

**C03: Understand** the unconstrained optimization techniques to solve models related to nonlinear programming

**C04: Understand** the constrained optimization techniques to solve models related to nonlinear programming

**C05: Apply** the decision making abilities in optimizing the dynamic programming models

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Apply	the knowledge of vector design for optimizing the problems involved with single and multiple variables		in industry	L3
C02	Apply	the mathematical procedure for solving the LPP and transportation models		in logistic related fields	L3
C03	Understand	the unconstrained optimization techniques to solve models related to nonlinear programming		in industry	L2
C04	Understand	the constrained optimization techniques to solve models related to nonlinear programming		in industries	L2
C05	Apply	the decision making abilities in optimizing the dynamic programming models		in industrial management	L3

<b>UNIT - I</b>	
<p>Introduction and Classical Optimization Techniques: Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems.</p> <p>Classical Optimization Techniques: Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – Multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.</p>	
<b>UNIT - II</b>	
<p>Linear Programming: Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.</p> <p>Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems.</p>	
<b>UNIT - III</b>	

Unconstrained Nonlinear Programming: One dimensional minimization method, Classification, Fibonacci method and Quadratic interpolation method Unconstrained Optimization Techniques: Univariant method, Powell's method and steepest descent method.		
<b>UNIT - IV</b>		
Constrained Nonlinear Programming: Characteristics of a constrained problem - classification - Basic approach of Penalty Function method - Basic approach of Penalty Function method - Basic approaches of Interior and Exterior penalty function methods - Introduction to convex programming problem.		
<b>UNIT - V</b>		
Dynamic Programming: Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.		
<b>Textbooks:</b>		
1. Singiresu S. Rao, Engineering Optimization: Theory and Practice by John Wiley and Sons, 4th edition, 2009. 2. H. S. Kasene & K. D. Kumar, Introductory Operations Research, Springer (India), Pvt. Ltd., 2004		
<b>Reference Books:</b>		
1. George Bernard Dantzig, Mukund Narain Thapa, "Linear programming", Springer series in operations research 3rd edition, 2003. 2. H.A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson/Prentice Hall, 2007. 3. Kalyanmoy Deb, "Optimization for Engineering Design – Algorithms and Examples", PHI Learning Pvt. Ltd, New Delhi, 2005.		
<b>Online Learning Resources:</b>		
<a href="https://www.youtube.com/watch?v=gw_ZEUjI9KM&amp;list=PLYihddLF-CgZGDFVwB1v699kvl4FMeAr-">https://www.youtube.com/watch?v=gw_ZEUjI9KM&amp;list=PLYihddLF-CgZGDFVwB1v699kvl4FMeAr-</a>		

### Co po Mapping

Course Title	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
	CO1	3		3s									2	2
	CO2	3		3		3							2	2
	CO3	2		2		2							2	2
	CO4	2	2										3	2
	CO5	3	3			3							2	2

### Correlation matrix

CO	CO		Program Outcomes (PO)	PO(s): Action Verb and BTL (for P01 to P05)	Level of Correlation
	Verb	BTL			
1	CO1: Apply	L3	PO1 PO3 PSO1 PSO2	Apply (L3) Develop (L3) TR TR	3 3 2 2
2	CO2: Apply	L3	PO1 PO3 PO5 PSO1 PSO2	Apply (L3) Develop (L3) Apply (L3) TR TR	3 3 3 2 2
3	CO3: Understand	L2	PO1 PO3 PO5 PSO1 PSO2	Apply (L3) Develop (L3) Apply (L3) TR TR	2 2 2 2 2

4	<b>C04: Understand</b>	L2	PO1 PO2 PSO1 PSO2	Apply (L3) Identify (L3) TR TR	2 2 3 2
5	<b>C05: Apply</b>	L3	PO1 PO2 PO5 PSO1 PSO2	Apply (L3) Identify (L3) Apply (L3) TR TR	3 3 3 2 2

#### Justification Statements:

**C01: Apply** the knowledge of vector design for optimizing the problems involved with single and multiple variables

**Action Verb: Apply (L3)**

PO1 Verb: **Apply (L3)**

C01 Action verb is same level as PO1 verb. Therefore, the correlation is high (3).

PO3 Verb: **Develop (L3)**

C01: Action verb is same level as PO3 verb. Therefore, the correlation is high (3).

**C02: Apply** the mathematical procedure for solving the LPP and transportation models.

**Action Verb: Apply (L3)**

PO1 Verb: **Apply (L3)**

C02: Action verb is same level as PO1 verb. Therefore, the correlation is high (3).

PO3 Verb: **Develop (L3)**

C02: Action verb is same level as PO3 verb. Therefore, the correlation is high (3).

PO5 Verb: **Apply (L3)**

C02: Action verb is same level as PO5 verb. Therefore, the correlation is high (3).

**C03: Understand** the unconstrained optimization techniques to solve models related to nonlinear programming .

**Action Verb: Understand (L2)**

PO1 Verb: **Apply (L3)**

C02: Action verb is lower level as PO1 verb. Therefore, the correlation is low (2).

PO3 Verb: **Develop (L3)**

C02: Action verb is lower level as PO3 verb. Therefore, the correlation is low (2).

PO5 Verb: **Apply (L3)**

C02: Action verb is lower level as PO5 verb. Therefore, the correlation is low (2).

**C04: Understand** the constrained optimization techniques to solve models related to nonlinear programming .

**Action Verb: Understand (L2)**

PO1 Verb: **Apply (L3)**

C01 Action verb is lower level as PO1 verb. Therefore, the correlation is low (2).

PO2 Verb: **Identify (L3)**

C01: Action verb is lower level as PO2 verb. Therefore, the correlation is low (2).

**C05: Apply** the decision making abilities in optimizing the dynamic programming models.

**Action Verb: Apply (L3)**

PO1 Verb: **Apply (L3)**

C01 Action verb is same level as PO1 verb. Therefore, the correlation is high (3).

PO2 Verb: **Identify (L3)**

C01: Action verb is same level as PO2 verb. Therefore, the correlation is high (3).

PO5 Verb: **Apply (L3)**

C05: Action verb is same level as PO5 verb. Therefore, the correlation is high (3).





**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: III**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	Internet of Things	L	T/CLC	P	C
20AES0505	III-I		4	2	0	3

**Course Outcomes:**

CO1: **Understand** the vision of IoT from the Global Context.

CO2: **Understand** the concept of Market perspective in M2M and IoT

CO3: **Understand** the M2M and IoT Technology Fundamentals.

CO4: **Analyze** the Architecture of IoT in ETSI, IETF, ITU-T

CO5: **Apply** the Real world design Constraints and Industrial Automation

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	Vision of IoT from the Global Context			L2
CO2	Understand	the concept of Market Perspective in M2M & IoT			L2
CO3	Understand	M2M and IoT Technology Fundamentals			L2
CO4	Analyze	Architecture in IoT	Networks		L4
CO5	Apply	Identify Real World Design Constraints and Industrial Automation			L3

<b>UNIT – I</b>		9 Hrs
M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics.		
<b>UNIT – II</b>		9 Hrs
M2M to IoT - A Market Perspective- Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview- Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.		
<b>UNIT – III</b>		9 Hrs
M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management		
<b>UNIT – IV</b>		9 Hrs
IoT Architecture-State of the Art - Introduction, State of the art.		
<b>UNIT – V</b>	<b>ZigBee</b>	9 Hrs
IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints hardware is popular again, Data representation and visualization, Interaction and remote control. Industrial Automation- Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things		

<b>Textbooks:</b>
1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatias Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1 st Edition, Academic Press, 2014. (ISBN-13:978-0124076846)
<b>Reference Books:</b>
1. Vijay Madiseti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014. (ISBN-13: 978-8173719547)
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013. (ISBN-13: 978- 1430257400).

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>		3											
<b>CO2</b>		3											
<b>CO3</b>	3	3		3									
<b>CO4</b>	2												
<b>CO5</b>	3	2											

**CO1:** Understand the vision of IoT from the Global Context.

**Action Verb: Understand (L2)**

PO2 Verbs: Review (L2)

CO1 Action Verb is equal to PO2 verb; Therefore, correlation is high (3).

**CO2:** Understand the concept of Market perspective in M2M and IoT

**Action Verb: Understand (L2)**

PO1 Verbs: Identify (L2)

CO2 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

**CO3:** Understand M2M and IoT Technology Fundamentals.

**Action Verb: Understand (L2)**

PO1 Verbs: Apply (L2)

CO3 Action Verb is equal to PO1 verb; Therefore correlation is high (3).

PO2 Verb: Identify (L2)

CO3 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).

**CO4:** Analyze the Architecture of IoT in ETSI, IETF, ITU-T.

**Action Verb: Analyze (L4)**

PO1 Verbs: Apply (L3)

CO4 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).

PO4 Verbs: Analyze (L3)

CO4 action verb is equal to PO4 verb. Therefore correlation is high(3)

**CO5:** Apply Real world design Constraints and Industrial Automation.

**Action Verb: Apply (L3)**

PO1 Verb: Apply (L3)

CO5 Action verb is equal to PO1 verb; therefore the correlation is high (3).

PO2 Verb: Identify (L2)

CO5 Action Verb is greater than PO2 verb; Therefore correlation is high (3).



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: III**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	Design And Analysis Of Algorithms	L	T/CLC	P	C
20APE3001	III-I		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

C01: **Apply** the Divide and conquer method to solve various problems.

C02: **Apply** the greedy and dynamic programming methods to solve real time problems.

C03: **Evaluate** the various problems using traversal, backtracking and searching techniques.

C04: **Apply** the branch and bound methods to solve minimization problems.

C05: **Analyze** the P, NP, NP hard and NP complete problems for solving reduction problems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Apply	The Divide and conquer method		to solve various problems	L3
C02	Apply	The greedy and dynamic programming methods		to solve real time problems.	L3
C03	Evaluate	The various problems	Using traversal, backtracking and searching techniques.		L5
C04	Apply	The branch and bound methods		to solve minimization problems	L3
C05	Analyze	The P, NP, NP hard , NP complete problems		for solving reduction problems	L4

<b>UNIT - I</b>		9Hrs
<b>Introduction:</b> What is an Algorithm, Algorithm specification, Performance analysis. <b>Divide and Conquer:</b> General method, Binary Search, Finding the maximum and minimum, Merge sort, Quick Sort, Selection sort, Stresen's matrix multiplication.		
<b>UNIT - II</b>		9 Hrs
<b>Greedy Method:</b> General method, Knapsack problem, Job Scheduling with Deadlines, Minimum cost Spanning Trees, Optimal storage on tapes, Single-source shortest paths. <b>Dynamic programming:</b> General Method, Multistage graphs, All-pairs shortest paths, Optimal binary search trees, 0/1 knapsack, The traveling sales person problem.		
<b>UNIT - III</b>		9 Hrs
<b>Basic Traversal and Search Techniques:</b> Techniques for binary trees, Techniques for Graphs, Connected components and Spanning trees, Bi-connected components and DFS <b>Back tracking:</b> General Method, 8 – queens problem, Sum of subsets problem, Graph coloring and Hamiltonian cycles, Knapsack Problem.		
<b>UNIT - IV</b>		8 Hrs
<b>Branch and Bound:</b> The method, Travelling salesperson, 0/1 Knapsack problem, Efficiency Considerations. <b>Lower Bound Theory:</b> Comparison trees, Lower bounds through reductions – Multiplying triangular matrices, inverting a lower triangular matrix, computing the transitive closure.		
<b>UNIT - V</b>		10Hrs
<b>NP – Hard and NP – Complete Problems:</b> NP Hardness, NP Completeness, Consequences of being in P, Cook's Theorem, Reduction Source Problems, Reductions: Reductions for some known problems		
<b>Textbooks:</b>		
1. "Fundamentals of Computer Algorithms", Ellis Horowitz, S. Satraj Sahani and Rajasekhran, 2nd edition, University Press.2014,		

2. "Design and Analysis of Algorithms", Parag Himanshu Dave, Himanshu Bhalchandra Dave, Pearson Education, Second Edition, 2009.
<b>Reference Books:</b>
1. "Introduction to Algorithms", second edition, T.H.Cormen, C.E.Leiserson, R.L.Rivest and C.Stein, PHI Pvt. Ltd./ Pearson Education.
2. "Introduction to Design and Analysis of Algorithms A strategic approach", R.C.T.Lee, S.S.Tseng, R.C.Chang and T.Tsai, Mc Graw Hill.
3. "Design and Analysis of algorithms", Aho, Ullman and Hopcroft, Pearson education.
<b>Online Learning Resources:</b>
nptel videos

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3									2	3	
CO2	3	3				2					2	2	
CO3	3	3	3	3	3	2					2	2	
CO4	3	3									2	2	
CO5	3	3	3	3	3						2	2	

Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	17	23%	3	CO1: Apply	L3	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	3 3 2
2	16	22%	3	CO2: Apply	L3	PO1 PO2 PO6 PO11	PO1: Apply(L3) PO2: Review(L2) PO6: Thumb rule PO11: Thumb rule	3 3 2 2
3	16	22%	3	CO3: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO6 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO6: Thumb rule PO11: Thumb rule	3 3 3 3 3 2 2
4	13	18%	2	CO4: Apply	L3	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	3 3 2
5	12	15%	2	CO5: Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb rule	3 3 3 3 3 2
	74	100 %						

Justification Statements :

**CO1: Apply** the Divide and conquer method to solve various problems.

**Action Verb : Apply (L3)**

**PO1 Verb : Apply(L3)**

C01 Action verb is same level of P01 verb by one level. Therefore, the correlation is High (3)

**P02 Verb : Review(L2)**

C01 Action verb is greater than P02 verb. Therefore the correlation is high(3)

**P011: Thumb rule**

Divide and conquer strategy is applied to solve various problems, where the work is distributed to many members to complete that task. Therefore the correlation is medium (2)

**C02: Apply** the greedy and dynamic programming methods to solve real time problems.

**Action Verb : Apply (L3)**

**P01: Apply(L3)**

C02 Action verb is same level as P01 verb. Therefore, the correlation is high (3)

**P02: Review(L2)**

C02 Action verb is greater than P02 verb. Therefore, the correlation is high(3)

**P06: Thumb rule**

Greedy and dynamic programming concepts were applied to solve traffic problems and finding best route to the destination. Therefore, the correlation is medium (2)

**P011: Thumb rule**

Finding optimal solution to a real world problems is a continuous activity. Therefore the correlation is medium (2)

**C03: Evaluate** the various problems using traversal, backtracking and searching techniques.

**Action Verb : Evaluate (L5)**

**P01: Apply(L3)**

C03 Action verb is greater level of P01 verb. Therefore, the correlation is High (3)

**P02: Review (L2)**

C03 Action verb is greater level as P02 verb. Therefore, the correlation is high (3)

**P03: Develop (L3)**

C03 Action verb is greater than P03 verb. Therefore the correlation is high(3)

**P04: Analyze (L4)**

C03 Action verb is greater than P04 verb. Therefore the correlation is high(3)

**P05: Apply(L3)**

C03 Action verb is greater than P05 verb. Therefore the correlation is high(3)

**P06 : Thumb rule**

backtracking and searching techniques were applied for GPS. Therefore, the correlation is medium (2)

**P011: Thumb rule**

backtracking and searching techniques will give optimal solutions to various problems. Therefore, the correlation is medium (2)

**C04: Apply** the branch and bound methods to solve minimization problems.

**Action Verb : Apply (L3)**

**P01: Apply(L3)**

C04 Action verb is same level of P01 verb. Therefore the correlation is high (3)

**P02: Review(L2)**

C04 Action verb is greater than P02 verb. Therefore the correlation is high(3)

**P011: Thumb rule**

Lower bound techniques were applied to minimize cost of finding best routes. Therefore the correlation is medium(2)

**C05: Analyze** the P, NP, NP hard and NP complete problems for solving reduction problems.

**Action Verb : Analyze (L4)**

**P01: Apply(L3)**

C05 Action verb is greater than P01 verb. Therefore the correlation is high(3)

**P02: Review (L2)**

C05 Action verb is greater than P02 verb. Therefore the correlation is high (3)

**P03: Develop (L3)**

C05 Action verb is greater than P03 verb. Therefore the correlation is high(3)

**P04: Analyze (L4)**

C05 Action verb is same as P04 verb. Therefore the correlation is high(3)

**P05: Apply(L3)**

C05 Action verb is greater than P05 verb. Therefore the correlation is high (3)

**P011: Thumb rule**

In research oriented purpose P, NP concepts can be applied. Therefore the correlation is medium (2)

ATSTPT-AIDS



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
Artificial Intelligence and Data Science (AI&DS)**

Course Code	Year & Sem	COMPUTER GRAPHICS	L	T/CLC	P	C
20APE3002	III-I		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

**C01: Understand** the over view of Computer Graphics System.

**C02: Evaluate** various algorithms based on output primitives.

**C03: Apply** Two-dimensional Geometric Transformations for designing clipping of lines and polygons.

**C04: Analyze** three dimensional graphics and viewing models.

**C05: Apply** the removal of hidden surfaces in computer animation.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	the over view of Computer Graphics System			L2
C02	Evaluate	various algorithms	based on output primitives		L5
C03	Apply	Two-dimensional Geometric Transformations		for designing clipping of lines and Polygons.	L3
C04	Analyze	three dimensional graphics and viewing models			L4
C05	Apply	the removal of hidden surfaces		in computer animation	L3

UNIT - I	OVERVIEW OF COMPUTER GRAPHICS SYSTEM	9 Hrs
OverView of Computer Graphics System – Video display devices – Raster Scan and random scan system – Input devices – Hard copy devices.		
UNIT - II	OUTPUT PRIMITIVES AND ATTRIBUTES	9Hrs
Drawing line, circle and ellipse generating algorithms – Scan line algorithm – CharacterGeneration – attributes of lines, curves and characters – Antialiasing.		
UNIT - III	TWO DIMENSIONAL GRAPHICS TRANSFORMATIONS AND VIEWING	9 Hrs
Two-dimensional Geometric Transformations – Windowing and Clipping – Clipping of lines and clipping of polygons.		
UNIT - IV	THREE DIMENSIONAL GRAPHICS AND VIEWING	9 Hrs
Three-dimensional concepts – Object representations- Polygon table, Quadric surfaces, Splines, Bezier curves and surfaces – Geometric and Modelling transformations – Viewing - Parallel and perspective projections.		
UNIT - V	REMOVAL OF HIDDEN SURFACES	9 Hrs
Visible Surface Detection Methods – Computer Animation.		
Textbooks:		

Hearn, D. and Pauline Baker, M., Computer Graphics (C-Version), 2nd Edition, Pearson Education, 2002.

#### Reference Books:

1. Neuman, W.M., and Sproull, R.F., Principles of Interactive Computer Graphics, Mc Graw Hill Book Co., 1979.
2. Roger, D.F., Procedural elements for Computer Graphics, Mc Graw Hill Book Co., 1985.
3. Asthana, R.G.S and Sinha, N.K., Computer Graphics, New Age Int. Pub. (P) Ltd., 1996.
4. Floey, J.D., Van Dam, A, Feiner, S.K. and Hughes, J.F, Computer Graphics, Pearson Education, 2001.

#### Online Learning Resources:

<https://www.youtube.com/watch?v=fwzYuhduME4&list=PL338D19C40D6D1732>

#### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3									2	3	
CO2	3	3				2					2	2	
CO3	3	3	3	3	3	2					2	2	
CO4	3	3									2	2	
CO5	3	3	3	3	3						2	2	

#### Correlation matrix

Unit No.	CO		Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Co's Action verb	BTL			
1	CO1: Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	2 3 2
2	CO2: Evaluate	L5	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	3 3 2
3	CO3: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb rule	3 3 3 3 3 2
4	CO4: Analyze	L4	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	3 3 2
5	CO5: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb rule	3 3 3 2 3 2

#### Justification Statements :

**CO1: Understand** the over view of Computer Graphics System.

**Action Verb : Understand (L2)**

**PO1 Verb : Apply(L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is Medium (2)

**PO2 Verb : Review(L2)**



C01 Action verb is same level as PO2 verb. Therefore the correlation is high(3)

**P011: Thumb rule**

Computer Graphics Systems implementation is needed in current scenario. Therefore the correlation is medium (2)

**C02: Evaluate** various algorithms based on output primitives.

**Action Verb : Evaluate (L5)**

**P01: Apply(L3)**

C02 Action verb is greater than PO1 verb. Therefore, the correlation is high (3)

**P02: Review(L2)**

C02 Action verb is greater than PO2 verb. Therefore, the correlation is high(3)

**P011: Thumb rule**

Development of algorithms using output primitives is a continuous activity. Therefore the correlation is high(3)

**C03: Apply** Two-dimensional Geometric Transformations for designing clipping of lines and polygons.

**Action Verb : Apply (L3)**

**P01: Apply(L3)**

C03 Action verb is same level as PO1 verb. Therefore, the correlation is High (3)

**P02: Review (L2)**

C03 Action verb is greater level as PO2 verb. Therefore, the correlation is high (3)

**P03: Develop (L3)**

C03 Action verb is same level as PO3 verb. Therefore the correlation is high(3)

**P04: Analyze (L4)**

C03 Action verb is greater than PO4 verb. Therefore the correlation is high(3)

**P05: Apply(L3)**

C03 Action verb is greater than PO5 verb. Therefore the correlation is high(3)

**P011: Thumb rule**

Two-dimensional Geometric Transformation is regular activity for graphics enhancements. Therefore, the correlation is medium (2)

**C04: Analyze** three dimensional graphics and viewing models.

**Action Verb : Analyze (L4)**

**P01: Apply(L3)**

C04 Action verb is greater than PO1 verb. Therefore the correlation is high (3)

**P02: Review(L2)**

C04 Action verb is greater than PO2 verb. Therefore the correlation is high(3)

**P011: Thumb rule**

Three dimensional graphics and viewing models are widely using models. Therefore the correlation is medium(2)

**C05: Apply** the removal of hidden surfaces in computer animation.

**Action Verb : Apply (L3)**

**P01: Apply(L3)**

C05 Action verb is same as PO1 verb. Therefore the correlation is high(3)

**P02: Review (L2)**

C05 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

**P03: Develop (L3)**

C05 Action verb is greater than PO3 verb. Therefore the correlation is high(3)

**P04: Analyze (L4)**

C05 Action verb is less than PO4 verb by one level. Therefore the correlation is Medium(2)

**P05: Apply(L3)**

C05 Action verb is greater than PO5 verb. Therefore the correlation is high (3)

**P011: Thumb rule**

Removal of hidden surfaces in computer animation is regular activity. Therefore the correlation is medium(2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: III**

**SEMESTER: I**

**Branch of study: AIDS**

Course Code	Year & Sem	ADHOC & SENSOR NETWORKS	L	T/CLC	P	C
20APE3003	III-I		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

C01: **Understand** the basics of IEEE 802.11 standard and Ad-hoc networks.

C02: **Analyze** the various design issues of MAC protocol for ADHOC networks

C03: **Apply** the different routing protocol for ADHOC networks

C04: **Evaluate** the various multi-cast routing approaches for ADHOC networks

C05: **Analyze** the various security concepts in ADHOC Wireless network

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	the basics of IEEE 802.11 standard and Ad-hoc networks			L2
C02	Analyze	the various design issues of MAC protocol		for ADHOC networks	L4
C03	Apply	the different routing protocol		for ADHOC networks	L3
C04	Evaluate	the various multi-cast routing approaches		for ADHOC networks	L5
C05	Analyze	the various security concepts in ADHOC Wireless network			L4

<b>UNIT – I</b>	<b>IEEE 802 Networking Standard</b>	9 Hrs
IEEE 802 Networking Standard. Fundamentals of WLANs, IEEE 802.11 standard. What is Wireless Internet?, Mobile IP, Cellular and Adhoc Wireless Networks, Applications of Adhoc Networks, Issues in Ad Hoc Wireless Networks, Ad Hoc Wireless Internet.		
<b>UNIT – II</b>	<b>Issues in Designing a MAC Protocol for Ad Hoc</b>	10 Hrs
Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks, Design Goals of a MAC Protocol for Ad Hoc Wireless Networks, Classification of MAC Protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that used Directional Antennas, Other MAC Protocols.		
<b>UNIT – III</b>	<b>Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks</b>	8 Hrs
Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table-Driven Routing Protocols, On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols, Power-Aware Routing Protocols		
<b>UNIT – IV</b>	<b>Multicast Routing in Ad hoc Wireless Networks</b>	8 Hrs
Multicast Routing in Ad hoc Wireless Networks- Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An architecture reference model for multicast routing protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols, Mesh-Based Multicast Routing Protocols, Summary of Tree and Mesh-Based Protocols. Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions. TCP over Ad Hoc Wireless Networks, Other Transport Layer Protocols for Ad Hoc Wireless Networks.		
<b>UNIT – V</b>	<b>Security in Ad Hoc Wireless Networks</b>	10 Hrs
Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks. Wireless Sensor Networks- Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a		

Sensor Network, Evolving Standards, Other issues.
<b>Textbooks:</b>
Murthy, C. Siva Ram, and B. S. Manoj. Ad hoc wireless networks: Architectures and protocols. Pearson Education India, 2004.
<b>Reference Books:</b>
1. Carlos De Moraes Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2006.
2. Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication -2002.
3. Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2005

**Mapping of course outcomes with program outcomes**

CO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02
C01	2	3		3									
C02	3	3	3	3	3	3							
C03	3	3	3	2	3								
C04	1	1		3									
C05		3	3	3	3		3				3		

**Correlation matrix**

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for P01 to P011)	Level of Correlation (0-3)
1	C01:Understand	L2	P01 P02 P04	P01: Apply(L3) P02: Review(L2) P04: Interpret(L2)	2 3 3
2	C02 : Analyze	L4	P01 P02 P03 P04 P05 P06	P01: Apply(L3) P02: Review(L2) P03: Develop(L3) P04: Analyze(L4) P05: Apply(L3) P06: Thumb rule	3 3 3 3 3 3
3	C03 : Apply	L3	P01 P02 P03 P04 P05	P01: Apply(L3) P02: Review(L2) P03: Develop(L3) P04: Analyze(L4) P05: Apply(L3)	3 3 3 2 3
4	C04 : Evaluate	L5	P01 P02 P04 P05	P01: Apply(L3) P02: Identify(L3) P04: Interpret(L5) P05: Apply(L3)	1 1 3 1
5	C05 :Analyze	L4	P02 P03 P04 P05 P08 P011	P02: Review(L2) P03: Develop(L3) P04: Analyze(L4) P05: Apply(L3) P08: Thumb rule P011: Thumb rule	3 3 3 3 3 3

**Justification Statements**

C01: **Understand** the basics of IEEE 802.11 standard and Ad-hoc networks.

Action Verb : Understand(L2)

P01 Verb : Apply(L3)

C01 Action verb is less than P01 verb by one level. Therefore the correlation is medium (2)

**P02 Verb : Review(L2)**

C01 Action verb is same as P02 verb. Therefore the correlation is high(3)

**P04: Interpret(L2)**

C01 Action verb is same as P04 verb. Therefore the correlation is high(3)

C02: **Analyze** the various design issues of MAC protocol for ADHOC networks

**Action Verb : Analyze (L4)**

**P01: Apply(L3)**

C02 Action verb is greater than P01 verb .Therefore the correlation is high (3)

**P02: Review(L2)**

C02 Action verb is greater than P02 verb. Therefore the correlation is high (3)

**P03: Develop(L3)**

C02 Action verb is greater than P03 verb. Therefore the correlation is high (3)

**P04: Analyze (L4)**

C02 Action verb is same as P04 verb. Therefore the correlation is high(3)

**P05: Apply(L3)**

C02 Action verb is greater than P05 verb .Therefore the correlation is high (3)

**P06: Thumb rule**

For designing protocols for various design issues we need to take safety rules. Therefore, the correlation is high(3)

C03: **Apply** the different routing protocol for ADHOC networks

**Action Verb : Apply(L3)**

**P01: Apply(L3)**

C03 Action verb is same as P01 verb. Therefore the correlation is high (3)

**P02: Review(L2)**

C03 Action verb is greater than P02 verb. Therefore the correlation is high (3)

**P03: Develop(L3)**

C03 Action verb is same as P03 verb. Therefore the correlation is high (3)

**P04: Analyze (L4)**

C03 Action verb is less than P04 verb by one level. Therefore the correlation is medium(2)

**P05: Apply(L3)**

C03 Action verb is same as P05 verb. Therefore the correlation is high (3)

C04: **Evaluate** the various multi-cast routing approaches for ADHOC networks

**Action Verb : Evaluate(L5)**

**P01: Apply(L3)**

C04 Action verb is two levels lower than P01 verb. Therefore the correlation is low(1)

**P02: Identify(L3)**

C04 Action verb is two levels lower than P02 verb. Therefore the correlation is low(1)

**P05: Interpret(L5)**

C03 Action verb is one level lower than P05 verb. Therefore the correlation is low(1)

C05: **Analyze** the various security concepts in ADHOC Wireless network

**Action Verb : Analyze (L4)**

**P02: Review(L2)**

C05 Action verb is greater than P02 verb. Therefore the correlation is high (3)

**P03: Develop(L3)**

C05 Action verb is greater than P03 verb. Therefore the correlation is high (3)

**P04: Analyze (L4)**

C05 Action verb is same as P04 verb. Therefore the correlation is high(3)

**P05: Apply(L3)**

C05 Action verb is greater than P05 verb. Therefore the correlation is high (3)

**P08 : Thumb rule**

Since ethical principles should be followed to analyze the security breaches. Therefore the correlation is high(3)

**P011 : Thumb rule**

For some of Security applications, Various security issues need to be learned continuously. Therefore the correlation is high(3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: III**

**Semester: I**

**Branch of study: AIDS**

Course Code	Year & Sem	ARTIFICIAL INTELLIGENCE LAB	L	T/CLC	P	C
20APC3018	III-I		0	0	3	1.5

**Course Outcomes:**

After studying the course, student will be able to

**CO 1: Apply** the Searching Algorithm for finding shortest path.

**CO 2: Analyze** the informed and un-informed search for puzzle solving.

**CO 3: Apply** the Back tracking Algorithm to the N Queen problem.

**CO 4: Analyze** the AI algorithms to implement simple Chatbot.

**CO 5: Apply** the NLTK to implement Lemmatization and POS.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Apply	the Searching Algorithm		for finding shortest path	L3
CO2	Analyze	the informed and un-informed search		for puzzle solving.	L4
CO3	Apply	the Back tracking Algorithm		to the N Queen problem	L3
CO4	Analyze	the AI algorithms		to implement simple Chatbot	L4
CO5	Apply	the NLTK		to implement Lemmatization and POS	L3

**List of Experiments**

1. Write a Program to Implement BFS and DFS. **(CO1)**
2. Write a Program to find the solution for travelling sales person problem. **(CO1)**
3. Write a program to implement simulated annealing Algorithm. **(CO1)**
4. Write a Program to Implement Tic-Tac-Toe game. **(CO2)**
5. Write a Program to Implement 8-Puzzle problem. **(CO2)**
6. Write a program to implement Towers of Hanoi problem. **(CO2)**
7. Write a program to implement A\* Algorithm. **(CO2)**
8. Write a Program to Implement Water-Jug problem. **(CO2)**
9. Write a program to implement Hangman game. **(CO2)**
10. Write a program to solve N Queen problem using backtracking. **(CO3)**
11. Generate Calendar for the given month and year using a python program. **(CO4)**
12. Write a program to implement simple Chatbot. **(CO4)**
13. Write a program to remove stop words for a given passage from a text file using NLTK. **(CO5)**
14. Write a program to implement stemming for a given sentence using NLTK. **(CO5)**
15. Write a program to POS (Parts of Speech) tagging for the give sentence using NLTK. **(CO5)**
16. Write a program to implement Lemmatization using NLTK. **(CO5)**

**Reference Books:**

1. Tensorflow: <https://www.tensorflow.org/>
2. Pytorch: <https://pytorch.org/>,
3. <https://github.com/pytorch>
4. Theano: <http://deeplearning.net/software/theano/> <https://github.com/Theano/Theano>
5. <https://www.nltk.org/>

### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	3	3									3		3
C02	3	3		3	3						3		3
C03	3		3	3	3						3	2	3
C04	3	3	3	3							3		3
C05	3	3	3	3	3							3	3

### Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	C01: Apply	L3	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	3 3
2	C02: Analyze	L4	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze (L4) PO5: Apply (L3)	3 3 3 3
3	C03: Apply	L3	PO1 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3) PO11: Thumb rule	3 3 2 3 3
4	C04: Analyze	L4	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4) PO11: Thumb rule	3 3 3 3 3
5	C05: Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3)	3 3 3 2 3

### Justification Statements:

**CO 1: Apply** the Searching Algorithm for finding shortest path.

**Action Verb: Understand (L2)**

**P01 Verb: Apply (L3)**

C01 Action verb is Same P01 verb. Therefore, the correlation is high(3)

**P02 Verb: Review(L2)**

C01 Action verb is same as P02 verb. Therefore, the correlation is high (3)

**CO 2: Analyze** the informed and un-informed search for puzzle solving.

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

C02 Action verb is greater than as P01 verb. Therefore, the correlation is high (3)

**P02: identify(L3)**

C02 Action verb is greater than as P02 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

C02 Action verb is same as P04 verb. Therefore, the correlation is high (3)

**P05: Apply (L3)**

C02 Action verb is greater than as P05 verb. Therefore, the correlation is high (3)

**CO 3: Apply** the Back tracking Algorithm to the N Queen problem.

**Action Verb: Apply (L3)**

**P01: Apply (L3)**

C03 Action verb is greater than as P01 verb. Therefore, the correlation is high (3)

**P03: Develop (L3)**

C03 Action verb is same as P03 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

C03 Action verb is Less than as P04 verb by one level. Therefore, the correlation is high (2)

**P05: Apply (L3)**

C03 Action verb is same as P05 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

Chatbot construction is a continues learning process for the users to communicate AI the correlation is high (3)

**CO 4: Analyze** the AI algorithms to implement simple Chatbot.

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

C04 Action verb is greater than as P01 verb. Therefore, the correlation is high (3)

**P02: idetify(L3)**

C04 Action verb is greater than as P02 verb. Therefore, the correlation is high (3)

**P03: Develop (L3)**

C04 Action verb is greater than as P03 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

C04 Action verb is same as P04 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

NLTK is continuous learning process for programmers to implement so the correlation is high (3)

**CO 5: Apply** the NLTK to implement Lemmatization and POS.

**Action Verb: Apply (L3)**

**P01: Apply (L3)**

C05 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P02: idetify(L3)**

C05 Action verb is same as P02 verb. Therefore, the correlation is high (3)

**P03: Develop (L3)**

C05 Action verb is same as P03 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

C05 Action verb is less than P04 verb by one level. Therefore, the correlation is medium (2)

**P05: Apply (L3)**

C05 Action verb is same as P05 verb. Therefore, the correlation is high (3)





**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
Artificial Intelligence and Data Science (AI&DS)**

**Year: III**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	Principles of Data Science Lab	L	T/CLC	P	C
20APC3016	III-I		0	0	3	1.5

**CO 1: Apply** the basic concepts of R Programming to implementation.

**CO 2: Analyze** the concepts of R script for extracting data from data frames and performing file operations.

**CO 3: Analyze** the different statistical techniques by using R.

**CO 4: Apply** the Add-on packages to extend the functionality of R.

**CO 5: Apply** the R graphics and tables to visualize the results of various statistical operations

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Apply	the basic concepts of R Programming		to implementation	L3
CO2	Analyze	the concepts of R script for extracting data		from data frames and performing file operations.	L4
CO3	Analyze	the different statistical techniques	by using R.		L4
CO4	Apply	the Add-on packages		to extend the functionality of R.	L3
CO5	Apply	the R graphics and tables		to visualize the results of various statistical operations on data.	L3

### List of Tasks

#### **1. INTRODUCTION TO COMPUTING (CO1)**

- Installation of R
- The basics of R syntax, workspace
- Matrices and lists
- Subsetting
- System-defined functions; the help system
- Errors and warnings; coherence of the workspace

#### **2. GETTING USED TO R: DESCRIBING DATA(CO1)**

- Viewing and Manipulating Data
- Plotting Data
- Reading the Data from console, file (.csv) local disk and Web
- Working with larger datasets

#### **3. VISUALIZING DATA (CO1)**

- Tables, charts and plots.
- Visualizing Measures of Central Tendency, Variation, and Shape.
- Box plots, Pareto diagrams.
- Find the mean, media, standard deviation and quantiles of a set of observations. Note: Experiment with real as well as artificial data sets.

#### **4. BINOMIAL DISTRIBUTION (CO2)**

- Study of binomial distribution.
- Plots of density and distribution functions.
- Normal approximation to the Binomial distribution.



### Correlation Matrix

Unit No.	CO		Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Co's Action verb	BTL			
1	CO1: Apply	L3	PO1 PO2 PO3 PO5 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop(L3) PO5: Apply (L3) PO11: Thumb rule	3 2 3 3 2
2	CO2: Analyze	L4	PO1 PO2 PO3 PO5	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO5: Apply (L3)	3 3 3 3
3	CO3: Analyze	L4	PO1 PO2 PO3 PO5	PO1: Apply(L3) PO2: Formulate (L6) PO3: Design(L6) PO5: Create (L6)	3 1 1 1
4	CO4: Apply	L3	PO1 PO2 PO3 PO5 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop(L3) PO5: Apply (L3) PO11: Thumb rule	3 2 3 3 2
5	CO5: Apply	L3	PO1 PO2	PO1: Apply (L3) PO2: Review (L2)	3 3

### Justification Statements:

**CO 1: Apply** the basic concepts of R Programming to implementation.

**Action Verb: Apply (L3)**

**PO1: Apply (L3)**

CO3 Action verb is same as PO1 verb. Therefore, the correlation is high (3)

**PO2: Analyze (L4)**

CO3 Action verb is less than as PO2 verb. Therefore, the correlation is moderate (2)

**PO3: Develop (L3)**

CO3 Action verb is same as PO3 verb. Therefore, the correlation is high (3)

**PO5: Apply (L3)**

CO3 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

**PO11: Thumb rule**

Different techniques are used to generate solution for error correction the correlation is moderate (2)

**CO 2: Analyze** the concepts of R script for extracting data from data frames and performing file operations.

**Action Verb: Analyze (L4)**

**PO1: Apply (L3)**

CO2 Action verb is more than PO1 verb. Therefore, the correlation is high (3)

**PO2: identify (L3)**

CO2 Action verb is more than PO2 verb. Therefore, the correlation is high (3)

**PO3: Develop (L3)**

CO2 Action verb is more than PO3 verb. Therefore, the correlation is high (3)

**PO5: Apply (L3)**

C02 Action verb is more than P05 verb. Therefore, the correlation is high (3)

**CO 3: Analyze** the different statistical techniques by using R.

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

C03 Action verb is more than P01 verb. Therefore, the correlation is high (3)

**P02: Formulate (L6)**

C03 Action verb is less than P02 verb by two levels. Therefore, the correlation is low (1)

**P03: Design (L6)**

C03 Action verb is less than P03 verb by two levels. Therefore, the correlation is low (1)

**P05: create (L6)**

C03 Action verb is less than P05 verb by two levels. Therefore, the correlation is low (1)

**CO 4: Apply** the Add-on packages to extend the functionality of R.

**Action Verb: Apply (L3)**

**P01: Apply (L3)**

C04 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P02: Analyze (L4)**

C04 Action verb is less than as P02 verb. Therefore, the correlation is moderate (2)

**P03: Develop (L3)**

C04 Action verb is same as P03 verb. Therefore, the correlation is high (3)

**P05: Apply (L3)**

C04 Action verb is same as P05 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

Congestion control techniques are used to solve congestion problems the correlation is moderate (2)

**CO 5: Apply** the R graphics and tables to visualize the results of various statistical operations

**Action Verb: Apply (L3)**

**P01 Verb: Apply (L3)**

C05 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P02 Verb: Review (L2)**

C05 Action verb is more than P02 verb. Therefore, the correlation is high (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: III**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	Conversational AI / AI Chatbot	L	T/CLC	P	C
20ASC3003	III-I		1	0	2	2

**Course Outcomes:**

**CO 1: Understand** the AI Applications, Chatbots in Different Message platforms.

**CO 2: Understand** the basics of bot building and design principles.

**CO 3: Apply** the chatbot methods for different training and testing assistance.

**CO 4: Analyze** the Chatbot and NLU classifier for voice assistants.

**CO 5: Create** the Chatbot for Deploying the different applications.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the AI Applications, Chatbots		in Different Message platforms	L2
CO2	Understand	the basics of bot building		design principles	L2
CO3	Apply	the chatbot methods		for different training and testing assistance.	L3
CO4	Analyze	the Chatbot and NLU classifier		for voice assistants	L5
CO5	Create	the Chatbot		for Deploying the different applications	L6

**UNIT - 1:**

Introduction to Chatbots, Setting Up the Developer Environment, What are chatbots? Journey of Chatbots, Rise of Chatbots, Messaging Platforms, Botframework, Local Installation

**UNIT - 2:**

Basics of Bot Building, Advanced Bot Building, Intents, Entities, Design principles, showing product results, saving messages, Building your own intent classifier

**UNIT - 3:**

Building Chatbots the easy way, Introduction to dialog flow, building a food ordering chatbot, deploying dialog flow chatbot on the web, Integrate dialog flow chatbot on Facebook messenger, Fulfilment

**UNIT - 4:**

Building Chatbots the hard way, What is Rasa NLU? Training and building a chatbot from scratch, Dialog management using Rasa core, writing custom actions of chatbot, Data preparing for training the bot, Testing the bot

**UNIT - 5:**

Deploying your chatbot, First steps, Rasa's credential management, Deploying the chatbot on Facebook, Deploying the chatbot on slack, Deploying the chatbot on your own

**Textbooks:**

1. Rashid Khan, Anik Das "Build Better Chatbots", Apress, 2018.
2. Sumit Raj "Building Chatbots with Python", Apress, 2019.

**Reference Books:**

1. Conversational AI: Chatbots that work By Andrew Freed, 2021

## Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	3	2	2							2	1
CO2	2	2	3	2	2							1	
CO3	3	3	3	2					2	2			
CO4	3	3	3	3						3		2	1
CO5	3	3	3	3	3				3	3	3	2	1

### Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify(L3) PO3: Select(L1) PO4: Analyze(L4) PO5: Apply(L3)	2 2 3 2 2
2	CO2: Understand	L2	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Design(L6) PO3: Select(L1) PO4: Analyze(L4) PO5: Apply(L3)	2 2 3 2 2
3	CO3: Apply	L3	PO1 PO2 PO3 PO4 PO8 PO9	PO1: Apply(L3) PO2: Identify(L3) PO3: Select(L1) PO4: Analyze(L4) PO8: Thumb Rule PO9: Thumb Rule	3 3 3 2 2 2
4	CO4: Analyze	L5	PO1 PO2 PO3 PO4 PO10	PO1: Apply(L3) PO2: Identify(L3) PO3: Select(L1) PO4: Apply(L3) PO10: Thumb Rule	3 3 3 3 3
5	CO5: Create	L6	PO1 PO2 PO3 PO4 PO5 PO10 PO11 PO11	PO1: Apply(L3) PO2: Identify(L3) PO3: Select(L1) PO4: Analyze(L4) PO5: Apply(L3) PO9: Thumb Rule PO10: Thumb Rule PO11: Thumb Rule	3 3 3 3 3 3 3 3

### Justification Statements:

**CO 1: Understand** the AI Applications, Chatbots in Different Message platforms.

**Action Verb: Understand (L2)**

**PO1 Verb: Apply (L3)**

CO1 Action verb is less than as PO1 verb. Therefore, the correlation is moderate (2)

**PO2: Identify(L3)**

CO1 Action verb is less than as PO2 verb. Therefore, the correlation is moderate (2)

**PO3: Select(L1)**

CO1 Action verb is more than as PO3 verb. Therefore, the correlation is high (3)

**PO4: Analyze(L4)**

CO1 Action verb is less than as PO4 verb. Therefore, the correlation is moderate (2)

**PO5: Apply(L3)**

CO1 Action verb is less than as PO4 verb. Therefore, the correlation is moderate (2)

**CO 2: Understand** the basics of bot building and design principles.

**Action Verb: Understand (L2)**

**PO1 Verb: Apply (L3)**

CO2 Action verb is lesser than as PO1 verb. Therefore, the correlation is moderate (2)

**P02: Identify(L3)**

C02 Action verb is lesser than as P02 verb. Therefore, the correlation is moderate (2)

**P03: Select(L1)**

C02 Action verb is greater than as P03 verb. Therefore, the correlation is high (3)

**P04: Analyze(L4)**

C02 Action verb is lesser than as P04 verb. Therefore, the correlation is moderate (2)

**P05: Apply(L3)**

C02 Action verb is lesser than as P05 verb. Therefore, the correlation is moderate (2)

**CO 3: Apply** the chatbot methods for different training and testing assistance.

**Action Verb: Apply(L3)**

**P01 Verb: Apply (L3)**

C03 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P02: Identify(L3)**

C03 Action verb is same as P02 verb. Therefore, the correlation is high (3)

**P03: Select(L1)**

C03 Action verb is more than as P03 verb. Therefore, the correlation is high (3)

**P04: Analyze(L4)**

C03 Action verb is less than as P04 verb by one level . Therefore, the correlation is moderate (2)

**P09: Thumbrule**

C03 Creating chatbot, therefore the correlation is moderate (2)

**P010: Thumbrule**

C03 Using chatbot to manage projects in multi-disciplinary environments as a member or leader in a team, therefore the correlation is moderate (2)

**CO 4: Analyze** the Chatbot and NLU classifier for voice assistants.

**Action Verb: Analyze(L5)**

**P01 Verb: Apply (L3)**

C04 Action verb is more than as P01 verb. Therefore, the correlation is high (3)

**P02: Identify(L3)**

C04 Action verb is more than as P02 verb. Therefore, the correlation is high (3)

**P03: Select(L1)**

C04 Action verb is more than as P03 verb. Therefore, the correlation is high (3)

**P04: Analyze(L4)**

C04 Action verb is more than as P04 verb. Therefore, the correlation is high(3)

**P010: Thumbrule**

C04 chatbot in multi-disciplinary environments as a member or leader in a team, therefore the correlation is high (3)

**CO 5: Create** the Chatbot for Deploying the different applications.

**Action Verb: Create(L6)**

**P01: Apply (L3)**

C05 Action verb is more than as P01 verb. Therefore, the correlation is high (3)

**P02: Identify(L3)**

C05 Action verb is more than as P02 verb. Therefore, the correlation is high (3)

**P03: Select(L1)**

C05 Action verb is more than as P03 verb. Therefore, the correlation is high (3)

**P04: Analyze(L4)**

C05 Action verb is more than as P04 verb. Therefore, the correlation is high (3)

**P05: Apply(L3)**

C05 Action verb is more than as P05 verb. Therefore, the correlation is high (3)

**P09: Thumbrule**

C05 Using dialog flow in Chatbots,therefore the correlation is high (3)

**P010: Thumbrule**

C05 Using Chatbot to manage projects in multi-disciplinary environments as a member or leader in a team, therefore the correlation is high (3)

**P011: Thumbrule**

C05 Using Chatbot, lifelong learning in the broadest context of technological change, therefore the correlation is (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
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**Artificial Intelligence and Data Science (AI &**

**DS)**

**Year: III**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	BIOLOGY FOR ENGINEERS	L	T/CLC	P	C
20AMC9901	III-I		3	0	0	0

**Course Outcomes:**

After studying the course, student will be able to

**CO1: Understand** the structure of cells and basics in living organisms

**CO2: Understand** the importance of various biomolecules and enzymes in living organisms

**CO3: Analyze** the functioning of physiology in respiratory system and digestive system.

**CO4: Understand** the DNA technology and gen cloning in living organisms.

**CO5: Apply** the biological principles in different technologies for the production of medicines and pharmaceuticals.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	the structure of cells and basics in living organisms			L2
2	Understand	the importance of various biomolecules and enzymes		in living organisms	L2
3	Analyze	the functioning of physiology		in respiratory system and digestive system	L4
4	Understand	the DNA technology and gen cloning		in living organisms	L2
5	Apply	the biological principles in different technologies	for the production of medicines and pharmaceuticals		L3

**Unit I: Introduction to Basic Biology**

**(10 hrs.)**

Evolution: Different patterns of evolution, Darwin's theory of evolution, Cell as Basic unit of life, cell theory, Cell shapes, Cell structure, Cell cycle. Chromosomes. Prokaryotic and eukaryotic Cell. Plant Cell, Animal Cell, Plant tissues and Animal tissues, Brief introduction to five kingdoms of classification, Tissue Engineering.

**Unit II: Introduction to Biomolecules**

**(10 hrs.)**

Carbohydrates, lipids, proteins, Vitamins and minerals, Nucleic acids (DNA and RNA) and their types. Enzymes, Enzyme application in Industry. Large scale production of enzymes by Fermentation.

**Unit III: Human Physiology**

**(09 hrs.)**

Digestive system, Respiratory system, (aerobic and anaerobic Respiration). Respiratory organs, respiratory cycle, Central Nerves System and Excretory system.

**Unit IV: Introduction to Molecular Biology and recombinant DNA Technology**

**(09 hrs.)**

Prokaryotic gene and Eukaryotic gene structure. DNA replication, Transcription and Translation. DNA technology. Introduction to gene cloning.

**Unit V: Application of Biology**

**(10 hrs.)**

Brief introduction to industrial Production of Enzymes, Pharmaceutical and therapeutic Proteins, Vaccines and antibodies. Basics of biosensors, Properties and Classification of virus, Immune



response to virus, Definitions-Pandemic, Epidemic and outbreak, pandemic alert system ranges, Prevention of pandemic disease and pandemic preparation.

**Text books:**

1. P.K.Gupta, Cell and Molecular Biology, 5<sup>th</sup> Edition, Rastogi Publications
2. U. Satyanarayana. Biotechnology, Books & Allied Ltd 2017

**Reference Books:**

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A Global Approach", Pearson Education Ltd, 2018.
2. T Johnson, Biology for Engineers, CRC press, 2011
3. J.M. Walker and E.B. Gingold, Molecular Biology and Biotechnology 2nd ed. Panima Publications. PP 434.
4. David Hames, Instant Notes in Biochemistry –2016
5. Phil Tunner, A. Mctennan, A. Bates & M. White, Instant Notes – Molecular Biology – 2014.
6. Richard Dawkins, River Out of Eden: A Darwinian View of Life

**Mapping of COs to POs and PSOs**

C O	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1						2							
2						2					2		
3						2							
4						2							
5						2					2		

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

**CO-PO mapping justification:**

CO	Percentage of contact hours over the total planned contact hours				CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Register (Hrs)	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	10		20	2	Understand	L2	PO6	PO6:	2
2	10		20	2	Understand	L2	PO6,PO11	PO6: PO11:	2,2
3	9		18	1	Understand	L2	PO6	PO6	2
4	9		18	1	Understand	L2	PO6	PO6	2
5	10		20	2	Apply	L3	PO6,PO11	PO6: PO11:	2,2
	48								

**CO1: Understand the structure of cells and basics in living organisms**

**Action Verb: Understand (L2)**

CO1 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

**CO2: Understand the role of biomolecules in industry.**

**Action Verb: Understand (L2)**

CO2 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 and po11 as moderate (2).

**CO3: Understand the functioning of physiology in respiratory system and digestive system**

**Action Verb: Understand (L2)**

C03 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

**C04: Understand DNA technology in living organisms.**

**Action Verb: Understand (L2)**

C04 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

**C05: Apply the biological principles in different technologies for the production of medicines and pharmaceuticals.**

**Action Verb: Apply (L3)**

C05 Action Verb is of BTL 3. Using Thumb rule, L2 correlates PO6 and PO11 as moderate (2).

**B. Tech - Artificial Intelligence and Data Science (AI&DS)**  
(Effective for the batches admitted from 2020-21)

### Semester VI (Third year)

Sl. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P	C			
1	PC	20APC3020	Big Data Analytics	4	2	0	3	30	70	100
2	PC	20APC3022	Machine Learning	4	2	0	3	30	70	100
3	PC	20APC3024	Cloud Computing	4	2	0	3	30	70	100
4	PE -2 MOOCS-II	20APE3004 20APE3005 20APE3006	Software Engineering for AI Game Programming Introduction To NoSQL Database	4	2	0	3	30	70	100
		20MOC3002	3. Development using UML, JAVA and Patterns. 4. Privacy And Security in online Social Media							
5	PC LAB	20APC3021	Big Data Analytics Lab	0	0	3	1.5	30	70	100
6	PC LAB	20APC3023	Machine Learning Lab	0	0	3	1.5	30	70	100
7	PC LAB	20APC3025	Cloud Computing Lab	0	0	3	1.5	30	70	100
8	SC	20ASA0502	Soft Skills	1	0	2	2	100	0	100
9	Mandatory Course (AICTE Suggested)	20AMC9904	Professional Ethics and Human Values	2	0	0	0	30	0	30
			Total credits				18.5	340	490	830
Industrial/Research Internship (Mandatory) 2 Months during summer vacation										



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI**  
**(AUTONOMOUS)**  
**Artificial Intelligence and Data Science (AI &**

DS)

**Year: III**

**Semester: II**

**Branch of Study: AIDS**

Course Code	Year & Sem	Big Data Analytics	L	T/CLC	P	C
20APC3020	III-II		4	2	0	3

**Course Outcomes:**

After studying the course, Student will able to

**CO1: Understand** the concepts and challenges of hadoop in big data.

**CO2: Evaluate** the existing modern technologies related to big data Analytics

**CO3: Analyze** the different formats to perform operations on big data Analytics

**CO4: Apply** the large scale analytics tools to solve open big data problem.

**CO5: Analyze** the big data applications using modern tools Hive and spark

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	the concepts and challenges of hadoop in big data			L2
CO2	Evaluate	the Existing modern technologies		related to big data Analytics	L5
CO3	Analyze	the Different formats		to perform operation on big data Analytics	L4
CO4	Apply	the Large scale analytics tools		to solve open big data problem	L3
CO5	Analyze	the Big data application	using modern tools Hive and Spark		L4

<b>UNIT - I</b>	
<b>Introduction to Big Data :</b> What is Big Data? Why Big Data is Important? Meet Hadoop, Data, Data Storage and Analysis, Comparison with other systems, History of Apache Hadoop, Hadoop Ecosystem, VMWare Installation of Hadoop. Analyzing the Data with Hadoop, Scaling Out.	
<b>UNIT - II</b>	
<b>HDFS :</b> The Design of HDFS, HDFS Concepts, The Command-Line Interface, Hadoop File systems, The Java Interface, Data flow. <b>MapReduce:</b> Developing a MapReduce application, The Configuration API, Setting up the Development Environment, Running Locally on Test Data, Running on a Cluster	
<b>UNIT- III</b>	
<b>How MapReduce Works :</b> Anatomy of a MapReduce, Job Run, Failures, Shuffle and Sort, Task Execution. MapReduce Types and Formats: MapReduce Types, Input formats, output formats.	
<b>UNIT - IV</b>	
<b>Hadoop Environment:</b> Setting up a Hadoop Cluster, Cluster specification, Cluster Setup and Installation, Hadoop Configuration, Security. <b>Pig:</b> Installing and Running Pig, an Example, Comparison with Databases, Pig Latin, User-Defined Functions, Data Processing Operators.	
<b>UNIT - V</b>	

**Hive:** Installing Hive, Running Hive, Comparison with traditional Databases, HiveQL, Tables, Querying Data. **Spark:** Installing Spark, Resilient Distributed Datasets, Shared Variables, Anatomy of a Spark Job Run. HBase: HBasics, Installation, clients, Building an Online Query Application.

**Textbooks:**

1. Tom White, "Hadoop: The Definitive Guide" Fourth Edition, O'reilly Media, 2015.
2. Big Data, Big Analytics: Emerging business intelligence and analytic trends for today's businesses, Michael Minnelli, Michelle Chambers, and Ambiga Dhiraj, Wiley Cio Series

**Reference Books:**

1. Glenn J. Myatt, Making Sense of Data , John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O'Reilly, 2011.
2. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, Understanding Big Data : Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill Publishing, 2012.
4. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets Cambridge University Press, 2012.

**Mapping of course outcomes with program outcomes**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2											
CO2	3	3		3	3						3		
CO3	3	3		3							3		
CO4	3	3		2							2		
CO5	3	3		3							3	1	

**Correlation matrix**

Unit no	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	10	19%	2	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Identify(L3)	2 2
2	12	22%	3	CO2: Evaluate	L5	PO1 PO2 PO4 PO5 PO11	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze (L4) PO5: Select(L3) PO11: Thumb rule	3 3 3 3 3
3	10	19%	2	CO3: Analyze	L4	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO4: Analysis (L4) PO11: Thumb rule	3 3 3 3
4	11	20%	2	CO4: Apply	L3	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Identify (L3) PO4: Analysis(L4) PO11: Thumb rule	3 3 2 2
5	11	20%	2	CO5: Analyze	L4	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Identify(L3) PO4: Analysis(L4) PO11: Thumb rule	3 3 3 3
	54	100 %						

### **Justification Statements:**

**C01: Understand** the concepts and challenges of hadoop in big data.

**Action Verb: Understand (L2)**

**P01 Verb: Apply (L3)**

CO1 Action verb is less than P01 verb by one level. Therefore, the correlation is moderate(2)

**P02 Verb: Identify (L3)**

CO1 Action verb is less than P02 verb by one level. Therefore, the correlation is moderate(2)

**C02: Evaluate** the existing modern technologies related to big data Analytics

**Action Verb: Evaluate (L5)**

**P01: Apply (L3)**

CO2 Action verb is more than P01 verb. Therefore, the correlation is high (3)

**P02: Identify (L3)**

CO2 Action verb is more than P02 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

CO2 Action verb is more than P04 verb. Therefore, the correlation is high (3)

**P05: Select (L3)**

CO2 Action verb is more than P05 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

For use some different technologies to handling big data. Therefore, the correlation is high (3)

**C03: Analyze** the different formats to perform operations on big data Analytics

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

CO3 Action verb is more than P01 verb. Therefore, the correlation is high (3)

**P02: Analyze (L4)**

CO3 Action verb is same level as P02 verb. Therefore, the correlation is high (3)

**P04: Analysis (L4)**

CO3 Action verb is same level as P04 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

For use map reduce and H base technologies to handling big data. Therefore, the correlation is high (3)

**C04: Apply** the large scale analytics tools to solve open big data problem.

**Action Verb: Apply(L3)**

**P01: Apply(L3)**

CO4 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P02: Identify (L3)**

CO4 Action verb is same as P02 verb. Therefore, the correlation is high (3)

**P04: Analysis (L4)**

CO4 Action verb is less than P04 verb by one level. Therefore, the correlation is moderate (2)

**P011: Thumb rule**

For use map reduce applications to test and debug big data. Therefore, the correlation is moderate(2)

**C05: Analyze** the big data applications using modern tools Hive and spark.

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

CO5 Action verb is more than P01 verb. Therefore, the correlation is high (3)

**P02: Identity (L3)**

CO5 Action verb is more than P02 verb. Therefore, the correlation is high (3)

**P04: Analysis (L4)**

CO5 Action verb same as P04 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

For use to create data base application using Hive and NoSQL technologies to handling big data. Therefore, the correlation is high (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science(AI&DS)**

**Year: III**

**Semester: II**

**Branch of Study: AIDS**

Course Code	Year & Sem	MACHINE LEARNING	L	T/CLC	P	C
20APC3022	III-II		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

C01: **Apply** the supervised learning techniques for few machine learning problems

C02: **Evaluate** the hypotheses by comparing its learning algorithms

C03: **Analyze** the Unsupervised learning methods using clustering methods.

C04: **Evaluate** the machine learning algorithms using linear discrimination methods.

C05: **Evaluate** the decision making problems by using SVM and graphical models

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Apply	The supervised learning techniques		for few machine learning problems	L3
C02	Evaluate	The hypotheses	by comparing its learning algorithms		L5
C03	Analyze	The Unsupervised learning methods	using clustering methods.		L4
C04	Evaluate	The machine learning algorithms	using linear discrimination methods		L5
C05	Evaluate	The decision making problems	by using SVM and graphical models		L5

<b>UNIT - I</b>	9 Hrs
What is Machine Learning?, Examples of machine learning applications, <b>supervised Learning:</b> learning a class from examples, Vapnik- Chervonenkis dimension, probably approximately correct learning, noise, learning multiple classes, regression, model selection and generalization, dimensions of a supervised machine learning algorithm. <b>Decision Tree Learning:</b> Introduction, Decisions Tree representation, Appropriate problems for decision tree learning, the basic decision tree learning algorithm, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, issues in decision tree learning.	
<b>UNIT - II</b>	9Hrs
<b>Evaluating Hypotheses:</b> Motivation, Estimating hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, differences in error of two hypothesis, comparing learning algorithms. <b>Bayesian Learning:</b> Introduction, Bayes Theorem, Bayes Theorem and Concept Learning, Maximum Likelihood and least squared error hypothesis, Maximum Likelihood hypothesis for predicting probabilities, Minimum Description Length Principle, Bayes Optimal Classifier, Gibbs Algorithm , Naïve Bayes Classifier , Bayesian Belief Network, EM Algorithm.	
<b>UNIT - III</b>	9 Hrs
<b>Dimensionality Reduction:</b> Introduction, Subset selection, principle component analysis, feature embedding, factor analysis, singular value decomposition and matrix factorization, multidimensional scaling, linear discriminant analysis, canonical correlation analysis, Isomap, Locally linear embedding, laplacian eigenmaps. <b>Clustering:</b> Introduction, Mixture densities, K- Means clustering, Expectations- Maximization algorithm, Mixture of latent variable models, supervised learning after clustering, spectral clustering, Hierarchal clustering, Choosing the number of clusters.	
<b>UNIT - IV</b>	9 Hrs
<b>Linear Discrimination:</b> Introduction, Generalizing the linear model, geometry of the linear discrimination, pair wise separation, parametric discrimination revisited, gradient descent, logistic discrimination, discrimination by regression, learning to rank.	
<b>UNIT - V</b>	9 Hrs



**Kernel Machines:** Introduction, Optimal separating hyperplane, the non-separable case: Soft Margin Hyperplane, v-SVM, kernel Trick, Vectorial kernels, defining kernels, multiple kernel learning, multicast kernel machines, kernel machines for regression, kernel machines for ranking, one-class kernel machines, large margin nearest neighbor classifier, kernel dimensionality reduction.

**Graphical models:** Introduction, Canonical cases for conditional independence, generative models, d separation, belief propagation, undirected Graphs: Markov Random fields, Learning the structure of a graphical model, influence diagrams.

**Textbooks:**

1. Machine Learning – Tom M. Mitchell - McGraw Hill Education, 2017
2. Introduction to Machine learning, Ethem Alpaydin, PHI, 3rd Edition, 2014.

**Reference Books:**

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis Chapman and Hall/CRC; 2nd edition, 2014
2. Machine Learning For Beginners: A Comprehensive Guide To Understand Machine Learning. How It Works And How Is Correlated To Artificial Intelligence And Deep Learning, Chris Neil, Alicex Ltd, 2020

**Online Learning Resources:**

[https://www.youtube.com/watch?v=r4sgKrRL2Ys&list=PL1xHD4vteKYVpaliy295pg6\\_SY5qznc77](https://www.youtube.com/watch?v=r4sgKrRL2Ys&list=PL1xHD4vteKYVpaliy295pg6_SY5qznc77)

**Mapping of course outcomes with program outcomes**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2				2						3	2
CO2	3	3	2	2	2			3			3	3	2
CO3	3	3	3	3	3							3	
CO4	3	3	3	3	2			3			3	2	
CO5	3	3	2	2	2			3			3		

**Correlation matrix**

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	13	19%	2	CO1: Apply	L3	PO1 PO2 PO6	PO1: Apply(L3) PO2: Analyze(L4) PO6: Thumb rule	3 2 2
2	12	18%	2	CO2: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO8 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO3: Design (L6) PO4: Design (L6) PO5: Create(L6) PO8: Thumb rule PO11: Thumb rule	3 3 2 2 2 3 3
3	18	26%	3	CO3: Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3)	3 3 3 3 3
4	12	18%	2	CO4: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO8 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop(L3) PO4: Analyze(L4) PO5: Create(L6) PO8: Thumb rule PO11: Thumb rule	3 3 3 3 2 3 3
5	13	19%	2	CO5: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO8 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO3: Design (L6) PO4: Design (L6) PO5: Create(L6) PO8: Thumb rule PO11: Thumb rule	3 3 2 2 2 3 3
	68	100 %						

## **Justification Statements :**

**C01: Apply** the supervised learning techniques for few machine learning problems

**Action Verb : Apply (L3)**

**P01 Verb : Apply(L3)**

C01 Action verb is same level of P01 verb by one level. Therefore, the correlation is High (3)

**P02 Verb : Analyze(L4)**

C01 Action verb is less than P02 verb by one levels. Therefore the correlation is medium (2)

**P06: Thumb rule**

Some of the machine learning models will provide solutions to current societal problems.

Therefore the correlation is medium (2)

**C02: Evaluate** the hypotheses by comparing its learning algorithms

**Action Verb : Evaluate (L5)**

**P01: Apply(L3)**

C02 Action verb is greater level of P01 verb. Therefore, the correlation is High (3)

**P02: Analyze (L4)**

C02 Action verb is greater level as P02 verb. Therefore, the correlation is high (3)

**P03: Design (L6)**

C02 Action verb is less than P03 verb by one level. Therefore the correlation is medium(2)

**P04: Design (L6)**

C02 Action verb is less than P04 verb by one level. Therefore the correlation is medium(2)

**P05: Create(L6)**

C02 Action verb is less than P05 verb by one level. Therefore the correlation is medium(2)

**P08 : Thumb rule**

While creating hypothesis one need to follow the ethical principles. Therefore, the correlation is High (3)

**P011: Thumb rule**

In current scenario all machine learning models are updating so one needs to follow the change. Therefore, the correlation is high (3)

**C03: Analyze** the Unsupervised learning methods using clustering methods.

**Action Verb : Analyze (L4)**

**P01: Apply(L3)**

C03 Action verb is greater level of P01 verb. Therefore, the correlation is High (3)

**P02: Analyze (L4)**

C03 Action verb is same level as P02 verb. Therefore, the correlation is high (3)

**P03: Develop(L3)**

C03 Action verb is greater level of P03 verb. Therefore, the correlation is High (3)

**P04: Analyze(L4)**

C03 Action verb is same level as P04 verb. Therefore, the correlation is high (3)

**P05: Apply(L3)**

C03 Action verb is greater level of P05 verb. Therefore, the correlation is High (3)

**C04: Evaluate** the machine learning algorithms using linear discrimination methods.

**Action Verb : Evaluate (L5)**

**P01: Apply(L3)**

C04 Action verb is greater level of P01 verb. Therefore, the correlation is High (3)

**P02: Analyze (L4)**

C04 Action verb is greater level as P02 verb. Therefore, the correlation is high (3)

**P03: Develop(L3)**

C04 Action verb is greater level of P03 verb. Therefore, the correlation is high (3)

**P04: Analyze(L4)**

C04 Action verb is same level as P04 verb. Therefore, the correlation is high (3)

**P05: Create(L6)**

C04 Action verb is less than P05 verb by one level. Therefore the correlation is medium(2)

**P08 : Thumb rule**

some ethical principles will apply while training a model using discrimination methods. Therefore, the correlation is High (3)

**P011: Thumb rule**

In today's world training a machine is big challenge to the developers, it is a continuous learning process. Therefore, the correlation is high (3)

**C05: Evaluate** the decision making problems by using SVM and graphical models

**Action Verb : Evaluate (L5)**

**P01: Apply(L3)**

C05 Action verb is greater level of P01 verb. Therefore, the correlation is High (3)

**P02: Analyze (L4)**

C05 Action verb is greater level as P02 verb. Therefore, the correlation is high (3)

**P03: Design (L6)**

C05 Action verb is less than P03 verb by one level. Therefore the correlation is medium(2)

**P04: Design (L6)**

C05 Action verb is less than P04 verb by one level. Therefore the correlation is medium(2)

**P05: Create(L6)**

C05 Action verb is less than P05 verb by one level. Therefore the correlation is medium(2)

**P08 : Thumb rule**

While making decisions for solving real world problems one must follow the ethical principles. Therefore, the correlation is High (3)

**P011: Thumb rule**

For developing solutions for future problems a continuous study is need. Therefore, the correlation is high (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: III**

**Semester: II**

**Branch of Study: AIDS**

Course Code	Year & Sem	Cloud Computing	L	T/CLC	P	C
20APC3024	III-II		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

C01: **Understand** the basics concepts of cloud computing

C02: **Analyze** the cloud architecture and service delivery models

C03: **Analyze** the need for virtualization in a cloud environment.

C04: **Evaluate** the map reducing programming model using Hadoop tools

C05: **Apply** the CIA traid and disaster management for cloud security

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	The basics concepts of cloud computing			L2
C02	Analyze	The cloud architecture and service delivery models			L4
C03	Analyze	the need for virtualization		in a cloud environment	L4
C04	Evaluate	The map reducing programming model	using Hadoop tools		L5
C05	Apply	The CIA traid and disaster management		For cloud security	L3

<b>UNIT - I</b>	9 Hrs
<b>Introduction to Cloud:</b> Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, Characteristics and Benefits, A Closer Look, Cloud Computing Reference Model, Challenges Ahead, Historical Developments, Applications of cloud computing: Healthcare, energy systems, transportation, manufacturing, education, government, mobile communication, application development.	
<b>UNIT - II</b>	9 Hrs
<b>Cloud Computing Architecture:</b> Introduction, NIST reference architecture, Cloud Reference Model, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Interoperability and Standards, Scalability and Fault Tolerance	
<b>UNIT - III</b>	9 Hrs
<b>Virtualization:</b> Introduction to Virtualization concept & Hypervisors, Pros and Cons of Virtualization, Virtual Machine (VM), implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Types of Hypervisors, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.	
<b>UNIT - IV</b>	9 Hrs
<b>Programming Model:</b> Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job – Design of Hadoop file system, HDFS concepts, dataflow of File read & File write, map reduce applications <b>Cloud Platforms in Industry:</b> Amazon Web Services- Compute Services, Storage Services.	
<b>UNIT - V</b>	9 Hrs
<b>Cloud Security &amp; Disaster Recovery:</b> Cloud Security: Risks, privacy and privacy impacts assessments; Multi-tenancy issues, security in VM, OS, virtualization system security issues and vulnerabilities; Virtualization system-specific attacks: Technologies for virtualization-based security	

enhancement, legal.

**Disaster Recovery:** Disasters in the Cloud, Disaster Management, Compromise Response Disaster Recovery

**Textbooks:**

1. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi from TMH 2013.
2. George Reese Cloud Application Architectures, First Edition, O'Reilly Media 2009.
3. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.

**Reference Books:**

1. Cloud Computing and SOA Convergence in Your Enterprise A Step-by-Step Guide by David S. Linthicum from Pearson 2010.
2. Cloud Computing 2 nd Edition by Dr. Kumar Saurabh from Wiley India 2012.
3. Cloud Computing – web based Applications that change the way you work and collaborate Online – Micheal Miller.Pearson Education.

**Online Learning Resources:**

[https://www.youtube.com/playlist?list=PLmcndht8X48zKf-jqk9xY5Wg\\_AhXR8aHb](https://www.youtube.com/playlist?list=PLmcndht8X48zKf-jqk9xY5Wg_AhXR8aHb)

**Mapping of course outcomes with program outcomes**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	PS03
CO1	2	2											1	
CO2	3	3			3								2	1
CO3	3	3		2	3				3	3			2	
CO4			3	2	3				2				2	2
CO5		3	3	2		2		2			2		2	

**Correlation matrix**

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BT L			
1	13	22 %	3	CO1:Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Identify(L3)	2 2
2	15	25 %	3	CO2:Analyze	L4	PO1 PO2 PO5	PO1: Apply(L3) PO2: Identify(L3) PO5: Apply(L3)	3 3 3
3	11	19 %	2	CO3:Analyze	L4	PO1 PO2 PO4 PO5 PO9 PO10	PO1: Apply(L3) PO2: Identify(L3) PO4: Analyze(L4) PO5: Develop(L3) PO9: Thumb rule PO10: Thumb rule	3 3 3 3 3 3
4	11	19 %	2	CO4:Evaluate	L5	PO3 PO4 PO5 PO9	PO3: Develop(L3) PO4: Interpret(L5) PO5: Create(L6) PO9: Thumb rule	3 3 2 3
5	9	15 %	2	CO5:Apply	L3	PO2 PO3 PO4 PO6 PO8 PO11	PO2: Review(L2) PO3: Develop(L3) PO4: Analyze(L4) PO6: Thumb rule PO8: Thumb rule PO11: Thumb rule	3 3 2 2 2 2
	59	100 %						

### **Justification Statements :**

**C01: Understand** the basics concepts of cloud computing

Action Verb : **Understand(L2)**

**P01 Verb : Apply(L3)**

C01 Action verb is less than P01 verb by one level. Therefore the correlation is medium (2)

**P02 Verb : Identify(L3)**

C01 Action verb is less than P02 verb by one level. Therefore the correlation is medium (2)

**C02: Analyze** the cloud architecture and service delivery models

Action Verb : **Analyze (L4)**

**P01: Apply(L3)**

C02 Action verb is greater than P01 verb. Therefore the correlation is high(3)

**P02: Identify(L3)**

C02 Action verb is greater than P02 verb. Therefore the correlation is high(3)

**P05: Apply(L3)**

C02 Action verb is greater than P05 verb. Therefore the correlation is high(3)

**C03: Analyze** the need for virtualization in a cloud environment.

Action Verb : Analyze (L4)

**P01: Apply(L3)**

C03 Action verb is greater than P01 verb. Therefore the correlation is high(3)

**P02: Identify (L3)**

C03 Action verb is greater than P02 verb. Therefore the correlation is high(3)

**P04: Analyze (L4)**

C03 Action verb is same level as P04 verb. Therefore the correlation is high (3)

**P05: Develop(L3)**

C03 Action verb is greater than P05 verb. Therefore the correlation is high(3)

**P09 : Thumb rule**

Team work is required between cloud provider and consumers. Hence the correlation is high(3)

**P010: Thumb rule**

Effective communication is required , reports to be generated between cloud users and providers. Therefore the correlation is high(3)

**C04: Evaluate** the map reducing programming model using Hadoop tools

Action Verb : Evaluate(L5)

**P03: Develop(L3)**

C04 Action verb is greater than P03 verb. Therefore the correlation is high(3)

**P04: Interpret (L5)**

C04 Action verb is same level as P04 verb. Therefore the correlation is high (3)

**P05: Create(L6)**

C04 Action verb is less than P05 verb by one level. Therefore the correlation is medium(2)

**P09: Thumb rule**

Team work is required between cloud provider and consumers in multi disciplinary activities. Therefore the correlation is high(3)

**C05: Apply** the CIA triad and disaster management for cloud security

Action Verb : Apply(L3)

**P02: Review(L2)**

C05 Action verb is less than P02 verb by one level. Therefore the correlation is medium(2)

**P03: Develop(L3)**

C05 Action verb is same level as P03 verb. Therefore the correlation is high (3)

**P04: Analyze (L4)**

C05 Action verb is same level as P04 verb. Therefore the correlation is high (3)

**P06 : Thumb rule**

Since ethical principles should be followed to create a cloud and providing services to cloud.

Therefore the correlation is medium(2)

**P08 : Thumb rule**

Team work is required between cloud consumers and providers. Hence the correlation is medium(2)

**P011: Thumb rule**

For some of real world applications we use cloud services. Therefore the correlation is medium(2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: III**

**Semester: II**

**Branch of Study: AIDS**

Course Code	Year & Sem	Software Engineering for AI	L	T/CLC	P	C
20APE3004	III-II		4	2	0	3

**Course Outcomes:**

After studying the course, student will be able to

**CO 1: Understand** the Artificial Intelligence problems and software methods.

**CO 2: Analyse** the software system to introduce new paradigms for System Engineering.

**CO 3: Analyse** the utilization of exploratory programming in Machine Learning by assessing the performance of ML models.

**CO 4: Apply** the knowledge for software development through expert systems.

**CO 5: Evaluate** the integration of AI into practical software to reduce complexity.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO 1	<b>Understand</b>	the Artificial Intelligence problems and software methods			L2
CO 2	<b>Analyse</b>	the software system to introduce new paradigms	for System Engineering		L4
CO 3	<b>Analyse</b>	the utilization of exploratory programming in machine learning	by assessing the performance of machine learning models.		L4
CO 4	<b>Apply</b>	the knowledge for software development	through expert systems		L3
CO 5	<b>Evaluate</b>	the integration of AI into practical software	to reduce complexity		L5

<b>UNIT - I</b>	<b>Introduction to Computer Software for AI, AI Problems and Conventional SE Problems, Software Engineering Methodology</b>	
Computers and software systems, An introduction to Software engineering, Bridges and buildings versus software systems, the software crisis, A demand for more software power, Responsiveness to human users, Software systems in new types of domains, Responsiveness to dynamic usage environments, Software systems with self-maintenance capabilities, A need for AI systems What is an AI problem, Ill-defined specifications, correct versus 'good enough' solutions, It's the HOW not the WHAT, the problem of dynamics, the quality of modular approximations, Context-free problems? Specify and verify—the SAV methodology, the myth of complete specification, what is verifiable, Specify and test—the SAT methodology, testing for reliability, the strengths, the weaknesses, what are the requirements for testing, what's in a specification, Prototyping as a link.		
<b>UNIT - II</b>	<b>An Incremental and Exploratory Methodology, New Paradigms for System Engineering</b>	
Classical methodology and AI problems, The RUDE cycle, how do we start, Malleable software, AI muscles on a conventional skeleton How do we proceed, how do we finish, The question of hacking, Conventional paradigms Automatic programming, Transformational implementation, The "new paradigm" of Blazer, Cheatham and Green, Operational requirements of Kowalski, The POLITE methodology		
<b>UNIT- III</b>	<b>Towards a Discipline of Exploratory Programming, Machine Learning: Much Promise, Many Problems</b>	



Reverse engineering, Reusable software Design knowledge, Stepwise abstraction, The problem of decompiling, Controlled modification, Structured growth  
Self-adaptive software, The promise of increased software power, The threat of increased software problems

#### UNIT - IV Machine Learning and Expert Systems

Practical machine learning examples, Multisession inductive programming, Expert Systems: The Success Story, Expert systems as AI software, Engineering expert systems, The lessons of expert systems for engineering AI software.

#### UNIT - V AI into Practical Software

Support environments, Reduction of effective complexity, Moderately stupid assistance, An engineering toolbox, Selfreflective software, Over engineering software, Summary and What the Future Holds

#### Textbooks:

1. Derek Partridge, "Artificial Intelligence and Software Engineering", Glenlake Publishing Company, 1998.

#### REFERENCES:

1. "The role of Artificial Intelligence in Software Engineering", K. Nitalksheswara Rao, 2020
2. "Farid Meziane & Sunil Vadera, "Artificial Intelligence Applications for Improved Software Engineering Development", Information Science Reference, 2009

#### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	2	1											
C02		3	1		1								
C03		3	1		1	3							
C04	3				3	1					2		
C05		3		3									

#### Correlation matrix

Unit no	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	19	26	3	CO1 :Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Analyze(L4)	2 1
2	14	19	2	CO2 :Analyse	L4	PO2 PO3 PO5	PO2 :Analyse (L4) PO3: Create (L6) PO5: Create(L6)	3 1 1
3	12	16	2	CO3 : Analyse	L4	PO2 PO3 PO5 PO6	PO2:Analyse (L4) PO3:Create(L6) PO5:Create (L6) PO6: Thumb rule	3 1 1 2
4	13	18	2	CO4 : Apply	L3	PO1 PO5 PO6 PO11	PO1: Apply(L3) PO5:Apply (L3) PO6:Thumb rule PO11: Thumb rule	3 3 1 2

5	15	21	3	C05 :Evaluate	L5	P02 P04	P02: Evaluate (L5) P04: Evaluate (L5)	3 3
	73	100 %						

### Justification Statements:

**C0 1: Understand** the Artificial Intelligence problems and software methods.

**Action Verb: Understand (L2)**

**P01 Verb: Apply (L3)**

C01 Action verb is less than P01 verb by one level. Therefore the correlation is moderate(2)

**P02 Verb: Analyse (L4)**

C01 Action verb is less than P02 verb by two levels. Therefore the correlation is low (1)

**C0 2: Analyse** the software system to introduce new paradigms for System Engineering.

**Action Verb:Analyse (L4)**

**P02: Analyse (L4)**

C02 Action verb is same level as P02 verb. Therefore the correlation is high (3)

**P03: Create (L6)**

C02 Action verb is less than P02 verb by two levels. Therefore the correlation is low (1)

**P05: Create(L6)**

C02 Action verb is less than P05 verb by two levels. Therefore the correlation is low (1)

**C0 3: Analyse** the utilization of exploratory programming in Machine Learning by assessing the

performance of ML models.

**Action Verb : Analyse (L4)**

**P02: Analyze(L4)**

C03 Action verb is same level as P02 verb. Therefore the correlation is high (3)

**P03: Create (L6)**

C03 Action verb is less than P03 verb by two levels. Therefore the correlation is low (1)

**P05: Create (L6)**

C03 Action verb is less than P05 verb by two levels. Therefore the correlation is low (1)

**P06: Thumb rule**

By using machine learning concepts the programmers are able to solve engineering problems using machine learning algorithms. Therefore the correlation is high (3).

**C0 4: Apply** the knowledge for software development through expert systems.

**Action Verb : Apply (L3)**

**P01: Apply(L3)**

C04 Action verb is same level as P01 verb. Therefore the correlation is high (3)

**P05: Apply(L3)**

C04 Action verb is same level as P05 verb. Therefore the correlation is high (3)

**P06: Thumb rule**

Apply reasoning informed by the contextual knowledge to asses expert systems. Therefore the correlation is moderate (2)

**P011: Thumb rule**

Demonstrate knowledge and understanding of the software engineering principles is  
Therefore the correlation is moderate (2).

**CO 5: Evaluate** the integration of AI into practical software to reduce complexity.

**Action Verb : Evaluate (L5)**

**P02: Evaluate (L5)**

C05 Action verb is same level as P02 verb. Therefore the correlation is high (3)

**P04: Evaluate (L5)**

C05 Action verb is same level as P04 verb. Therefore the correlation is high (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: III**

**Semester: II**

**Branch of Study: AIDS**

Course Code	Year & Sem	Game Programming	L	T/CLC	P	C
20APE3005	III-II		4	2	0	3

**Course Outcomes:**

After Studying the Course, student will be able to

**CO1: Understand** the concept of 3D Graphics and Game Programming to perform 3D Modelling.

**CO2: Apply** the Game Engine Architecture to Generate Game Engine.

**CO3: Analyze** the Game Programming for Game Logic and Game view.

**CO4: Analyze** the 2D and 3D Game development using Flash, Java and Python .

**CO5: Create** the 2D and 3D interactive games using DirectX or Python.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the concept of 3D Graphics and Game Programming	to perform 3D Modelling.		L2
CO2	Apply	the Game Engine Architecture	to Generate Game Engine		L3
CO3	Analyze	the Game Programming		for Game Logic and Game view.	L4
CO4	Analyze	the 2D and 3D Game development	using Flash, Java and Python		L4
CO5	Understand	the 2D and 3D interactive games	using DirectX or Python.		L2

<b>UNIT - I</b>		
<b>3D GRAPHICS FOR GAME PROGRAMMING:</b> 3D Transformations, Quaternions, 3D Modeling and Rendering, Ray Tracing, Shader Models, Lighting, Color, Texturing, Camera and Projections, Culling and Clipping, Character Animation, Physics-based Simulation, Scene Graphs.		
<b>UNIT - II</b>		
<b>GAME ENGINE DESIGN:</b> Game engine architecture, Engine support systems, Resources and File systems, Game loop and real-time simulation, Human Interface devices, Collision and rigid body dynamics, Game profiling.		
<b>UNIT - III</b>		
<b>GAME PROGRAMMING:</b> Application layer, Game logic, Game views, managing memory, controlling the main loop, loading and caching game data, User Interface management, Game event management.		
<b>UNIT - IV</b>		
<b>GAMING PLATFORMS AND FRAMEWORKS:</b> 2D and 3D Game development using Flash, DirectX, Java, Python, Game engines - Unity, DX Studio,		
<b>UNIT - V</b>		
<b>GAME DEVELOPMENT:</b> Developing 2D and 3D interactive games using DirectX or Python – Isometric and Tile Based Games, Puzzle games, Single Player games, Multi Player games		
<b>Textbooks:</b>		
1. Mike Mc Shaffrly and David Graham, "Game Coding Complete", Fourth Edition, Cengage Learning, PTR, 2012.		
2. Jason Gregory, "Game Engine Architecture", CRC Press / A K Peters, 2009.		
3. David H. Eberly, "3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics" 2 nd Editions, Morgan Kaufmann, 2006.		
<b>Reference Books:</b>		
1. Ernest Adams and Andrew Rollings, "Fundamentals of Game Design", 2 nd Edition Prentice Hall / New Riders, 2009.		
2. Eric Lengyel, "Mathematics for 3D Game Programming and Computer Graphics", 3 rd Edition, Course Technology PTR, 2011.		

3. Jesse Schell, The Art of Game Design: A book of lenses, 1 st Edition, CRC Press, 2008.

#### Mapping of course outcomes with program outcomes

CO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02
C01	2	2	2		2						2	2	2
C02	3	3	3		3						2	2	2
C03	3	3			3	3					3	2	2
C04	3	3			3	3					3	2	2
C05	3	3	3	3	3	3		3			3	2	2

#### Correlation matrix

Unit No.	CO Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	C01: Understand	L2	P01 P02 P03 P05 P011	P01: Apply(L3) P02: Identify(L3) P03:Develop(L3) P05:Apply(L3) P011:Thumb Rule	2 2 2 2 2
2	C02: Apply	L3	P01 P02 P03 P05 P011	P01: Apply(L3) P02:Identify(L3) P03:Develop(L3) P05:Apply(L3) P011:Thumb Rule	3 3 3 3 2
3	C03: Analyze	L4	P01 P02 P05 P06 P011	P01: Apply(L3) P02:Identify(L3) P05:Apply(L3) P06: Apply(L3) P011:Thumb Rule	3 3 3 3 3
4	C04: Analyze	L4	P01 P02 P05 P06 P011	P01: Apply (L3) P02:Identify(L3) P05:Apply(L3) P06:Apply(L3) P011: Thumb Rule	3 3 3 3 3
5	C05: Create	L6	P01 P02 P03 P04 P05 P06 P08 P011	P01: Analyze (L4) P02:Identify(L3) P03:Develop(L3) P04:Design(L6) P05:Create(L6) P06:Apply(L3) P08:Apply(L3) P011: Thumb Rule	3 3 3 3 3 3 3 3

#### Justification Statements:

**C01: Understand** the concept of 3D Graphics and Game Programming to perform 3D Modelling.

**Action Verb: Understand (L2)**

**P01: Apply(L3)**

C01 Action Verb is less than P01 verb by one level. Therefore the correlation is moderate (2)

**P02: Identify(L3)**

C01 Action Verb is less than P02 verb by one level. Therefore the correlation is moderate (2)

**P03:Develop(L3)**

C01 Action Verb is less than P03 verb by one level. Therefore the correlation is moderate (2)

**P05:Apply(L3)**

**C01** Action Verb is less than P05 verb by one level. Therefore the correlation is moderate(2)

**P011:Thumb Rule**

Hence the concept of 3D Graphics and Game Programming to perform 3D Modelling.  
Therefore correlation is moderate (2).

**C02: Apply** the Game Engine Architecture to Generate Game Engine.

**Action Verb: Apply (L3)**

**P01: Apply(L3)**

**C02** Action Verb is same as P01 verb Therefore correlation is high (3)

**P02: Identify(L3)**

**C02** Action verb is same as P02 verb Therefore correlation is high (2)

**P03: Develop(L3)**

**C02** Action verb is same as P03 verb Therefore correlation is high (2)

**P05: Apply(L3)**

**C02** Action verb is same as P05 verb Therefore correlation is high (2)

**P011:Thumb Rule**

Here the Game Engine Architecture to Generate Game Engine. Therefore correlation is Moderate (2).

**C03: Analyze** the resource sharing techniques in distributed systems

**Action Verb: Analyze (L4)**

**P01: Apply(L3)**

**C03** Action Verb is more than P01 verb; Therefore correlation is high (3).

**P02:Identify(L3)**

**C03** Action Verb is more than P02 verb; Therefore correlation is high (3).

**P05: Apply(L3)**

**C03** Action Verb is more than P05 verb; Therefore correlation is high (3).

**P06:Apply(L3)**

**C03** Action Verb is more than P06 verb; Therefore correlation is high (3).

**P011:Thumb Rule**

Here the Game Programming for Game Logic and Game view. Therefore correlation is high (3).

**C04: Analyze** the 2D and 3D Game development using Flash, Java and Python .

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

**C04** Action Verb is more than P01 Verb. Therefor correlation is High(3)

**P02:Identify(L3)**

**C04** Action Verb is more than P02 Verb. Therefor correlation is high(3)

**P05:Apply(L3)**

**C04** Action Verb is More than P05 Verb. Therefor correlation is high(3)

**P06:Apply(L3)**

**C03** Action Verb is more than P06 verb; Therefore correlation is high (3).

**P011: Thumb Rule**

Here, working model of 2D and 3D Game development using Flash, Java and Python .. Therefore correlation is high (3)

**C05: Create** the 2D and 3D interactive games using DirectX or Python.

**Action Verb: Create (L6)**

**P01: Analyze (L4)**

**C05** Action Verb is more than P01 verb. Therefore correlation is High (3)

**P02:Identify(L3)**

**C05** Action Verb is more than P02 verb. Therefore correlation is High (3)

**P03:Develop(L3)**

**C05** Action Verb is more than P03 verb . Therefore correlation is High (3)

**P04:Design(L6)**

**C05** Action Verb is more than P04 verb. Therefore correlation is High (3)

**P05:Create(L6)**

**C05** Action Verb is more than P05 verb. Therefore correlation is High (3)

**P06:Apply(L3)**

Here the 2D and 3D interactive games are used for interactive mode of society. Therefore correlation is high(3)

**P08:Apply(L3)**

Here the 2D and 3D games developed based on the society and consider the ethics. Therefore correlation is high(3)

**P011: Thumb Rule**

Here we discussd the 2D and 3D interactive games using DirectX or Python., Therefore correlation is high(3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: III**

**Semester: II**

**Branch of Study: AIDS**

Course Code	Year & Sem	Introduction to NoSQL Database	L	T/CLC	P	C
20APE3006	III-II		4	2	0	3

**Course Outcomes:**

After Studying the Course, student will be able to

**CO1: Understand** the different types of NoSQL Databases

**CO2: Analyze** the NoSQL database applications to perform data models.

**CO3: Apply** the NoSQL databases platforms on Web Analytics or Real-Time Analytics.

**CO4: Apply** the NoSQL databases using MongoDB to perform different data Operations.

**CO5: Analyze** the NoSQL development tools on different types of NoSQL Databases

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the different types of NoSQL Databases			L2
CO2	Analyze	the NoSQL database applications	to perform data models.		L4
CO3	Apply	the NoSQL databases platforms on Web Analytics or Real-Time Analytics			L3
CO4	Apply	the Nosql databases	using MangoDB to perform different data Operations.		L3
CO5	Analyze	the NoSQL development tools on different types of NoSQL Databases			L4

<b>UNIT - I</b>	
Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points.	
<b>UNIT - II</b>	
Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases. Replication and sharding, Map Reduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.	
<b>UNIT - III</b>	
NoSQL Key/Value databases using MongoDB, Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.	
<b>UNIT - IV</b>	
Column- oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.	
<b>UNIT - V</b>	
NoSQL Key/Value databases using Riak, Key-Value Databases, Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets. Graph NoSQL databases using Neo4, NoSQL database development tools and programming languages, Graph Databases, Graph Database. Features, Consistency,	



Transactions, Availability, Query Features, Scaling, Suitable Use Cases
<b>Textbooks:</b>
1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications, 1st Edition, 2019.
<b>WEB REFERENCES:</b>
1. <a href="https://www.ibm.com/cloud/learn/nosql-databases">https://www.ibm.com/cloud/learn/nosql-databases</a>
2. <a href="https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp">https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp</a>
3. <a href="https://www.geeksforgeeks.org/introduction-to-nosql/">https://www.geeksforgeeks.org/introduction-to-nosql/</a>
4. <a href="https://www.javatpoint.com/nosql-databa">https://www.javatpoint.com/nosql-databa</a>

#### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2									2	2	2
CO2	3	3	3		3						3	2	2
CO3	3	3	3		3						3	2	2
CO4	2	3			3						2	2	2
CO5	1	2									2	2	2

#### Correlation matrix

Unit No.	CO Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Identify(L3) PO11:Thumb Rule	2 2 2
2	CO2: Analyze	L4	PO1 PO2 PO3 PO5 PO11	PO1: Apply(L3) PO2:Identify(L3) PO3:Develop(L3) PO5:Apply(L3) PO11:Thumb Rule	3 3 3 3 3
3	CO3: Apply	L3	PO1 PO2 PO3 PO5 PO11	PO1: Apply(L3) PO2:Identify(L3) PO3:Develop(L3) PO5:Apply(L3) PO11:Thumb Rule	3 3 3 3 2
4	CO4: Apply	L3	PO1 PO2 PO11	PO1: Analyze (L4) PO2:Identify(L3) PO11: Thumb Rule	2 3 2
5	CO5: Analyze	L4	PO1 PO2 PO5 PO11	PO1: Analyze (L4) PO2:Identify(L3) PO5:Apply(L3) PO11: Thumb Rule	3 3 3 3

#### Justification Statements:

**CO1: Understand** the different types of NoSQL Databases

**Action Verb: Understand (L2)**

**PO1: Apply(L3)**

CO1 Action Verb is low level to PO1 verb by one level. Therefore correlation is moderate (2).

**PO2: Identify(L3)**

CO1 Action Verb is low level to PO2 verb by one level. Therefore correlation is moderate (2).

**PO11:Thumb Rule**

Hence The NoSQL Databases are used data maintains. Therefore correlation is moderate (2).

**C02: Analyze** the NoSQL database applications to perform data models.

**Action Verb: Analyze (L4)**

**P01: Apply(L3)**

C02 Action Verb is more than P01 verb; Therefore correlation is high (3).

**P02:Identify(L3)**

C02 Action Verb is more than P02 verb; Therefore correlation is high (3).

**P03:Develop(L3)**

C02 Action Verb is more than P03 verb; Therefore correlation is high (3).

**P05:Apply(L3)**

C02 Action Verb is more than P05 verb; Therefore correlation is high (3).

**P011:Thumb Rule**

Here various database applications are used to create, truncate data. Therefore correlation is high (3).

**C03: Apply** the NoSQL databases platforms on Web Analytics or Real-Time Analytics.

**Action Verb: Apply (L3)**

**P01: Apply(L3)**

C03 Action Verb is more than P01 verb; Therefore correlation is high (3).

**P02:Identify(L3)**

C03 Action Verb is more than P02 verb; Therefore correlation is high (3).

**P03:Develop(L3)**

C03 Action Verb is more than P03 verb; Therefore correlation is high (3).

**P05:Apply(L3)**

C03 Action Verb is more than P05 verb; Therefore correlation is high (3).

**P011:Thumb Rule**

Here various the NoSQL databases platforms on Web Analytics or Real-Time Analytics. Therefore correlation is moderate (2).

**C04: Apply** the NoSQL databases using MangoDB to perform different data Operations.

**Action Verb: Apply (L3)**

**P01: Analyze (L4)**

C04 Action Verb is less than P01 Verb by one level. Therefor correlation is Moderate(2)

**P02:Identify(L3)**

C04 Action Verb is same as P02Verb. Therefor correlation is high(3)

**P011: Thumb Rule**

Here, the NoSQL databases using MangoDB to perform different data Operations. Therefore correlation is Moderate(2)

**C05: Analyze** the NoSQL development tools on different types of NoSQL Databases

**Action Verb: Analyze (L4)**

**P01: Analyze (L4)**

C05 Action Verb is same as P01 verb. Therefore correlation is high(3)

**P02:Identify(L3)**

C05 Action Verb is more than P02 verb. Therefore correlation is high(3)

**P05:Apply(L3)**

C04 Action Verb is more than P05 Verb. Therefor correlation is high(3)

**P011: Thumb Rule**

Here we discussd the NoSQL development tools on different types of NoSQL Databases, Therefore correlation is high(3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI &**

**DS)  
Year: III**

**Semester: II**

**Branch of Study: AIDS**

Course Code	Year & Sem	Big Data Analytics Lab	L	T/CLC	P	C
20APC3021	III-II		0	0	3	1.5

**Course Outcomes:**

After Studying the Course, Student will able to

**CO 1: Evaluate** the Big data Configure Hadoop to perform File Management Tasks.

**CO 2: Apply** the MapReduce programs real time works to word count, weather data set and sales of a company

**CO 3: Analyze** the big data sets using Hadoop distributed file systems and MapReduce.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Evaluate	the Big data Configure Hadoop		to perform File Management Tasks	L5
CO2	Apply	the MapReduce programs real time works		to word count, weather dataset and sales of a company	L3
CO3	Analyze	the big data sets	using Hadoop distributed file systems and MapReduce		L4
CO4	Apply	the different data storages tools	using Hive and Hadoop		L3
CO5	Apply	the different data processing tools	using Hive and pig, Spark		L3

**CO 4: Apply** the different data storages tools using Hive and Hadoop

**CO 5: Apply** the different data processing tools using Hive and pig, Spark

**List of Tasks**

1. Install Apache Hadoop(CO1)
2. Develop a MapReduce program to calculate the frequency of a given word in a given file. (CO1)
3. Develop a MapReduce program to find the maximum temperature in each year.(CO1)
4. Develop a MapReduce program to find the grades of student's.(CO1)
5. Develop a MapReduce program to implement Matrix Multiplication.(CO2)
6. Develop a MapReduce to find the maximum electrical consumption in each year given electrical consumption for each month in each year.(CO2)
7. Develop a MapReduce to analyze weather data set and print whether the day is shinny or cool day. (CO2)
8. Develop a MapReduce program to find the number of products sold in each country by considering sales (CO3)

Tranction _Date	Prod uct	Price	Payment _Type	Name	City	State	Country	Account _Created	Last _Login	Latitude	Longi tude
--------------------	-------------	-------	------------------	------	------	-------	---------	---------------------	----------------	----------	---------------

9. Develop a MapReduce program to find the tags associated with each movie by analyzing movie lens data.(CO3)

10. XYZ.com is an online music website where users listen to various tracks, the data gets collected which is given below. The data is coming in log files and looks like as shown below.(CO3)

Userld	Trackld	Shared	Radio	Skip
111115	222	0	1	0
111113	225	1	0	0
111117	223	0	1	1
111115	225	1	0	0

11. Develop a MapReduce program to find the frequency of books published each year and find in which year maximum number of books were published using the following data. (CO4)

Title	Author	Published year	Author country	Language	No of pages
-------	--------	-------------------	-------------------	----------	-------------

Column 1 : PassengerId

Column 2 : Survived (survived=0 & died=1)

Column 3 : Pclass

Column 4 : Name

Column 5 : Sex

Column 6 : Age

Column 7 : SibSp

Column 8 : Parch

Column 9 : Ticket

Column 10 : Fare Title Author Published year Author

country Language No of pages

Column 11 : Cabin

Column 12 : Embarked

13. Develop a MapReduce program to analyze Uber data set to find the days on which each basement has more trips using the following dataset.(CO4)

The Uber dataset consists of four columns they are

dispatching_base_number	date	active_vehicles	trips
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14. Develop a program to calculate the maximum recorded temperature by yearwise for the weather dataset in Pig Latin(CO4)

15. Write queries to sort and aggregate the data in a table using HiveQL.(CO5)

16. Develop a Java application to find the maximum temperature using Spark.(CO5)

### Text Books:

1. Tom White, "Hadoop: The Definitive Guide" Fourth Edition, O'reilly Media, 2015.

### Reference Books:

1. Glenn J. Myatt, Making Sense of Data , John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O'Reilly, 2011.

2. Michael Berthold, David J.Hand, Intelligent Data Analysis, Spingers, 2007.

3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, Uderstanding Big Data : Analytics for Enterprise Class Hadoop and Streaming Data, McGrawHill Publishing, 2012.

4. AnandRajaraman and Jeffrey David Ullman, Mining of Massive Datasets Cambridge University Press, 2012

### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02
C01	3	1		3									
C02	3	2	3		3						2		
C03	3	3	1		2							1	
C04	3	2	3		3						2		
C05	3	2	3		3						2		

## Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: Evaluate	L5	PO1 PO2 PO4	PO1: Apply(L3) PO2: Formulate (L6) PO4: Analysis (L4)	3 1 3
2	CO2: Apply	L3	PO1 PO2 PO3 PO5 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop(L3) PO5: Apply (L3) PO11: Thumb rule	3 2 3 3 2
3	CO3: Analyze	L4	PO1 PO2 PO3 PO4	PO1: Apply(L3) PO2: Review (L2) PO3: Design(L6) PO4: Apply(L3)	3 3 1 2
4	CO4: Apply	L3	PO1 PO2 PO3 PO5 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop(L3) PO5: Apply (L3) PO11: Thumb rule	3 2 3 3 2
5	CO4: Apply	L3	PO1 PO2 PO3 PO5 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop(L3) PO5: Apply (L3) PO11: Thumb rule	3 2 3 3 2

### Justification Statements:

**CO 1: Evaluate** the Big data Configure Hadoop to perform File Management Tasks.

**Action Verb: Evaluate (L5)**

**PO1: Apply (L3)**

CO1 Action verb is more than PO1 verb. Therefore, the correlation is high (3)

**PO2: Formulate (L6)**

CO1 Action verb is less than PO2 verb by one levels. Therefore, the correlation is moderate (2)

**PO4: Analysis (L4)**

CO1 Action verb is more than PO4 verb. Therefore, the correlation is high(3)

**CO 2: Apply** the MapReduce programs real time works to word count, weather data set and sales of a company

**Action Verb: Apply (L3)**

**PO1: Apply (L3)**

CO2 Action verb is same as PO1 verb. Therefore, the correlation is high (3)

**PO2: Analyze (L4)**

CO2 Action verb is less than as PO2 verb by one level. Therefore, the correlation is moderate(2)

**PO3: Develop (L3)**

CO2 Action verb is same as PO3 verb. Therefore, the correlation is high (3)

**PO5: Apply (L3)**

CO2 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

**PO11: Thumb rule**

Using orange to visualize real world solutions the correlation is moderate (2)

**CO 3: Analyze** the big data sets using Hadoop distributed file systems and MapReduce.

**Action Verb: Analyze (L4)**

**P01 Verb: Apply (L3)**

C03 Action verb is more than P01 verb. Therefore, the correlation is high (3)

**P02 Verb: Review (L2)**

C03 Action verb is more than P02 verb. Therefore, the correlation is high (3)

**P03 Verb: Design(L6)**

C03 Action verb is less than P03 verb by two level. Therefore, the correlation is low (1)

**P04 Verb: Apply (L3)**

C03 Action verb is less than P04 verb by one level. Therefore, the correlation is moderate (2)

**CO 4: Apply** the different data storages tools using Hive and Hadoop

**Action Verb: Apply (L3)**

**P01: Apply (L3)**

C04 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P02: Analyze (L4)**

C04 Action verb is less than P02 verb by one level. Therefore, the correlation is moderate (2)

**P03: Develop (L3)**

C04 Action verb is same as P03 verb. Therefore, the correlation is high (3)

**P05: Apply (L3)**

C04 Action verb is same as P05 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

Using orange to visualize real world solutions the correlation is moderate (2)

**CO 5: Apply** the different data processing tools using Hive and pig, Spark

**Action Verb: Apply (L3)**

**P01: Apply (L3)**

C05 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P02: Analyze (L4)**

C05 Action verb is less than P02 verb by one level. Therefore, the correlation is moderate (2)

**P03: Develop (L3)**

C05 Action verb is same as P03 verb. Therefore, the correlation is high (3)

**P05: Apply (L3)**

C05 Action verb is same as P05 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

Using orange to visualize real world solutions the correlation is moderate (2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: III**

**Semester: II**

**Branch of Study: AIDS**

Course Code	Year & Sem	Machine Learning Lab	L	T/CLC	P	C
20APC3023	III-II		0	0	3	1.5

**Course Outcomes:**

After Studying the Course , Student will able to

**CO 1: Evaluate** the procedures for various learning's to machine learning algorithms.

**CO 2: Apply** the Python programs for various Learning algorithms using Pandas and Matplotlib.

**CO 3: Analyze** the different data sets to the Machine Learning algorithm.

**CO 4: Analyze** the various types of data set for clustering using k-Means algorithm

**CO 5: Apply** the Machine Learning algorithms to solve real world problems

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Evaluate	the procedures for the various learning		to machine learning	L5
CO2	Apply	the Python programs for various Learning algorithms	using Pandas and Matplotlib		L3
CO3	Analyze	the various types of data set		to the Machine Learning algorithm	L4
CO4	Apply	various types of data set for clustering	using k-Means algorithm		L3
CO5	Apply	the Machine Learning algorithms		to solve real world problems	L3

**List of Tasks**

1. Exercises to solve the real-world problems using the following machine learning methods: (CO1)

a. Linear Regression

b. Logistic Regression.

2. Write a program to Implement Support Vector Machines. (CO1)

3. Exploratory Data Analysis for Classification using Pandas and Matplotlib. (CO1)

4. Implement a program for Bias, Variance, and Cross Validation. (CO2)

5. Write a program to simulate a perception network for pattern classification and function approximation. (CO2)

6. Write a program to demonstrate the working of the decision tree based ID3 algorithm.

Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample. (CO2)

7. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets. (CO3)

8. Write a program to implement the naïve Bayesian classifier for Iris data set. Compute the accuracy of the classifier, considering few test data sets. (CO3)

9. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set. (CO3)

10. Apply EM algorithm to cluster a Heart Disease Data Set. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and

comment on the quality of clustering. You can add Java/Python ML library classes/API in the program. (CO4)

11. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.(CO4)

12. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs. (CO4)

13. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples. (CO5)

14. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file. (CO5)

15. Solve optimal relay coordination as a linear programming problem using Genetic Algorithm. (CO5)

#### Text Books:

1. Machine Learning – Tom M. Mitchell - 7 02l, oiaaudElliH wrGcM
2. Introduction to Machine learning, Ethem Alpaydin, PHI, 3rd Edition, 2014.

#### Reference Books:

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis Chapman and Hall/CRC; 2nd edition, 2014
2. Machine Learning For Beginners: A Comprehensive Guide To Understand Machine Learning. How It Works And How Is Correlated To Artificial Intelligence And Deep Learning, Chris Neil, Alicex Ltd, 2020

#### Mapping of course outcomes with program outcomes

CO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02
C01	3	2		3									
C02	3	2	3		3						2		
C03	3	3	1		3							1	
C04	3	3									3		
C05	3	2	3		3						2		

#### Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for P01 to P011)	Level of Correlation (0-3)
1	C01: Evaluate	L5	P01 P02 P04	P01: Apply(L3) P02: Formulate (L6) P04: Analysis (L4)	3 2 3
2	C02: Apply	L3	P01 P02 P03 P05 P011	P01: Apply(L3) P02: Analyze (L4) P03: Develop(L3) P05: Apply (L3) P011: Thumb rule	3 2 3 3 2
3	C03: Analyze	L4	P01 P02	P01: Apply(L3) P02: Review (L2) P03: Design(L6) P04: Apply(L3)	3 3 1 3
4	C04: Analyze	L4	P01 P02	P01: Apply(L3) P02: Review (L2)	3 3



			<b>P011</b>	<b>P011: Thumb rule</b>	<b>3</b>
<b>5</b>	<b>CO4: Apply</b>	<b>L3</b>	<b>P01</b>	<b>P01: Apply(L3)</b>	<b>3</b>
			<b>P02</b>	<b>P02: Analyze (L4)</b>	<b>2</b>
			<b>P03</b>	<b>P03: Develop(L3)</b>	<b>3</b>
			<b>P05</b>	<b>P05: Apply (L3)</b>	<b>3</b>
			<b>P011</b>	<b>P011: Thumb rule</b>	<b>2</b>

### Justification Statements:

**CO 1: Evaluate** the procedures for various learning's to machine learning algorithms.

**Action Verb: Evaluate (L5)**

**P01: Apply (L3)**

CO1 Action verb is more than P01 verb. Therefore, the correlation is high (3)

**P02: Formulate (L6)**

CO1 Action verb is less than P02 verb by one level. Therefore, the correlation is moderate(2)

**P04: Analysis (L4)**

CO1 Action verb is more than P04 verb. Therefore, the correlation is high (3)

**CO 2: Apply** the Python programs for various Learning algorithms using Pandas and Matplotlib.

**Action Verb: Apply (L3)**

**P01: Apply (L3)**

CO2 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P02: Analyze (L4)**

CO2 Action verb is less than as P02 verb by one level. Therefore, the correlation is moderate (2)

**P03: Develop (L3)**

CO2 Action verb is same as P03 verb. Therefore, the correlation is high (3)

**P05: Apply (L3)**

CO2 Action verb is same as P05 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

Using orange to visualize real world solutions the correlation is moderate (2)

**CO 3: Analyze** the different data sets to the Machine Learning algorithm.

**Action Verb: Analyze (L4)**

**P01 Verb: Apply (L3)**

CO3 Action verb is more than P01 verb. Therefore, the correlation is high (3)

**P02 Verb: Review (L2)**

CO3 Action verb is more than P02 verb. Therefore, the correlation is high (3)

**P03 Verb: Design(L6)**

CO3 Action verb is less than P03 verb by two levels. Therefore, the correlation is low (1)

**P04 Verb: Apply (L3)**

CO3 Action verb is more than P04 verb. Therefore, the correlation is high (3)

**CO 4: Analyze** the various types of data set for clustering using k-Means algorithm

**Action Verb: Analyze (L4)**

**P01 Verb: Apply (L3)**

CO4Action verb is more than P01 verb. Therefore, the correlation is high (3)

**P02 Verb: Review (L2)**

CO4 Action verb is more than P02 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

Using orange to visualize real world solutions . Therefore, the correlation is high (3)

**CO 5: Apply** the Machine Learning algorithms to solve real world problems

**Action Verb: Apply (L3)**

**P01: Apply (L3)**

C05 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P02: Analyze (L4)**

C05 Action verb is less than as P02 verb by one level. Therefore, the correlation is moderate (2)

**P03: Develop (L3)**

C05 Action verb is same as P03 verb. Therefore, the correlation is high (3)

**P05: Apply (L3)**

C05 Action verb is same as P05 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

Using orange to visualize real world solutions. Therefore , the correlation is moderate (2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: III**

**Semester: II**

**Branch of Study: AIDS**

Course Code	Year & Sem	Cloud Computing Laboratory	L	T/CLC	P	C
20APC3025	III-II		0	0	3	1.5

**Course Outcomes:**

After studying the course, student will be able to

**CO 1: Understand** the various service delivery models of a cloud computing architecture.

**CO 2: Analyze** the installation of different cloud simulation tools and cloud setup tools.

**CO 3: Design** the web applications using various cloud platforms

**CO 4: Analyze** the various virtualization & Virtual Machine Provisioning tools such as Virtual Box, VMware.

**CO 5: Apply** Hadoop single node cluster and run simple applications.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the service delivery models of a cloud computing architecture.			L2
CO2	Analyze	the installation of different cloud simulation tools and cloud setup tools			L4
CO3	Design	the web applications	using various cloud platforms		L6
CO4	Analyze	the various virtualization & Virtual Machine Provisioning tools such as Virtual Box, VMware.			L4
CO5	Apply	Hadoop single node cluster and run simple applications.			L3

**List of Experiments**

1. To study in detail about cloud computing. **(CO1)**
2. Working of Google Drive to make spreadsheet and notes. **(CO1)**
3. Installation and Configuration of Justcloud. **(CO1)**
4. Working in Cloud9 to demonstrate different language. **(CO1)**
5. Install Google App Engine. Create hello world app and other simple web applications using python/java. **(CO2)**
6. Deployment and Configuration options in Google Cloud**(CO2)**
7. Install Virtual box/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8. **(CO2)**
8. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs**(CO2)**
9. Install Hadoop single node setup**(CO2)**
10. Develop hadoop application to count no of characters, no of words and each character frequency**(CO3)**

**Programs on SaaS**

11. Create an word document of your class time table and store locally and on the cloud with doc, and pdf format. ( use www.zoho.com and docs.google.com). **(CO3)**
12. Create a spread sheet which contains employee salary information and calculate gross and total sal using the formula DA=10% OF BASIC HRA=30% OF BASIC PF=10% OF BASIC IF BASIC<=3000 12% OF BASIC IF BASIC>3000 TAX=10% OF BASIC IF BASIC<=1500 =11% OF BASIC IF BASIC>1500 AND BASIC<=2500 =12% OF BASIC IF BASIC>2500 ( use www.zoho.com and docs.google.com) NET\_SALARY=BASIC\_SALARY+DA+HRA-PF-TAX**(CO3)**

13. Prepare a ppt on cloud computing –introduction , models, services ,andarchitecture Ppt should contain explanations, images and at least 20 pages ( use [www.zoho.com](http://www.zoho.com) and [docs.google.com](http://docs.google.com)). **(C04)**
14. Create your resume in a neat format using google and zoho cloud. **(C04)**

#### Programs on PaaS

15. Write a Google app engine program to generate n even numbers and deploy it to google cloud. **(C05)**
16. Google app engine program multiply two matrices. **(C05)**
17. Write a Google app engine program to display nth largest no from the given list of numbers and deploy it into google cloud. **(C05)**

#### Reference Books:

1. spoken-tutorial.org
2. Bart Jacob (Editor), –Introduction to Grid Computing, IBM Red Books, Vervante, 2005
3. Ian Foster, Carl Kesselman, –The Grid: Blueprint for a New Computing Infrastructure, 2nd Edition, Morgan Kaufmann

#### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	2	3											
C02	3	3	3	3	3								
C03	3	3	3	3	3					1			
C04	3	3	3	3	3				3		3		
C05	3	3	3	2	3						1		

#### Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	C01: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	C02: Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3)	3 3 3 3 3
3	C03: Design	L6	PO1 PO2 PO3 PO4 PO5 PO10	PO1: Apply(L3) PO2: Formulate (L6) PO3: Design(L6) PO4: Analyze (L4) PO5: Create (L6) PO10: Thumb rule	3 3 3 3 3 1
4	C04: Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO9	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3) PO9: Thumb rule	3 3 3 3 3 3
5	C05: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3) PO11: Thumb rule	3 3 3 2 3 1

## **Justification Statements :**

**CO 1: Understand** the various service delivery models of a cloud computing architecture.

**Action Verb: Understand (L2)**

**P01 Verb: Apply (L3)**

C01 Action verb is less than P01 verb by one level. Therefore, the correlation is medium (2)

**P02 Verb: Review(L2)**

C01 Action verb is same as P02 verb. Therefore, the correlation is high (3)

**CO 2: Analyze** the installation of different cloud simulation tools and cloud setup tools.

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

C02 Action verb is greater than as P01 verb. Therefore, the correlation is high (3)

**P02: identify(L3)**

C02 Action verb is greater than as P02 verb. Therefore, the correlation is high (3)

**P03: Develop (L3)**

C02 Action verb is greater than as P03 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

C02 Action verb is same as P04 verb. Therefore, the correlation is high (3)

**P05: Apply (L3)**

C02 Action verb is greater than as P05 verb. Therefore, the correlation is high (3)

**CO 3: Design** the web applications using various cloud platforms

**Action Verb: Design (L6)**

**P01: Apply (L3)**

C03 Action verb is greater than as P01 verb. Therefore, the correlation is high (3)

**P02: Formulate(L6)**

C03 Action verb is same as P02 verb. Therefore, the correlation is high (3)

**P03: Design (L6)**

C03 Action verb is same as P03 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

C03 Action verb is greater than as P04 verb. Therefore, the correlation is high (3)

**P05: create (L6)**

C03 Action verb is same as P05 verb. Therefore, the correlation is high (3)

**P010: Thumb rule**

Effective communication is required, reports to be generated between cloud users and service providers the correlation is low (1)

**CO 4: Analyze** the various virtualization & Virtual Machine Provisioning tools such as Virtual Box, VMware.

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

C04 Action verb is greater than as P01 verb. Therefore, the correlation is high (3)

**P02: identify(L3)**

C04 Action verb is greater than as P02 verb. Therefore, the correlation is high (3)

**P03: Develop (L3)**

C04 Action verb is greater than as P03 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

C04 Action verb is same as P04 verb. Therefore, the correlation is high (3)

**P05: Apply (L3)**

C04 Action verb is greater than as P05 verb. Therefore, the correlation is high (3)

**P09: Thumb rule**

Team work is required between cloud providers and cloud vendors to consumers in multi-disciplinary activities therefore, the correlation is high (3)

**CO 5: Apply** Hadoop single node cluster and run simple applications.

**Action Verb: Apply (L3)**

**P01: Apply (L3)**

C05 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P02: identify(L3)**

C05 Action verb is same as P02 verb. Therefore, the correlation is high (3)

**P03: Develop (L3)**

C05 Action verb is same as P03 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

C05 Action verb is less than P04 verb by one level. Therefore, the correlation is medium (2)

**P05: Apply (L3)**

C05 Action verb is same as P05 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

For some real world applications we can use Hadoop framework techniques therefore, the correlation is low (1)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: III**

**Semester: II**

**Branch of Study: AIDS**

Course Code	Year & Sem	SOFT SKILLS LAB	L	T	P	C
20ASA0502	III-II		1	0	2	2

**Course Outcomes:**

After studying the course, student will be able to

**C01: Understand** the importance of verbal and non-verbal skills

**C02: Apply** the interpersonal and intrapersonal skills

**C03: Apply** the grammatical structures to formulate sentences and correct word forms.

**C04: Understand** the trust among people and develop employability skills

**C05: Evaluate** the skills needed for approaching different types of interviews.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	the importance of verbal and non-verbal skills			L2
2	Apply	the interpersonal and intrapersonal skills			L3
3	Apply	the grammatical structures	to formulate sentences and correct word forms.		L3
4	Understand	the trust among people and develop employability skills			L2
5	Evaluate	the skills needed	for approaching different types of interviews.		L5

**UNIT – I:**

**Grammar:** Articles, Prepositions, Antonyms, Synonyms.

**Vocabulary:** Basics of Communication (Definition, Types of communication). Importance of body language in corporate culture, Body language ( Facial expressions – eye contact – posture – gestures – Proxemics – Haptics – Dress Code – Paralanguage – Tone, pitch, pause & selection of words), Impromptu speeches.

Articles:

Web links: <https://learnenglish.britishcouncil.org/grammar/a1-a2-grammar/articles-1>  
<https://www.youtube.com/watch?v=ueEp6U8td1I>

Prepositions:

Web links: <https://www.grammarbook.com/grammar/probPrep.asp>

Antonyms, Synonyms.

Web links: <https://www.youtube.com/watch?v=-mLRoxWM8dI>  
<https://www.youtube.com/watch?v=IEOrOPVMxiM>

[https://www.ititb.ac.in/~vijaya/ssrvn/worksheetscd/getWorksheets.com/Language%20Arts/syn\\_ant.pdf](https://www.ititb.ac.in/~vijaya/ssrvn/worksheetscd/getWorksheets.com/Language%20Arts/syn_ant.pdf)

Basics of Communication (Definition , Types of communication).

Web links: [https://wikieducator.org/INTRODUCTION\\_TO\\_COMMUNICATION](https://wikieducator.org/INTRODUCTION_TO_COMMUNICATION)

Importance of body language in Corporate culture

Web links: <https://www.forwardfocusinc.com/consciously-communicate/the-importance-of-body-language-in-the-workplace/>

Body language ( Facial expressions – eye contact – posture – gestures – Proxemics – Haptics – Dress Code – Paralanguage –Tone, pitch, pause & selection of words)

Web links: <https://open.lib.umn.edu/communication/chapter/4-2-types-of-nonverbal-communication/>

[https://en.wikipedia.org/wiki/Nonverbal\\_communication](https://en.wikipedia.org/wiki/Nonverbal_communication)

*Impromptu speeches.*

Web links: <https://www.write-out-loud.com/impromptu-public-speaking-topics.html>;

<https://faculty.washington.edu/mcgarrit/COM220/online%20readings/sample%20critique.pdf>

## **UNIT – II :**

**Grammar:** Tenses, Idioms and Phrases, One word substitutes.

**Vocabulary:** Public speaking - *Oral presentations*, writing skills – *Short Essay writing and E- mail writing.*

Tenses

Web links: [https://www.englisch-hilfen.de/en/grammar/english\\_tenses.htmj](https://www.englisch-hilfen.de/en/grammar/english_tenses.htmj);

<https://onlymyenglish.com/tenses/>;

<https://www.englishpage.com/verbpage/verbtenseintro.html>;

<https://www.englishclub.com/grammar/verb-tenses.htm>

Idioms and Phrases:

Web links: <https://www.britannica.com/list/7-everyday-english-idioms-and-where-they-come-from>

<https://eslexpat.com/english-idioms-and-phrases/>;

<https://onlineteachersuk.com/english-idioms/>;

One word substitutes:

Web links: <https://www.careerpower.in/one-word-substitution.html>;

<https://www.hitbullseye.com/Vocab/One-Word-Substitute-List.php>;

<https://englishan.com/one-word-substitution-set-1/>;

Public speaking - *Oral presentations*

Web links: <https://egyankosh.ac.in/bitstream/123456789/26773/1/Unit-14.pdf>;

<https://www.skillsyouneed.com/rhubarb/preparing-oral-presentations.html>;

<https://courses.lumenlearning.com/publicspeakingprinciples/chapter/chapter-12-methods-of-delivery/>

Writing skills – *Short Essay writing and E-mail writing.*

Web links: <https://www.kibin.com/essay-writing-blog/important-essay-writing-skills/>

[https://www.scribendi.com/academy/articles/academic\\_essay\\_writing\\_skills.en.html](https://www.scribendi.com/academy/articles/academic_essay_writing_skills.en.html) ;

<https://www.microsoft.com/en-us/microsoft-365/business-insights-ideas/resources/improve-email-writing-skills>;

## **UNIT – III :**

**Grammar :** Direct and Indirect speeches, Active and Passive voice, Drawing inferences (reading comprehensions and listening comprehensions)

**Vocabulary:** Leadership Skills – Negotiation skills - Team-building – *Debate.* Leadership Skills – Negotiation skills - Team-building

Direct and Indirect speeches:

Web links: <https://onlymyenglish.com/direct-and-indirect-speech/>

<https://learnenglish.britishcouncil.org/grammar/b1-b2-grammar/reported-speech-1-statements>

<https://www.perfect-english-grammar.com/reported-speech.html>

Active and Passive voice,

Web links: <https://www.englishclub.com/grammar/passive-voice.htm>

<https://www.gingersoftware.com/content/grammar-rules/verbs/passive-voice/>

<https://nps.edu/web/gwc/revising-passive-voice-into-active-voice>

Drawing inferences (reading comprehensions and listening comprehensions)

Web links: <https://www.readingrockets.org/strategies/inference>

<https://www.thoughtco.com/making-inferences-3111201>



<https://www.comprehensionconnection.net/2019/03/exploring-difference-between-making.html>

Vocabulary: Leadership Skills – Negotiation skills - Team-building – *Debate*.

Leadership Skills – Negotiation skills - Team-building

Web links: <https://online.hbs.edu/blog/post/negotiation-skills>

<https://www.bumc.bu.edu/facdev-medicine/files/2014/08/BUSM-Leadership-training.pdf>

<https://in.indeed.com/career-advice/career-development/negotiation-skills>

<https://www.thebalancecareers.com/what-is-team-building-1918270>

Debate:

Web links: <https://noisyclassroom.com/debate-topics/>

<https://www.collegeessay.org/blog/debate-topics>

[https://www.edu.gov.mb.ca/k12/cur/socstud/frame\\_found\\_sr2/tns/tn-13.pdf](https://www.edu.gov.mb.ca/k12/cur/socstud/frame_found_sr2/tns/tn-13.pdf)

#### **UNIT – IV:**

**Grammar:** Common errors, Rearrangement of sentences.

**Vocabulary:** Resume writing, Pre-interview preparation , Group discussion.

Common errors, Rearrangement of sentences:

Web links: <https://www.letsstudytogether.co/sentence-arrangement-questions-pdf-for-banking-exams-ibps-sbi-po-and-clerk/>

<https://www.youtube.com/watch?v=e8nO3zZzkZs>

Vocabulary: Resume writing, Pre-interview preparation , Group discussion.

Web links: <https://www.youtube.com/watch?v=PfJg-67smf4>

<https://www.youtube.com/watch?v=-lXjbph22Fk>

#### **UNIT – V:**

**Grammar :** Verbal ability tests.

**Vocabulary:** Mock interviews, Post interview Etiquette.

Verbal ability tests.

Web links: <https://prepinsta.com/infosys-english-verbal-questions/>

<https://www.indiabix.com/online-test/verbal-ability-test/random>

<https://www.allindiaexams.in/online-test/online-general-english-test/61>

Vocabulary: Mock interviews, Post interview Etiquette.

Web links: <https://www.youtube.com/watch?v=ZOLCMa2QbdE>

<https://www.ziprecruiter.com/blog/the-right-way-to-follow-up-after-a-job-interview/>

<https://www.youtube.com/watch?v=KIoD19uox8>

#### **References:**

1. Barun K. Mitra, "Personality Development and Soft Skills", OXFORD Higher Education 2018.
2. Alka Wadkar, "Life Skills for Success", Sage publications 2016.
3. Robert M Sheffield, "Developing Soft Skills", Pearson, 2010.
4. Diana Booher, "Communicate with Confidence" Tata mcgraw hill, 1994.
5. B.N. Gosh, "Managing Soft skills for Personality development", Tata mcgraw hill 2012.
6. Michael Swan, "[Practical English Usage](#)", Oxford publications.
7. Raymond Murphy, "English Grammar in Use", Cambridge 5<sup>th</sup> Edition
8. Norman Lewis, "Word Power Made Easy", Penguin Publishers.
9. Advanced Grammar in Use A Self-Study Reference and Practice Book for Advanced Learners  
of English 3<sup>rd</sup> Edition , Cambridge

### Correlation of COs with the POs & PSOs

Course Outcomes COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1						2					
CO2									2		
CO3										2	
CO4									2		
CO5											3

**\*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated**

#### Correlation Matrix :

C O	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO6 to PO11)	Level of Correlation (0-3)
	(Approx. Hrs)	%	corr	Verb	BTL			
1	09	21	3	Understand	L2	PO6	Thumb Rule	2
2	09	21	3	Apply	L3	PO9	Thumb Rule	2
3	06	14	2	Apply	L3	PO10	Thumb Rule	2
4	06	14	2	Understand	L2	PO9	Thumb Rule	2
5	06	14	2	Evaluate	L5	PO11	Thumb Rule	3

#### CO-PO mapping justification:

**CO1:** Understand the importance of verbal and non-verbal skills

#### Action Verb: Understand (L2)

CO1 Action Verb Understand is of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

**CO2:** Apply the interpersonal and intrapersonal skills

#### Action Verb: Apply (L3)

CO2 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2)

**CO3:** Apply grammatical structures to formulate sentences and correct word forms.

#### Action Verb: Apply (L3)

CO3 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).

**CO4:** Understand trust among people and develop employability skills

#### Action Verb: Understand (L2)

C04 Action Verb Understand is of BTL 3. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

**C05:** Evaluate the skills needed for approaching different types of interviews.

**Action Verb: Evaluate (L5)**

C05 Action Verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 to PO11 as high (3).



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: III**

**Semester: II**

**Branch of Study: AIDS**

Course Code	Year & Sem	PROFESSIONAL ETHICS AND HUMAN VALUES	L	T/CLC	P	C
20AMC9904	III-II		2	0	0	0

**Course Outcomes:**

After studying the course, student will be able to

**C01: Understand** the sustained happiness through identifying the essentials of human values and skills.

**C02: Understand** the importance of Values and Ethics in their personal lives and professional careers.

**C03: Understand** the rights and responsibilities as an employee, team member and a global citizen.

**C04: Understand** the importance of trust, mutually satisfying human behavior and enriching interaction with nature.

**C05: Understand** appropriate technologies and management patterns to create harmony in professional and personal life.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	<b>Understand</b>	The sustained happiness	through identifying the essentials of human values and skills		<b>L2</b>
2	<b>Understand</b>	the importance of Values and Ethics		in their personal lives and professional careers.	<b>L2</b>
3	<b>Understand</b>	the rights and responsibilities	as an employee, team member and a global citizen.		<b>L2</b>
4	<b>Understand</b>	the importance of trust, mutually satisfying human behavior and enriching interaction with nature.			<b>L2</b>
5	<b>Understand</b>	appropriate technologies and management patterns		to create harmony in professional and personal life.	<b>L2</b>

<b>UNIT - I</b>	9 Hrs
Introduction to Human Values: Need, basic Guidelines, Content and Process for Value Education, Self Exploration - 'Natural Acceptance' and Experiential Validation. Continuous Happiness and Prosperity - A look at basic Human Aspirations. Right understanding, Relationship and Physical Facilities. Understanding Happiness and Prosperity correctly.	
<b>UNIT - II</b>	9Hrs
Understanding Harmony in the Family and Society: Harmony in Human - Human Relationship: Understanding harmony in the Family the basic unit of human interaction. Understanding values in human - human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect ( Samman) as the foundational values of relationship. Understanding the harmony in the society ( society being an extension of family). Visualizing a universal harmonious order in society - Undivided Society ( Akhand Samaj), Universal Order ( Sarvabhaum Vyawastha) - from family to world family!	

<b>UNIT - III</b>		9 Hrs
Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.		
<b>UNIT - IV</b>		9 Hrs
Professional Practices in Engineering: Work Place Rights & Responsibilities, Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession. Central Responsibilities of Engineers – The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walk away Collapse.		
<b>UNIT - V</b>		9 Hrs
Global issues in Professional Ethics: Introduction – Current Scenario, Technology Globalization of MNCs, International Trade, World Summits, Issues, Business Ethics and Corporate Governance, Sustainable Development Ecosystem, Energy Concerns, Ozone Depletion, Pollution, Ethics in Manufacturing and Marketing, Media Ethics, War Ethics, Bio Ethics, Intellectual Property Rights.		
<b>Textbooks:</b>		
1. R. R. Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics. 2. Professional Ethics: R. Subramanian, Oxford University Press, 2015. 3.Ethics in Engineering Practice & Research, Caroline Whitbeck, 2e, Cambridge University Press 2015.		
<b>Reference Books:</b>		
1. Prof. K. V. Subba Raju, 2013, Success Secrets for Engineering Students, Smart Student Publications, 3rd Edition. 2. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA 3.Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S Pritchard Michael J Rabins, 4e , Cengage learning, 2015. 4.Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008.		
<b>Online Learning Resources:</b>		
<a href="https://www.youtube.com/watch?v=9LSEBK03CiY&amp;list=PLysZquKdjuWSv87TaE7pByn5TE_e4602C">https://www.youtube.com/watch?v=9LSEBK03CiY&amp;list=PLysZquKdjuWSv87TaE7pByn5TE_e4602C</a>		

#### Mapping of COs to POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
1											2
2								2	2		
3						2			2		
4						2		2			
5					1		2				2

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

#### CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	8	27	2	Understand	L2	PO11	Thumb Rule	2
2	8	26	2	Understand	L2	PO8, PO9	Thumb Rule	2

							Thumb Rule	
3	4	13	2	Understand	L2	PO6, PO9	Thumb Rule Thumb Rule	2 2
4	5	17	2	Understand	L2	PO6, PO8	Thumb Rule Thumb Rule	2 2
5	5	17	2	Understand	L2	PO5, PO7, PO11	PO5 : APPLY Thumb Rule Thumb Rule	1 2 2

**C01:** Understand sustained happiness through identifying the essentials of human values and skills.

**Action Verb: Understand (L2)**

C01 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

**C02:** Understand the importance of Values and Ethics in their personal lives and professional careers.

**Action Verb: Understand (L2)**

C02 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

**C03:** Understand the rights and responsibilities as an employee, team member and a global citizen.

**Action Verb: Understand (L2)**

C03 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

**C04:** Understand the importance of trust, mutually satisfying human behavior and enriching interaction with nature.

**Action Verb: Understand (L2)**

C04 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

**C05:** Understand appropriate technologies and management patterns to create harmony in professional and personal life.

**Action Verb: Understand (L2)**

C05 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

C05 Action Verb is understand of BTL 2. Using action verb apply, L2 correlates PO5 as low (1).

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI**

**(AUTONOMOUS)**

**B. Tech - Artificial Intelligence and Data Science (AI&DS)**  
**(Effective for the batches admitted from 2020-21)**

**Semester VII (Fourth year)**

Sl. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P				
1	PE-3	20APE3007 20APE3008 20APE3009	Predictive Analytics Information Retrieval Techniques Deep Learning Techniques	4	2	0	3	30	70	100
2	JOE/OE-2	20AOE3001 20AOE3002/ 20APE3011 20AOE3003 20AOE3004 20AOE3005 20AOE3006	Natural Language Processing Virtual Reality Applications of AI AI for Image Analysis Ethics And Privacy In AI Reinforcement Learning	4	2	0	3	30	70	100
3	PE-4	20APE3016 20APE3017 20APE3018	Data Analytics Software Project Management Linux Environment System	4	2	0	3	30	70	100
4	PE -5	20APE3019 20APE3020 20APE3021 20APE3022 20APE3023	Data Science Applications Data Science for Business Data Stream Mining Process mining Computer Vision	4	2	0	3	30	70	100
5	OE -3	20APE0407 20APE0411 20AOE3601 20APE0415	Digital Image Processing Embedded Systems Enabling Technologies for data science and analytics :IOT Wireless Communications	4	2	0	3	30	70	100
6	HE	20AOE0302 20AOE9901 20AHSMB02	Management Science English for Research Paper Writing Entrepreneurship Development	4	2	0	3	30	70	100
7	SC	20ASC3004	Exploratory Data Analysis with R	1	0	2	2	100	0	100
8	PR	20APR3001	Evaluation of Industry Internship(III-II Summer Internship)	0	0	0	3	100	0	100
<b>Total credits</b>							<b>23</b>	<b>380</b>	<b>420</b>	<b>800</b>



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	PREDICTIVE ANALYTICS	L	T/CLC	P	C
20APE3007	IV-I		4	2	0	3

**Course Outcomes:**

After Studying the Course, student will be able to

**CO1: Understand** the basic concepts of Predictive Analytics in real time applications.

**CO2: Analyze** the various classification methods for different types of Machine Learning Algorithms.

**CO3: Analyze** the object segmentation methods for decision tree algorithms.

**CO4: Apply** the time series methods to find accuracy and performance in prediction.

**CO5: Apply** the standard optimization procedures for documentation and knowledge sharing.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the basic concepts of Predictive Analytics in real time applications			L2
CO2	Analyze	the various classification methods		for different types of Machine Learning Algorithms	L4
CO3	Analyze	the object segmentation methods		for decision tree algorithms	L4
CO4	Apply	the time series methods		to find accuracy and performance in prediction	L3
CO5	Apply	the standard optimization procedures		for documentation and knowledge sharing	L3

<b>UNIT - I</b>	<b>Introduction to Predictive Analytics &amp; Linear Regression (NOS 2101)</b>	<b>10 Hrs</b>
<b>Introduction to Predictive Analytics &amp; Linear Regression (NOS 2101):</b> What and Why Analytics, Introduction to Tools and Environment, Application of Modeling in Business, Databases & Types of data and variables, Data Modeling Techniques, Missing imputations etc. Need for Business Modeling, Regression — Concepts, Blue property-assumptions-Least Square Estimation, Variable Rationalization, and Model Building etc..		
<b>UNIT - II</b>	<b>Logistic Regression (NOS 2101)</b>	<b>10Hrs</b>
<b>Logistic Regression (NOS 2101):</b> Model Theory, Model fit Statistics, Model Conclusion, Analytics applications to various Business Domains etc. Regression Vs Segmentation — Supervised and Unsupervised Learning, Tree Building — Regression, Classification, Over fitting, Pruning and complexity, Multiple Decision Trees etc.		
<b>UNIT - III</b>	<b>Objective Segmentation (NOS 2101)</b>	<b>9 Hrs</b>
<b>Objective Segmentation (NOS 2101):</b> Regression Vs Segmentation — Supervised and Unsupervised Learning, Tree Building — Regression, Classification, Over fitting, Pruning and complexity, Multiple Decision Trees etc. Develop Knowledge, Skill and Competences (NOS 9005) Introduction to Knowledge skills & competences, Training & Development, Learning & Development, Policies and Record keeping, etc.		
<b>UNIT - IV</b>	<b>Time Series Methods I Forecasting</b>	<b>8 Hrs</b>
<b>Time Series Methods I Forecasting, Feature Extraction (NOS 2101):</b> Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height. Average, Energy etc and Analyze for prediction.		
<b>UNIT - V</b>	<b>Working with Documents (NOS 0703):</b>	<b>8 Hrs</b>
<b>Working with Documents (NOS 0703):</b> Standard Operating Procedures for documentation and knowledge sharing, Defining purpose and scope documents, Understanding structure of documents — case studies, art ideas, white papers, technical reports, minutes of meeting etc., Style and format, Intellectual Property and Copyright, Document preparation tools — Vision, PowerPoint, Word, Excel etc., Version Control, Accessing and updating corporate knowledge base, Peer review and feedback.		
<b>Textbooks:</b>		



**Reference Books:**

1. Gareth James' Daniela Witten Trevor Hastie Robert Tibshirani. An Introduction to Statistical
2. Learning with Applications in R

**Mapping of course outcomes with program outcomes**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	2	2		2							
CO2	3	3	3	3	3						3		
CO3	3	3	3	3	3								
CO4	3	3	3	2	3								
CO5	3	3	3	2	3					2			

**Mapping of course outcomes with program outcomes**

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s): Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1 PO2 PO3 PO5 PO6	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO5: Apply(L3) Thumb Rule	2 3 2 2 2
2	CO2: Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11:Thumb Rule	3 3 3 3 3 3
3	CO3: Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3 3
4	CO4: Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 2 3
5	CO4: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO10	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO10:Thumb Rule	3 3 3 2 3 2

**Justification Statements:**

**CO1: Understand** the basic concepts of Predictive Analytics in real time applications.

**Action Verb: Understand(L2)**

**PO1: Apply(L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)

**PO2: Review(L2)**

CO1 Action verb is same as PO2 verb. Therefore, the correlation is high (3)

**PO3: Develop(L3)**

CO1 Action verb is less than PO3 verb by one level. Therefore, the correlation is medium (2)

**PO5: Apply(L3)**

CO1 Action verb is less than PO5 verb by one level. Therefore, the correlation is medium (2)

**PO6: Thumb Rule**

Since basic of predictive analytics are needed to solve large complex engineering problems. Therefore correlation is medium(2).

**C02: Analyze** the various classification methods for different types of Machine Learning Algorithms.

**Action Verb: Analyze(L4)**

**P01: Apply(L3)**

C02 Action verb is greater than P01 verb. Therefore, the correlation is high (3)

**P02: Review(L2)**

C02 Action verb is greater than P02 verb. Therefore, the correlation is high (3)

**P03: Develop(L3)**

C02 Action verb is greater than P03 verb. Therefore, the correlation is high (3)

**P04: Analyze(L4)**

C02 Action verb is same as P04 verb. Therefore, the correlation is high (3)

**P05: Apply(L3)**

C02 Action verb is greater than P05 verb. Therefore, the correlation is high (3)

**P011: Thumb Rule**

Machine learning algorithms like supervised and unsupervised learning are used to give predictions for classification methods. Therefore the correlation is high(3).

**C03: Analyze** the object segmentation methods for decision tree algorithms.

**Action Verb: Analyze(L4)**

**P01: Apply(L3)**

C03 Action verb is greater than P01 verb. Therefore, the correlation is high (3)

**P02: Review(L2)**

C03 Action verb is greater than P02 verb. Therefore, the correlation is high (3)

**P03: Develop(L3)**

C03 Action verb is greater than P03 verb. Therefore, the correlation is high (3)

**P04: Analyze(L4)**

C03 Action verb is same as P04 verb. Therefore, the correlation is high (3)

**P05: Apply(L3)**

C03 Action verb is greater than P05 verb. Therefore, the correlation is high (3)

**C04: Apply** the time series methods to find accuracy and performance in prediction.

**Action Verb: Apply(L3)**

**P01: Apply(L3)**

C04 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P02: Review(L2)**

C04 Action verb is greater than P02 verb. Therefore, the correlation is high (3)

**P03: Develop(L3)**

C04 Action verb is same as P03 verb. Therefore, the correlation is high (3)

**P04: Analyze(L4)**

C04 Action verb is less than P04 verb by one level. Therefore, the correlation is medium (2)

**P05: Apply(L3)**

C04 Action verb is same as P05 verb. Therefore, the correlation is high (3)

**C05: Apply** the standard optimization procedures for documentation and knowledge sharing.

**Action Verb: Apply(L2)**

**P01: Apply(L3)**

C05 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P02: Review(L2)**

C05 Action verb is greater than P02 verb. Therefore, the correlation is high (3)

**P03: Develop(L3)**

C05 Action verb is same as P03 verb. Therefore, the correlation is high (3)

**P04: Analyze(L4)**

C05 Action verb is less than P04 verb by one level. Therefore, the correlation is medium (2)

**P05: Apply(L3)**

C05 Action verb is same as P05 verb. Therefore, the correlation is high (3)

**P010: Thumb Rule**

Knowledge sharing and preparing standard documentations are useful to prepare technical reports which helps in understand documentation. Therefore the correlation is medium(2).



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	Information Retrieval Techniques	L	T/CLC	P	C
20APE3008	IV-I		4	2	0	3

**Course Outcomes:**

After Studying the Course, student will be able to

**C01: Understand** the information retrieval search engine framework and explore its capabilities.

**C02: Understand** different models to acquire knowledge and pre-processing of web page.

**C03: Analyze** appropriate methods of classification or clustering.

**C04: Design** the web retrieval using search engines.

**C05: Analyze** different techniques of recommender system.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	Utilize the information of retrieval models		Search Engine Framework	L2
C02	Understand	document vector space and probabilistic models		Web Page	L2
C03	Analyze	Various supervised and un supervised learning methods		Machine Learning Algorithms	L4
C04	Design	Operate on various search engine systems	Search Engines		L4
C05	Analyze	To understand search engine functionality	Data Models		L4

<b>UNIT - I</b>	<b>Information Retrieval</b>	<b>9 Hrs</b>
<b>Information Retrieval</b> – Early Developments – The IR Problem – The User's Task – Information versus Data Retrieval – The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes – The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.		
<b>UNIT - II</b>	<b>MODELING AND RETRIEVAL EVALUATION</b>	<b>9Hrs</b>
<b>MODELING AND RETRIEVAL EVALUATION</b> : Basic IR Models - Boolean Model - TF-IDF (Term Frequency/Inverse Document Frequency) Weighting - Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.		
<b>UNIT - III</b>	<b>TEXT CLASSIFICATION AND CLUSTERING</b>	<b>9 Hrs</b>
<b>TEXT CLASSIFICATION AND CLUSTERING:</b> A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – k-NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing.		
<b>UNIT - IV</b>	<b>WEB RETRIEVAL AND WEB CRAWLING</b>	<b>9 Hrs</b>
<b>WEB RETRIEVAL AND WEB CRAWLING:</b> The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations -- Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.		
<b>UNIT - V</b>	<b>RECOMMENDER SYSTEM</b>	<b>9 Hrs</b>
<b>RECOMMENDER SYSTEM</b> : Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models – Neighborhood models.		
<b>Textbooks:</b>		
1. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, –Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011.		

2. Ricci, F, Rokach, L. Shapira, B.Kantor, —Recommender Systems Handbook, First Edition, 2011.

**Reference Books:**

1. C. Manning, P. Raghavan, and H. Schütze, —Introduction to Information Retrieval, Cambridge University Press, 2008.

2. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, —Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.

#### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2											
CO2	2	2			2								
CO3	2	2		3	1				1				
CO4	2		3	2									
CO5	1		1	3		1		1			1		

#### Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Identify(L3)	2 2
2	CO2: Understand	L2	PO1 PO2 PO5	PO1: Apply(L3) PO2: Identify(L3) PO5: Apply(L3)	2 2 2
3	CO3: Analyze	L4	PO1 PO2 PO4 PO9	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze(L4) PO9: Thumb rule	2 2 3 1
4	CO4: Design	L4	PO3 PO4	PO3: Design (L6) PO4: Interpret(L5)	3 2
5	CO5: Analyze	L4	PO1 PO2 PO3 PO4 PO6 PO8 PO11	PO2: Formulate(L6) PO3: Design (L6) PO4: Analyze(L4) PO6: Thumb rule PO8: Thumb rule PO11: Thumb rule	1 1 3 1 1 1 1

#### Justification Statements:

**CO1: Understand the information retrieval search engine framework and explore its capabilities.**

**Action Verb : Understand(L2)**

**PO1 Verb : Apply(L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

**PO2 Verb : Identify(L3)**

CO1 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)

**CO2: Understand different models acquire knowledge and pre-processing of web page.**

**Action Verb : Understand(L2)**

**PO1: Apply(L3)**

CO2 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

**PO2: Identify(L3)**

CO2 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)

**PO5: Apply(L3)**

CO2 Action verb is less than PO5 verb by one level. Therefore the correlation is medium (2)

**C03: Analyze appropriate methods of classification or clustering.**

**Action Verb : Analyze (L4)**

**P01: Apply(L3)**

C03 Action verb is less than P01 verb by one level. Therefore the correlation is medium (2)

**P02: Identify (L3)**

C03 Action verb is less than P02 verb by one level. Therefore the correlation is medium (2)

**P04: Analyze (L4)**

C03 Action verb is same level as P04 verb. Therefore the correlation is high (3)

**P05: Create(L6)**

C03 Action verb is less than P05 verb by two levels. Therefore the correlation is low (1)

**P09 : Thumb rule**

Finding solution to real world problems. Hence the correlation is low (1)

**C04: Design the web retrieval using search engines.**

**Action Verb: Design (L6)**

**P01 Verb : Apply(L3)**

C01 Action verb is less than P01 verb by one level. Therefore the correlation is medium (2)

**P03: Design (L6)**

C04 Action verb is same level as P03 verb. Therefore the correlation is high (3)

**P04: Interpret (L5)**

C04 Action verb is greater than P04 verb by one level. Therefore the correlation is high(3)

**C05: Analyze different techniques of recommender system.**

**Action Verb : Analyze (L4)**

**P02: Formulate (L6)**

C05 Action verb is less than two levels as P02 verb. Therefore the correlation is low(1)

**P03: Design (L6)**

C05 Action verb is less than two levels as P02 verb. Therefore the correlation is low(1)

**P04: Analyze (L4)**

C05 Action verb is same level as P04 verb. Therefore the correlation is high (3)

**P06 : Thumb rule**

Since ethical principles should be followed to create a recommender systems and services to users. Therefore the correlation is low(1)

**P08 : Thumb rule**

Team work is required between recommender system users and providers. Hence the correlation is low (1)

**P011: Thumb rule**

For some of real world applications we use recommender systems to provide services. Therefore the correlation is low (1)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI**  
**(AUTONOMOUS)**  
**Artificial Intelligence and Data Science**  
**(AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	Deep Learning Techniques	L	T/CLC	P	C
20APE3009	IV-I		4	2	0	3

**Course Outcomes:**

After Studying the Course, student will be able to

- C01: **Understand** the basic concepts of maths and statistics used for machine learning.
- C02: **Understand** the foundations of neural networks and deep learning
- C03: **Analyze** the common architecture principles of deep networks.
- C04: **Apply** the deep learning research models on linear factor models and auto encoders
- C05: **Evaluate** the deep generating models for deep learning applications

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	basic concepts of maths and statistics used		for machine learning.	L2
C02	Understand	the foundations of neural networks and deep learning			L2
C03	Analyse	the common architecture principles of deep networks.			L4
C04	Apply	the deep learning research models		on linear factor models and auto encoders	L3
C05	Evaluate	The deep generating models		for deep learning applications	L5

<b>UNIT - I</b>	<b>A Review of Machine Learning</b>	<b>9 Hrs</b>
<b>A Review of Machine Learning:</b> The Learning Machines, The Math Behind Machine Learning: Linear Algebra, The Math Behind Machine Learning: Statistics, How Does Machine Learning Work?, Logistic Regression, The Logistic Function, Evaluating Models, Building an Understanding of Machine Learning		
<b>UNIT - II</b>	<b>Foundations of Neural Networks and Deep Learning</b>	<b>9Hrs</b>
<b>Foundations of Neural Networks and Deep Learning :</b> Neural Networks: Biological Neuron, Perceptron, Multi Layer Perceptron. <b>Training Neural Networks:</b> Back-propagation, Activation Functions, Loss Function, Hyper-parameters.		
<b>UNIT - III</b>	<b>Fundamentals of Deep Learning</b>	<b>9 Hrs</b>
<b>Fundamentals of Deep Learning:</b> Definition of Deep Learning, Common Architecture Principles of Deep Networks, Building Blocks of Deep Learning. <b>Architectures of Deep Learning:</b> Unsupervised Pre trained Networks, Convolution Neural Networks (CNN's), Recurrent Neural Networks, and Recursive Neural Networks		
<b>UNIT - IV</b>	<b>Deep Learning Research</b>	<b>9 Hrs</b>
<b>Deep Learning Research: Linear factor models:</b> Probabilistic PCA And Factor Analysis, Independent Component Analysis, Sparse Coding, Manifold Interpretation of PCA, <b>Auto Encoders:</b> Regularized Autoencoders, Representational Power, Layer Size and Depth, Denoising Autoencoders, Applications of Autoencoders.		
<b>UNIT - V</b>	<b>Deep Generating Models</b>	<b>9 Hrs</b>
<b>Deep Generating Models:</b> Boltzmann Machines, Restricted Boltzmann Machines, Deep Belief Networks, Deep Boltzmann Machines, Convolution Boltzmann Machines, Backpropagation through Random Operations, Directed Generative Nets, Generating Static Networks. <b>Applications:</b> Large Scale Deep Learning, Image Recognition, Speech Recognition, Natural Language Processing, Other Applications.		
<b>Textbooks:</b>		
<ol style="list-style-type: none"> <li>1. Deep Learning A practitioner's approach- josh Patterson and Adam Gibson, OREILLY.</li> <li>2. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.</li> </ol>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt. Ltd, 2009.</li> <li>2. Matrix Computations, Golub, G.,H., and Van Loan,C.,F, JHU Press,2013.</li> <li>3. Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-Hill Education, 2004.</li> <li>4. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.</li> </ol>		

### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	2	1									2	3	
C02	2	1				2					2		
C03	3	3	1	1	1	2					2		
C04	3	2									2		
C05	3	3	3	3	3						2		

### Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	13	22%	3	CO1: Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO11: Thumb rule	2 1 2
2	09	15%	2	CO2: Understand	L2	PO1 PO2 PO6 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO6: Thumb rule PO11: Thumb rule	2 1 2 2
3	14	23%	3	CO3: Analyse	L4	PO1 PO2 PO3 PO4 PO5 PO6 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO3: Design (L6) PO4: Design (L6) PO5: Create(L6) PO6: Thumb rule PO11: Thumb rule	3 3 1 1 1 2 2
4	10	17%	2	CO4: Apply	L3	PO1 PO2 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO11: Thumb rule	3 2 2
5	14	23%	3	CO5: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop(L3) PO4: Design (L6) PO5: Create(L6) PO11: Thumb rule	3 3 3 2 2 3
	60	100%						

### Justification Statements :

**CO1: Understand** basic concepts of maths and statistics used for machine learning.

**Action Verb : Understand(L2)**

**PO1 Verb : Apply(L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is Medium (2)

**PO2 Verb : Analyze(L4)**

CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is Low (1)

**PO11: Thumb rule**

New statistical methods were derived and applied to solve various problems related to Deep Learning.

Therefore the correlation is medium (2)

**CO2: Understand** the foundations of neural networks and deep learning.

**Action Verb : Understand (L2)**

**PO1: Apply(L3)**

CO2 Action verb is less than PO1 verb by one level. Therefore, the correlation is Medium (2)

**PO2: Analyze(L4)**

CO2 Action verb is less than PO2 verb by two level. Therefore, the correlation is Low (1)

**PO6: Thumb rule**

New innovations with more complex and layered neural networks are applied to address the various societal needs related to Deep Learning applications. Therefore the correlation is medium (2)

**P011: Thumb rule**

New innovations with more complex and layered neural networks are derived to address the issues present in new trends of data. Therefore the correlation is medium (2)

**C03: Analyse** the common architecture principles of deep networks.

**Action Verb : Analyse (L4)**

**P01: Apply(L3)**

C03 Action verb is greater level of P01 verb. Therefore, the correlation is High (3)

**P02: Analyze (L4)**

C03 Action verb is Same level as P02 verb. Therefore, the correlation is High (3)

**P03: Design (L6)**

C03 Action verb is less than P03 verb by two level. Therefore the correlation is Low(1)

**P04: Design (L6)**

C03 Action verb is less than P04 verb by two level. Therefore the correlation is Low(1)

**P05: Create(L6)**

C03 Action verb is less than P05 verb by two level. Therefore the correlation is Low(1)

**P06 : Thumb rule**

New versions of architecture principles of deep networks were applied to address the societal needs. Therefore, the correlation is medium (2)

**P011: Thumb rule**

New innovations with more complex and layered deep networks are derived to address issues present in data set. Therefore the correlation is medium (2)

**C04: Apply** the deep learning research models on linear factor models and auto encoders.

**Action Verb : Apply (L3)**

**P01: Apply(L3)**

C04 Action verb is same level of P01 verb. Therefore the correlation is High (3)

**P02: Analyze(L4)**

C04 Action verb is less than P02 verb by one level. Therefore the correlation is Medium (2)

**P011: Thumb rule**

New research models are derived to address issues present in data set. Therefore the correlation is medium (2)

**C05: Evaluate** deep generating models for deep learning applications.

**Action Verb : Evaluate(L5)**

**P01: Apply(L3)**

C05 Action verb is greater than P01 verb by three level. Therefore the correlation is High (3)

**P02: Analyze (L4)**

C05 Action verb is greater than two level as P02 verb. Therefore the correlation is High (3)

**P03: Develop(L3)**

C05 Action verb is greater than two level as P03 verb. Therefore the correlation is High (3)

**P04: Design (L6)**

C05 Action verb is less than P04 verb by one level. Therefore the correlation is moderate(2)

**P05: Create(L6)**

C05 Action verb is less than P05 verb by one level. Therefore the correlation is moderate(2)

**P011: Thumb rule**

New sets of generative models are derived to address issues present in data set. Therefore the correlation is high(3)





**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	Natural Language Processing	L	T/CLC	P	C
20AOE3001	IV-I		4	2	0	3

**Course Outcomes:**

After Studying the Course, student will be able to

**C01: Understand** the basic concepts of NLP concepts to build language models

**C02: Apply** parsing techniques to study syntactic structure of sentences in natural language

**C03: Analyze** grammars and mechanisms of augmented transition network for NLP

**C04: Apply** language models and semantic interpretation to NLP

**C05: Analyze** machine translation and multi lingual information retrieval approaches to improve system performance

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	the basic concepts of NLP concepts		to build language models	L2
C02	Apply	parsing techniques		to study syntactic structure of sentences in natural language	L3
C03	Analyze	grammars and mechanisms of		augmented transition network for NLP	L4
C04	Apply	language models and semantic interpretation		to generate compelling 2D transitions between images	L3
C05	Analyze	machine translation and multi lingual information retrieval approaches		To improve system performance	L4

<b>UNIT - I</b>	<b>Introduction to Natural language</b>	<b>9 Hrs</b>
<b>Introduction to Natural language:</b> The Study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different Levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English Syntax		
<b>UNIT - II</b>	<b>Grammars and Parsing</b>	<b>9Hrs</b>
<b>Grammars and Parsing:</b> Grammars and Parsing- Top- Down and Bottom-Up Parsers, Transition Network Grammars, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks, Bayes Rule, Shannon game, Entropy and Cross Entropy.		
<b>UNIT - III</b>	<b>Grammars for Natural Language</b>	<b>9 Hrs</b>
<b>Grammars for Natural Language:</b> Grammars for Natural Language, Movement Phenomenon in Language, Handling questions in Context Free Grammars, Hold Mechanisms in ATNs, Gap Threading, Human Preferences in Parsing, Shift Reduce Parsers, Deterministic Parsers.		
<b>UNIT - IV</b>	<b>Semantic Interpretation</b>	<b>9 Hrs</b>
<b>Semantic Interpretation:</b> Semantic & Logical form, Word senses & ambiguity, The basic logical form language, Encoding ambiguity in the logical Form, Verbs & States in logical form, Thematic roles, Speech acts & embedded sentences, Defining semantics structure model theory. Language Modeling: Introduction, n-Gram Models, Language model Evaluation, Parameter Estimation, Language Model Adaption, Types of Language Models, Language-Specific Modeling Problems, Multilingual and cross lingual language modeling.		
<b>UNIT - V</b>	<b>Machine Translation Survey</b>	<b>9 Hrs</b>
<b>Machine Translation Survey:</b> Introduction, Problems of Machine Translation, Is Machine Translation Possible, Brief History, Possible Approaches, Current Status. Anusaraka or Language Accessor: Background, Cutting the Gordian Knot, The Problem, Structure of Anusaraka System, User Interface, Linguistic Area, Giving up Agreement in Anusarsaka Output, Language Bridges. Multilingual Information Retrieval: Introduction, Document Preprocessing, Monolingual Information Retrieval, CLIR, MLIR, Evaluation in Information Retrieval, Tools, Software and Resources. Multilingual Automatic Summarization: Introduction, Approaches to Summarization, Evaluation, How to Build a Summarizer, Competitions and Datasets.		
<b>Textbooks:</b>		

1. James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.
2. Multilingual Natural Language Processing Applications : From Theory To Practice Daniel M. Bikel and Imed Zitouni, Pearson Publications.
3. Natural Language Processing, A paninian perspective, Akshar Bharathi, Vineet chaitanya, Prentice - Hall of India.

#### Reference Books:

1. Charniak, Eugene, Statistical Language Learning, MIT Press, 1993.
2. Jurafsky, Dan and Martin, James, Speech and Language Processing, 2nd Edition, Prentice Hall, 2008.
3. Manning, Christopher and Henrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999

#### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	2	3		3								3	2
C02	3	3		2	3						2	3	2
C03	3	3		3	3						3		3
C04	3	3	3								2	2	
C05	3	3		3		3					3	3	

#### Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	C01:Understand	L2	PO1 PO2 PO4	PO1: Apply(L3) PO2: Review(L2) PO4: Interpret(L2)	2 3 3
2	C02 : Apply	L3	PO1 PO2 PO4 PO5 PO11	PO1: Apply(L3) PO2: Identify(L3) PO4: Analyze(L4) PO5: Apply(L3) PO11: Thumb rule	3 3 2 3 2
3	C03 : Analyze	L4	PO1 PO2 PO4 PO5 PO11	PO1: Apply(L3) PO2: Identify(L3) PO4: Analyze(L4) PO5: Apply(L3) PO11: Thumb rule	3 3 3 3 3
4	C04 : Apply	L3	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Identify(L3) PO3: Develop(L3) PO11: Thumb rule	3 3 3 2
5	C05 :Analyze	L4	PO1 PO2 PO4 PO6 PO11	PO1: Apply(L3) PO2: Identify(L3) PO4: Analyze(L4) PO6: Thumb rule PO11: Thumb rule	3 3 3 3 3

#### Justification Statements:

**C01: Understand** the basic concepts of NLP concepts to build language models

**Action Verb : Understand(L2)**

**PO1 Verb : Apply(L3)**

C01 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

**PO2 Verb : Review(L2)**

C01 Action verb is same as PO2 verb. Therefore the correlation is high (3)

**PO4: Interpret(L2)**

C01 Action verb is same as PO4 verb. Therefore the correlation is high (3)

**C02: Apply** parsing techniques to study syntactic structure of sentences in natural language

**Action Verb : Apply(L3)**

**PO1: Apply(L3)**

C02 Action verb is same as P01 verb .Therefore the correlation is high (3)

**P02: Identify(L3)**

C02 Action verb is same as P02 verb. Therefore the correlation is high (3)

**P04: Analyze (L4)**

C02 Action verb is less than P04 verb by one level. Therefore the correlation is medium(2)

**P05: Apply(L3)**

C02 Action verb is same as P05 verb .Therefore the correlation is high (3)

**P011: Thumb rule**

For developing natural language applications, one needs to learn continuously. Therefore the correlation is medium(2)

**C03: Analyze** grammars and mechanisms of augmented transistion network for NLP

**Action Verb : Analyze (L4)**

**P01: Apply(L3)**

C03 Action verb is greater than P01 verb. Therefore the correlation is high (3)

**P02: Identify(L3)**

C03 Action verb is greater than P02 verb. Therefore the correlation is high (3)

**P04: Analyze (L4)**

C03 Action verb is same as P04 verb. Therefore the correlation is high(3)

**P05: Apply(L3)**

C03 Action verb is greater than P05 verb. Therefore the correlation is high (3)

**P011 : Thumb rule**

For developing natural language applications, one needs to learn continuously. Therefore the correlation is high(3)

**C04: Apply** language models and semantic interpretation to NLP

**Action Verb : Apply(L3)**

**P01: Apply(L3)**

C04 Action verb is same level as P01 verb. Therefore the correlation is high (3)

**P02: Identify(L3)**

C04 Action verb is same level as P02 verb. Therefore the correlation is high (3)

**P03: Develop(L3)**

C04 Action verb is same as P03 verb. Therefore the correlation is high (3)

**P011: Thumb rule**

For developing natural language applications, one needs to learn continuously. Therefore the correlation is medium(2)

**C05: Analyze** machine translation and multi lingual information retrieval approaches to improve system performance

**Action Verb : Analyze (L4)**

**P01: Apply(L3)**

C04 Action verb is greater than P02 verb. Therefore the correlation is high (3)

**P02: Identify(L3)**

C05 Action verb is greater than P02 verb. Therefore the correlation is high (3)

**P04: Analyze (L4)**

C05 Action verb is same as P04 verb. Therefore the correlation is high (3)

**P06: Thumb rule**

Information retrieval methods are used in many real time applications. Therefore the correlation is high(3)

**P011 : Thumb rule**

In language translation retrieval approaches to improve performance gets updated regularly. Therefore the correlation is high (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	Virtual Reality	L	T/CLC	P	C
20AOE3002/ 20APE3011	IV-I		4	2	0	3

**Course Outcomes:**

After Studying the Course, student will be able to

**CO1: Understand** the fundamentals concepts of Virtual Reality, Augmented Reality and Mixed Reality.

**CO2: Apply** the appropriate software and hardware for developing Bird Eye View VR Applications.

**CO3: Analyze** the different parameters to generate Light and Optics in Virtual world.

**CO4: Analyze** the photoreceptors and the anatomy of human eye to implement human vision.

**CO5: Understand** the importance of auditory perception and motion for designing VR headset.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the fundamentals concepts of Virtual Reality, Augmented Reality and Mixed Reality.			L2
CO2	Apply	the appropriate software and hardware		for developing Bird Eye View VR Applications	L3
CO3	Analyze	the different parameters of geometric models and Behaviour		to generate Light and Optics in Virtual world	L4
CO4	Analyze	the photoreceptors and the anatomy of human eye		to implement human vision	L4
CO5	Understand	the importance of auditory perception and motion		for designing VR headset	L2

<b>UNIT - I</b>	<b>Introduction to Virtual Reality</b>	
<b>Introduction to Virtual Reality:</b> What is Virtual Reality, Modern VR experiences, History Repeats. Unity: Virtually Everything for you, what is virtual reality to you, types of head-mounted displays: Desktop VR, Mobile VR, The difference between virtual reality and augmented reality, Applications vs Games, Types of VR experiences, and Technical skills that are important to VR.		
<b>UNIT - II</b>	<b>Bird's-Eye View</b>	
<b>Bird's-Eye View:</b> Hardware, Software, Human Physiology and Perception. Unity: Objects and Scale: Getting started with unity, creating a simple Diorama, Measurement tools, First Person Character: Understanding the Unity characters, Unity standard assets.		
<b>UNIT - III</b>	<b>The Geometry of Virtual Worlds &amp; Light and Optics</b>	
<b>The Geometry of Virtual Worlds &amp; Light and Optics:</b> Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations. Light and Optics: Basic behavior of light, lenses, Optical Aberrations, Human Eye, Cameras, and Displays.		
<b>UNIT - IV</b>	<b>The Physiology of Human Vision</b>	
<b>The Physiology of Human Vision:</b> From the Cornea to Photoreceptors, From Photoreceptors to the Visual Cortex, Eye Movements, and Implications for VR.		
<b>UNIT - V</b>	<b>Motion in Real and Virtual Worlds</b>	
<b>Motion in Real and Virtual Worlds:</b> Motion in Real and Virtual Worlds : The Vestibular System, Physics in the Virtual World. Audio: The Physics of Sound, the Physiology of Human Hearing, Auditory Perception.		
<b>Textbooks:</b>		
1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016.		
<b>Reference Books:</b>		
1. Unity Virtual reality Projects, Jonathan Linowes, PACKT Publishing.		

## Mapping of course outcomes with program outcomes

CO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02
C01	2	2											
C02	3	3	3	3	3	2			2				
C03	3	3	1	3	1								
C04	3	1	1	3	3	3		3					
C05	2	2											

## Correlation matrix

Unit No.	CO Lesson plan(Hrs )	%	Correlation	Co's Action verb	BT L	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	13	20%	2	Understand	L2	P01 P02	P01: Apply(L3) P02: Identify(L3)	2 2
2	17	27%	3	Apply	L3	P01 P02 P03 P04 P05 P06 P09	P01: Apply(L3) P02: Identify(L3) P03: Apply (L3) P04: Analyze (L4) P05: Apply (L3) P06: Thumb rule P09: Thumb rule	3 3 3 2 3 2 2
3	13	20%	2	Analyze	L4	P01 P02 P03 P04 P05	P01: Apply(L3) P02: Identify (L3) P03: Design(L6) P04: Analyze (L4) P05: Create(L6)	3 3 1 3 1
4	8	13%	2	Analyze	L4	P01 P02 P03 P04 P05 P06 P08	P01: Apply(L3) P02: Formulate (L6) P03: Develop (L6) P04: Analyze(L4) P05: Apply(L3) P06: Thumb rule P08: Thumb rule	3 1 1 3 3 3 3
5	11	17%	2	Understand	L2	P01 P02	P01: Apply(L3) P02: Identify(L3)	2 2
	64	100 %						

## Justification Statements:

**C01: Understand** the fundamentals concepts of Virtual Reality, Augmented Reality and Mixed Reality.

**Action Verb: Understand (L2)**

**P01 Verb:** Apply (L3)

C01 Action verb is less than P01 verb by one level. Therefore the correlation is moderate (2)

**P02 Verb:** Identify (L3)

C01 Action verb is less than P02 verb by one level. Therefore the correlation is moderate (2)

**C02: Apply** appropriate software and hardware for developing VR Applications.

**Action Verb: Apply (L3)**

**P01: Apply (L3)**

C02 Action verb is same level as P01 verb. Therefore the correlation is high (3)

**P02: Identify (L3)**

C02 Action verb is same level as P02 verb. Therefore the correlation is high (3)

**P03: Apply (L3)**

C02 Action verb is same level as P03 verb. Therefore the correlation is high (3)

**P04: Analyze (L4)**

C02 Action verb is less than P04 verb by one level. Therefore the correlation is Moderate (2)

**P05: Apply (L3)**

C02 Action verb is same as P05 verb. Therefore the correlation is high (3)

**P06: Thumb rule**

We use virtual scenes and virtual objects for most of the disciplines in the society .Therefore the correlation is moderate (2).

**P09: Thumb rule**

For developing virtual objects and scenes there will be graphic designer, programmer, and analyst. Therefore the correlation is moderate (2).

**C03: Analyze** the different parameters of geometric models and Behavior to generate Light and Optics in VR.

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

C03 Action verb is more than P01 verb. Therefore the correlation is high (3)

**P02: Identify (L3)**

C03 Action verb more than P02 verb. Therefore the correlation is high (3)

**P03: Design (L6)**

C03 Action verb less than P02 verb by two levels. Therefore the correlation is low (1)

**P04: Analyze (L4)**

C03 Action verb is same level as P04 verb. Therefore the correlation is high (3)

**P05: Create (L6)**

C03 Action verb less than P05 verb by two levels. Therefore the correlation is low (1)

**C04: Analyze** the photoreceptors and the anatomy of human eye to implement human vision.

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

C04 Action verb is greater than P01 verb. Therefore the correlation is high (3)

**P02: Formulate (L6)**

C04 Action verb is P02 verb by two levels. Therefore the correlation is low (1)

**P03: Develop (L6)**

C04 Action verb is P02 verb by two levels. Therefore the correlation is low (1)

**P04: Analyze (L4)**

C04 Action verb is same as P04 verb. Therefore the correlation is high (3)

**P05: Apply (L3)**

C04 Action verb is more than P05 verb. Therefore the correlation is high (3)

**P06: Thumb rule**

Since we are developing virtual scenes and 3d objects for engineering and societal departments. Therefore the correlation is high (3)

**P08: Thumb rule**

Some ethical principles should be followed while developing virtual scenes and 3d objects for engineering and societal departments. Therefore the correlation is high (3)

**C05: Understand** importance of auditory perception and motion for designing VR headset.

**Action Verb: Understand (L2)**

**P01 Verb: Apply (L3)**

C05 Action verb is less than P01 verb by one level. Therefore the correlation is moderate (2)

**P02 Verb: Identify (L3)**

C05 Action verb is less than P02 verb by one level. Therefore the correlation is moderate (2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science**

**(AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	Applications of AI	L	T/CLC	P	C
20AOE3003	IV-I		4	2	0	3

**Course Outcomes:**

After Studying the Course, student will be able to

C01: **understand** the basic concepts of AI to Perform Robotic Operations

C02: **Apply** the searching techniques for solving searching problems.

C03: **Analyze** the concepts of Reinforcement Learning and NLP Models.

C04: **Analyze** the Natural Language Interfaces for Machines understanding.

C05: **Apply** the Standardised Approach for preparing Imaging data , Machine Learning tasks.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	the basic concepts of AI		to Perform Robotic Operations	L2
C02	Apply	the searching techniques		for Solving searching problems	L3
C03	Analyze	the concepts of Reinforcement Learning and NLP Models.			L4
C04	Analyze	the Natural Language Interfaces		for Machines understanding	L4
C05	Apply	the Standardised Approach		for preparing Imaging data , Machine Learning tasks.	L3

<b>UNIT - I</b>	<b>AI for Driverless systems</b>	
<b>Look:</b> The MEMEX Reloaded, Inside a Search Engine, Google and the Mind, Deeper and Darker. <b>The Robotic chauffeur:</b> Getting to driverless, A Cure for the deadliest disease, Seven delaying Myths, The timeline. <b>A Driverless World:</b> Friction-free personal mobility, Parking, Commuting, Take the pod - meet people, Anatomy of a Driverless cars: High definition digital maps, Digital Cameras, Light detection and ranging(lidar), Radio Detection and Ranging (Radar), Ultrasonic sensors(sonars), Global positioning systems (GPS), The inner ear (IMU), Drive by wire.		
<b>UNIT - II</b>	<b>AI for Marketing -I</b>	
<b>Solving the Marketing Problem</b> - One-to-One Marketing, One-to-Many Advertising, The Four Ps, What Keeps a Marketing Professional Awake? The Customer Journey, We Will Never Really Know, How Do I Connect? Let Me Count the Ways, Why Do I Connect? Branding, Marketing Mix Modelling, Econometrics, Customer Lifetime Value, One-to-One Marketing—The Meme, Seat-of-the-Pants Marketing, Marketing in a Nutshell, What Seems to Be the Problem?		
<b>UNIT - III</b>	<b>AI for Marketing -II</b>	
<b>Using AI to Get Their Attention</b> - Market Research: Whom Are We After? , Marketplace Segmentation, Raising Awareness, Social Media Engagement, In Real Life, The B2B World, Using AI to Persuade - The In-Store Experience, On the Phone, The Onsite Experience—Web Analytics, Merchandising, Closing the Deal, Back to the Beginning: Attribution.		
<b>UNIT - IV</b>	<b>AI for Customers</b>	
<b>Using AI for Retention</b> - Growing Customer Expectations, Retention and Churn, Many Unhappy Returns, Customer Sentiment, Customer Service, Predictive Customer Service.		
<b>UNIT - V</b>	<b>AI for Image processing</b>	
The role of medical image computing and machine learning in health care, Deep Learning and Machine Learning in Imaging: Basic Principles, how to develop Artificial Intelligence Applications, A Standardised Approach for preparing Imaging data for Machine Learning tasks in Radiology, Artificial Intelligence in Medicine: Validation and Study Design, Enterprise Imaging.		
<b>Textbooks:</b>		
1. Gautam Shroff "The Intelligent Web", OXFORD University Press, 2013. 2. Hod Lipson, and Melba kurman, "Driverless_ Intelligent cars and the Road Ahead", The MIT Press Cambridge, Massachusetts London, England, 2016.		

<b>Reference Books:</b>
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1. Jim Sterne "Artificial intelligence for Marketing", John Wiley & sons, 2017.
2. Erik R. Ranschaert, sergey Morozov, Paul R. Algra, "Artificial Intelligence in Medical Imaging, Springer Nature Switzerland AG, 2019.

#### Mapping of course outcomes with program outcomes

CO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02
C01	2	2											
C02	3	3		2							2		
C03	3	1	1	3									
C04	3	1		3							3		
C05	3	3	3	2			2						

#### Correlation matrix

Unit No.	CO		Program Outcome (PO)	PO(s): Action Verb and BTL (for P01 to P011)	Level of Correlation (0-3)
	Co's Action verb	BTL			
1	C01: Understand	L2	P01 P02	P01: Apply(L3) P02: Analyze(L4)	2 2
2	C02: Apply	L3	P01 P02 P04 P011	P01: Apply(L3) P02: Identify (L2) P04: Analyze (L4) P011: Thumb rule	3 3 2 2
3	C03: Analyze	L4	P01 P02 P03 P04	P01: Apply(L3) P02: Formulate (L6) P03: Design (L6) P04: Analysis(L4)	3 1 1 3
4	C04: Analyze	L4	P01 P02 P04 P011	P01: Apply(L3) P02: Formulate (L6) P04: Analysis (L4) P011: Thumb rule	3 1 3 3
5	C05: Apply	L3	P01 P02 P03 P04 P07	P01: Apply(L3) P02: Identify (L2) P03: Develop (L2) P04: Analysis(L4) P07: Thumb rule	3 3 3 2 2

#### Justification Statements:

C01: **understand** the basic concepts of AI to Perform Robotic Operations

**Action Verb: Understand (L2)**

**P01 Verb: Apply (L3)**

C01 Action verb is less than P01 verb by one level. Therefore, the correlation is moderate (2)

**P02 Verb: Analyze (L4)**

C01 Action verb is less than P02 verb by two levels. Therefore, the correlation is low (1)

C02: **Apply** the searching techniques for solving searching problems.

**Action Verb: Apply (L3)**

**P01: Apply (L3)**

C02 Action verb is same level as P01 verb. Therefore, the correlation is high (3)

**P02: Identify (L2)**

CO2 Action verb is less than PO2 verb by one levels. Therefore, the correlation is moderate (2)

**P04: Analyze (L4)**

CO2 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)

**P011: Thumb rule**

For some of Application of AI concepts are used to write programs. Therefore, the correlation is moderate (2)

CO3: **Analyze** the concepts of Reinforcement Learning and NLP Models.

**Action Verb: Analyze (L4)**

**P01: Apply(L3)**

CO3 Action verb is more than PO1 verb. Therefore, the correlation is high (3)

**P02: Formulate (L6)**

CO3 Action verb is less than PO2 verb by two level. Therefore, the correlation is low (1)

**P03: Design (L6)**

CO3 Action verb is less than PO3 verb by two level. Therefore, the correlation is low (1)

**P04: Analysis (L4)**

CO3 Action verb is same as PO4 verb. Therefore, the correlation is high (3)

CO4: **Analyze** the Natural Language Interfaces for Machines understanding.

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

CO4 Action verb is more than PO1 verb. Therefore, the correlation is high (3)

**P02: Formulate (L6)**

CO4 Action verb is less than PO2 verb by two levels. Therefore, the correlation is low (1)

**P04: Analysis (L4)**

CO4 Action verb is same as PO4 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

For some of application of AI in learning models concepts are used to Therefore, the correlation is high (3)

CO5: **Apply** the Standardised Approach for preparing Imaging data , Machine Learning tasks.

**Action Verb: Apply (L3)**

**P01: Apply(L3)**

CO5 Action verb is same as PO1 verb. Therefore, the correlation is high (3)

**P02: Identify (L2)**

CO5 Action verb is more than PO2 verb. Therefore, the correlation is high (3)

**P03: Develop (L3)**

CO5 Action verb is same as PO3 verb. Therefore, the correlation is high (3)

**P04: Analysis (L4)**

CO5 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)

**P07: Thumb rule**

For some of Real Time application of AI concept is sustainable environment development. Therefore, the correlation is moderate (2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
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**Artificial Intelligence and Data Science**

**(AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	AI For IMAGE ANALYSIS	L	T/CLC	P	C
20AOE3004	IV-I		4	2	0	3

**Course Outcomes:**

After Studying the Course, student will be able to

**C01: Understand** the concepts of image formation to perform 3-D Images Operations.

**C02: Understand** the image Processing Methods, colors spaces to perform Advanced Images.

**C03: Analyze** the python concepts scikit image using transformation techniques.

**C04: Apply** the Open CV for Advanced image Processing.

**C05: Apply** the machine learning and real time use cases for image processing.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	the concepts of image formation		to Perform 3-D Images Operations	L2
C02	Understand	the image Processing Methods, colors spaces		to perform Advanced Images.	L2
C03	Analysis	the python concepts scikit image	using transformation techniques		L4
C04	Apply	the Open CV		for Advanced image Processing	L3
C05	Apply	the machine learning and real time use cases		for image processing.	L3

<b>UNIT - I</b>	<b>Image Formation&amp; 3-D Imaging</b>	
Introduction to Image Formation: Introduction, World and camera coordinates, Ideal Imaging: Perspective Projection, Real Imaging, Radiometry of Imaging, Liner System Theory of Imaging, Homogeneous Coordinates Introduction to 3-D Imaging: Basics, Depth from Triangulation, Depth from Time-of-Flight, Depth from Phase: Interferometry, Shape from Shading, Depth from Multiple Projections: Tomography		
<b>UNIT - II</b>	<b>Image Processing</b>	
<b>Introduction to Image Processing:</b> Images, Pixels, Image Resolution, PPI and DPI, Bitmap Images, Lossless Compression, Lossy Compression, Image File Formats, <b>Color Spaces:</b> RGB, XYZ, HSV/HSL, LAB, LCH, YPbPr, YUV, YIQ, <b>Advanced Image Concepts:</b> Bezire Curve, Ellipsoid, Gamma Correction, Structural Similarity Index, Deconvolution, Homography, Convolution		
<b>UNIT - III</b>	<b>Basics of Python and Scikit Image</b>	
<b>Basics of Python:</b> Variables and Data Types, Data Structures, Control Flow Statements, Conditional Statements, Functions. <b>Scikit Image:</b> Uploading and Viewing an Image, Getting Image Resolution, Looking at Pixel Values, Converting Color Space, Saving an Image, Creating Basic Drawings, Doing Gamma Correction. Rotating, Shifting, and Scaling Images, Determining Structural Similarity.		
<b>UNIT - IV</b>	<b>Advanced Image Processing Using Open CV</b>	
Blending Two Images, Changing Contrast and Brightness, Adding Text to Images, <b>Smoothing Images:</b> Median Filter, Gaussian Filter, Bilateral Filter. Changing the Shape of Images, Effecting Image Thresholding, Calculating Gradients, Performing Histogram Equalization		
<b>UNIT - V</b>	<b>Image Processing Using Machine Learning &amp; Real-Time Use Cases</b>	
Feature Mapping Using the SIFT Algorithm, Image Registration Using the RANSAC Algorithm: estimate_ affine, residual lengths, processing the Images, The Complete code. Image Classification Using Artificial Neural Networks, Image Classification Using CNNs, Image Classification Using Machine Learning Approaches: Decision Trees, Support Vector Machines, Logistics Regression, Code, Important Terms <b>Introduction to Real-Time Use Cases:</b> Finding Palm Lines, Detecting Faces, Recognizing Faces, Tracking Movements, Detecting Lanes		
<b>Textbooks:</b>		
1. Digital Image Processing by Rafael C. Gonzalez, 4th Edition, 2018		

2. Hands-On Image Processing with Python: Expert techniques for advanced image analysis and effective interpretation of image data, by Sandipan Dey, 2018.

**Reference Books:**

1. Digital Image Processing-Bernd Jahne,2005

**Online Learning Resources:**

1. How to Implement Artificial Intelligence for Solving Image Processing Tasks | Apriorit
2. Image Processing for Engineering and Science | Coursera

**Mapping of course outcomes with program outcomes**

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO1	PSO2
C01	2	1						2					
CO 2	2	1						2					
C03	3		3		1			3	3	3			
CO 4	3		2					3	2	2	2		
CO 5	3		2	2				2	2	2	2		

**Correlation matrix**

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	C01: Understand	L2	PO1 PO2 PO8	PO1: Apply(L3) PO2: Analysis(L4) PO8: Thumb Rule	2 1 2
2	C02: Understand	L2	PO1 PO3 PO8	PO1: Apply(L3) PO3: Analysis(L4) PO8: Thumb Rule	2 1 2
3	C03: Analyze	L4	PO1 PO3 PO5 PO8 PO9 PO10	PO1: Apply(L3) PO3: Analysis(L4) PO5: Create(L6) PO8: Thumb Rule PO9: Thumb Rule PO10: Thumb Rule	3 3 1 3 3 3
4	C04: Apply	L3	PO1 PO3 PO8 PO9 PO10 PO11	PO1: Apply(L3) PO3: Analysis(L4) PO8: Thumb Rule PO9: Thumb Rule PO10: Thumb Rule PO11: Thumb Rule	3 2 3 2 2 2
5	C05: Apply	L3	PO1 PO3 PO4 PO8 PO9 PO10 PO11	PO1: Apply(L3) PO3: Analysis(L4) PO4: Analysis(L4) PO8: Thumb Rule PO9: Thumb Rule PO10: Thumb Rule PO11: Thumb Rule	3 2 2 2 2 2 2

**Justification Statements:**

**C01: Understand** the concepts of image formation to perform 3-D Images Operations.

**Action Verb: Understand (L2)**

**P01 Verb: Apply (L3)**

C01 Action verb is less than P01 verb by one level. Therefore, the correlation is moderate (2)

**P02: Analyze(L4)**

C01 Action verb is less than P02 verb by two levels. Therefore, the correlation is low (1)

**P08: Thumb Rule**

C01 Using 3-D Imaging, therefore the correlation is moderate (2)

**C02: Understand** the image Processing Methods, colors spaces to perform Advanced Images.

**Action Verb: understand (L2)**

**P01: Apply (L3)**

C02 Action verb is less than P01 verb by one level. Therefore, the correlation is moderate (2)

**P02: Analyze(L4)**

C02 Action verb is less than P02 verb by two level. Therefore, the correlation is low (1)

**P08: Thumbrule**

C02 Using Color Spaces like RGB,XYZ, therefore the correlation is moderate (2)

**C03: Analyze** the python concepts scikit image using transformation techniques.

**Action Verb: Analyze(L4)**

**P01: Apply (L3)**

C03 Action verb is more than P01 verb. Therefore, the correlation is high (3)

**P03: Analysis(L4)**

C03 Action verb is same as P03 verb. Therefore, the correlation is high (3)

**P05: Create(L6)**

C03 Action verb is less than as P05 verb by two levels. Therefore, the correlation is low (1)

**P08: Thumbrule**

C03 Scikit Image: Uploading and Viewing an Image, Getting Image Resolution, Looking at Pixel Values, Converting Color Space, therefore the correlation is high (3)

**P09: Thumbrule**

C03 Scikit Image creating, therefore the correlation is high (3)

**P010: Thumbrule**

C03 Designing Scikit Image using python Programming, therefore the correlation is high (3)

**C04: Apply** the Open CV for Advanced image Processing.

**Action Verb: Apply(L3)**

**P01: Apply (L3)**

C04 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P03: Analysis(L4)**

C04 Action verb is less than P03 verb by one level. Therefore, the correlation is moderate (2)

**P08: Thumbrule**

C04 Using Smoothing techniques Blending Two Images, therefore the correlation is moderate (2)

**P09: Thumbrule**

C04 Using Smoothing techniques, therefore the correlation is moderate (2)

**P010: Thumbrule**

C04 Advanced CSS style presentation and techniques to manage projects in multi-disciplinary environments as a member or leader in a team, therefore the correlation is moderate (2)

**P011: Thumbrule**

C04 Using Performing Histogram Equalization Techniques, Median Filter, Gaussian Filter, therefore the correlation is moderate (2)

**C05: Apply** the machine learning and real time use cases for image processing.

**Action Verb: Apply(L3)**

**P01: Apply (L3)**

C05 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P03: Analyze(L4)**

C05 Action verb is less than P03 verb by one level. Therefore, the correlation is moderate (2)

**P04: Analysis(L4)**

C05 Action verb is less than P04 verb by one level. Therefore, the correlation is moderate(2)

**P08: Thumbrule**

C05 Classification Using CNNs, therefore the correlation is moderate (2)

**P09: Thumbrule**

C05 Creating HTML and CSS programs, therefore the correlation is moderate (2)

**P010: Thumbrule**

C05 Using Image Classification Using Machine Learning Approaches, therefore the correlation is moderate (2)

**P011: Thumbrule**

C05 Using Real-Time Use Cases, therefore the correlation is moderate (2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science**

**(AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	ETHICS AND PRIVACY IN AI	L	T/CLC	P	C
20AOE3005	IV-I		4	2	0	3

**Course Outcomes:**

**After Studying the Course, student will be able to**

C01: **Understand** the ethical issues in the development of AI agents.

C02: **Analyze** the ethical consideration of AI to replace the work of humans.

C03: **Apply** the sociocultural factors in AI to develop code of ethics.

C04: **Analyze** the code to control pitfall in the ethics of AI.

C05: **Understand** the privacy aspects of ICT to Perform Data Mining.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	the ethical issues in the development		of AI agents	L2
C02	Analyse	the ethical consideration of AI		to replace the work of humans	L4
C03	Apply	the sociocultural factors in AI		to develop codes of ethics	L3
C04	Analyse	the code to control pitfall		in the ethics of AI	L4
C05	Understand	The privacy aspects of information and common technologies		to Perform Data Mining.	L2

<b>UNIT - I</b>	<b>Introduction, What Do We Need to Understand About Ethics?</b>	
Introduction: Artificial Intelligence and Ethics, Why Ethics in AI? Why Now? Current Initiatives in AI and Ethics, Codes of Ethics in Context: Other Approaches to Ethical Questions in AI What Do We Need to Understand About Ethics?: A Preliminary Plea: Ethics Is Not About ' Banning' Things, Normative Ethical Theories, Ethics and Empirical Evidence, So Why Do We Even Need Ethics?, So, With What Sort of Issues Is Ethics Concerned?, Who(or)What Is The Proper Object of Moral Concerns, and How Widely Should Our Concerns Extend?, Four Domains of Ethics: Self, Friend, Stranger, World, What Counts as Adequate Justification and Argument in Ethics?, Moral Relativism, Moral Justification and AI, A Distributed Morality?, MoralAgents, Moral Motivation, AI, Codes of Ethics and the Law		
<b>UNIT - II</b>	<b>Does AI Raise Any Distinctive Ethical Questions? Codes of Professional Ethics</b>	
Does AI Raise Any Distinctive Ethical Questions? Methodology: Focusing in on Ethical Questions, Many Ethical Issues in AI Are Shared with Other Rapidly Developing Technology, Ethical Questions Arise from AI's Typical Use to Enhance, Supplement, or Replace the Work of Humans, We Also Need to Consider the Methods of Production of AI, Hype in AI and Implications for Methodology in Ethics Codes of Professional Ethics: Introduction: The Varieties of Ethical Codes, Professional Codes of Ethics Tend to Have Certain Commonalities, Codes of Ethics and Institutional Backing, The Context of Codes of Ethics, Can Codes of Ethics Make the Situation Worse? Yes		
<b>UNIT - III</b>	<b>How AI Challenges Professional Ethics, Developing Codes of Ethics Amidst Fast Technological Change</b>	
How AI Challenges Professional Ethics: AI Professional Organisations and Companies, and the Nature of Its Development and Production, Gradients of Professional Power and Vulnerability in AI, A Third Layer of Complexity in Codes of Professional Ethics for AI: The Behaviour of Machines, The Authority of Any Resulting Codes. Developing Codes of Ethics Amidst Fast Technological Change: Social, Cultural and Technological Change and Ethics, Social, Cultural, Economic and Technological Change: The Example of AI and Employment, Regulating for Whom? The Global Reach of AI, Universalism, and Relativism, Diversity in Participation as Part of the Solution.		
<b>UNIT - IV</b>	<b>Some Characteristic Pitfalls in Considering the Ethics of AI, and What to Do About Them, Some Suggestions for How to Proceed</b>	
Some Characteristic Pitfalls in Considering the Ethics of AI, and What to Do About Them: The Idealisation of Human and of Machine Agency, Building Ethics into AI and the Idealisation of Moral Agency, Replacing and Enhancing Human Agency, Boundaries and AI, Addressing the Increased Gradient of Vulnerability, Common		

Language, Miscommunication and the Search for Clarity. Some Suggestions for How to Proceed: Organisations and Codes, Procedures for Drawing Up and Implementing Codes, The Content of Codes, Thinking About Ethical Issues in Developing and Implementing Codes of Ethics, Asilomar AI Principles

<b>UNIT - V</b>	<b>An Introduction to Privacy Aspects of Information and Communication Technologies, Data Mining in Large Databases</b>	
Introduction, Privacy and the Internet, Privacy in Databases, Privacy in Ubiquitous Computing. Data Mining in Large Databases — Strategies for Managing the Trade-Off Between Societal Benefit and Individual Privacy: Introduction, Examples of data-collecting institutions and data users, Strategies for controlling privacy, Measures of the utility of published data sets and outputs.		
<b>Textbooks:</b>		
1. Paula Boddington, "Towards a Code of Ethics for Artificial Intelligence", Springer. 2. Agusti Solanas & Antoni Martínez-Ballesté "Advances in Artificial Intelligence for Privacy Protection and Security" World Scientific		
<b>Reference Books:</b>		
1. "Oxford Handbook of Ethics of AI", Markus D. Dubber, Frank Pasquale, Unit Das, Oxford University Press.		
<b>Online Learning Resources:</b>		
1. Coursera: Ethics of Artificial Intelligence 2. Coursera: Artificial Intelligence Privacy and Convenience		

Mapping of course outcomes with program outcomes

CO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02
CO1	2	1				2		2	2				
CO2	3		3			3		3	3				
CO3	3		2			3		3	2	2	2		
CO4	3		3					3	3	3	3		
CO5	2		1	1					2	2	2		

### Justification Statements:

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: Understand	L2	P01 P02 P06 P08 P09	P01: Apply(L3) P02: Analysis(L4) P06: Apply(L3) P08: Apply(L3) P09: Thumb Rule	2 1 2 2 2
2	CO2: Analyse	L4	P01 P03 P06 P08 P09	P01: Apply(L3) P03: Analysis(L4) P06: Apply(L3) P08: Apply(L3) P09: Thumb Rule	3 3 3 3 3
3	CO3: Apply	L3	P01 P03 P06 P08 P09 P010 P011	P01: Apply(L3) P03: Analysis(L4) P06: Apply(L3) P08: Apply(L3) P09: Thumb Rule P010: Thumb Rule P011: Thumb Rule	3 2 3 3 2 2 2
4	CO4: Analyse	L4	P01 P03 P06 P08 P09 P010 P011	P01: Apply(L3) P03: Analysis(L4) P06: Apply(L3) P08: Apply(L3) P09: Thumb Rule P010: Thumb Rule P011: Thumb Rule	3 3 3 3 3 3 3
5	CO5: Understand	L2	P01 P03 P04 P09 P010 P011	P01: Apply(L3) P03: Analysis(L4) P04: Analysis(L4) P09: Thumb Rule P010: Thumb Rule P011: Thumb Rule	3 1 1 2 2 2

**Justification :**

C01: **Understand** the ethical issues in the development of AI agents.

**Action Verb: Understand (L2)**

**P01 Verb: Apply (L3)**

C01 Action verb is less than P01 verb by one level. Therefore, the correlation is moderate (2)

**P02: Analysis(L4)**

C01 Action verb is less than P02 verb by two level. Therefore, the correlation is low (1)

**P06: Apply(L3)**

C01 Action verb is less than P06 verb by one level. Therefore, the correlation is moderate (2)

**P08: Apply(L3)**

C01 Action verb is less than P08 verb by one level. Therefore, the correlation is moderate (2)

**P09: Thumb Rule**

C01 Using Moral Motivation, therefore the correlation is moderate (2)

C02: **Analyze** the ethical consideration of AI to replace the work of humans.

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

C02 Action verb is more than P01 verb. Therefore, the correlation is high (3)

**P03: Analysis(L4)**

C02 Action verb is same as P03 verb. Therefore, the correlation is high (3)

**P06: Apply (L3)**

C02 Action verb is more than P06 verb. Therefore, the correlation is high (3)

**P08: Apply (L3)**

C02 Action verb is more than P08 verb. Therefore, the correlation is high (3)

**P09: Thumbrule**

C02 Using Developing Technology, therefore the correlation is high (3)

C03: **Apply** the sociocultural factors in AI to develop code of ethics.

**Action Verb: Apply(L3)**

**P01: Apply (L3)**

C03 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P03: Analysis(L4)**

C03 Action verb is less than P03 verb by one level. Therefore, the correlation is moderate (2)

**P06: Apply(L3)**

C03 Action verb is same as P06 verb. Therefore, the correlation is high (3)

**P08: Apply(L3)**

C03 Action verb is same as P08 verb. Therefore, the correlation is high (3)

**P09: Thumbrule**

C03 Developing Codes of Ethics, therefore the correlation is moderate (2)

**P010: Thumbrule**

C03 Developing Codes of Ethics, therefore the correlation is moderate (2)

**P011: Thumbrule**

C03 Developing Codes of Ethics, therefore the correlation is moderate (2)

C04: **Analyze** the code to control pitfall in the ethics of AI.

**Action Verb: Analyze(L4)**

**P01: Apply (L3)**

C04 Action verb is more than P01 verb. Therefore, the correlation is high (3)

**P03: Analyze(L4)**

C04 Action verb is same as P03 verb. Therefore, the correlation is high (3)

**P06: Apply(L3)**

C03 Action verb is more than P06 verb. Therefore, the correlation is high (3)

**P08: Apply(L3)**

C03 Action verb is more than P08 verb. Therefore, the correlation is high (3)

**P09: Thumbrule**

C04 Building Ethics into AI , therefore the correlation is high (3)

**P010: Thumbrule**

C04 Using Enhancing Human Agency, therefore the correlation is high (3)

**P011: Thumbrule**



C04 Thinking About Ethical Issues in Developing and Implementing Codes of Ethics, therefore the correlation is high (3)

C05: **Understand** the privacy aspects of ICT to Perform Data Mining.

**Action Verb: Understand (L2)**

**P01: Apply (L3)**

C05 Action verb is less than P01 verb by one level. Therefore, the correlation is moderate (2)

**P03: Analysis(L4)**

C05 Action verb is less than P03 verb by two levels. Therefore, the correlation is low (1)

**P04: Analysis(L4)**

C05 Action verb is less than P04 verb by two levels. Therefore, the correlation is low (1)

**P09: Thumbrule**

C05 Data-collecting institutions and data users, therefore the correlation is moderate (2)

**P010: Thumbrule**

C05 Data-collecting institutions and data users, therefore the correlation is moderate (2)

**P011: Thumbrule**

C05 Strategies for controlling privacy, therefore the correlation is moderate (2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	Reinforcement Learning	L	T/CLC	P	C
20AOE3006	IV-I		4	2	0	3

**Course Outcomes:**

After Studying the Course, student will be able to

**C01: Understand** the Reinforcement learning problems with different branches of ML.

**C02: Evaluate** the various Tabular solution methods to Markov Decision process.

**C03: Apply** the various Prediction and Control by Dynamic Programming

**C04: Analyze** the model free prediction and control using Monte carlo methods.

**C05: Analyze** the policy gradient methods to Perform Reinforcement algorithm.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	the Reinforcement learning problems with different branches of ML.			L2
C02	Evaluate	the various Tabular solution methods		to Markov Decision process	L5
C03	Apply	the various Prediction and Control		by Dynamic Programming	L3
C04	Analyze	the model free prediction and control		using Monte carlo methods	L4
C05	Analyze	the policy gradient methods		to Perform Reinforcement algorithm.	L4

<b>UNIT - I</b>	
<b>Introduction</b> Course logistics and overview. Origin and history of Reinforcement Learning research. Its connections with other related fields and with different branches of machine learning. Probability Primer Brush up of Probability concepts - Axioms of probability, concepts of random variables, PMF, PDFs, CDFs, Expectation. Concepts of joint and multiple random variables, joint, conditional and marginal distributions. Correlation and independence	
<b>UNIT - II</b>	9Hrs
<b>Markov Decision Process</b> Introduction to RL terminology, Markov property, Markov chains, Markov reward process (MRP). Introduction to and proof of Bellman equations for MRPs along with proof of existence of solution to Bellman equations in MRP. Introduction to Markov decision process (MDP), state and action value functions, Bellman expectation equations, optimality of value functions and policies, Bellman optimality equations.	
<b>UNIT - III</b>	9 Hrs
<b>Prediction and Control by Dynamic Programming</b> Overview of dynamic programming for MDP, definition and formulation of planning in MDPs, principle of optimality, iterative policy evaluation, policy iteration, value iteration, Banach fixed point theorem, proof of contraction mapping property of Bellman expectation and optimality operators, proof of convergence of policy evaluation and value iteration algorithms, DP extensions.	
<b>UNIT - IV</b>	9 Hrs
<b>Monte Carlo Methods for Model Free Prediction and Control</b> Overview of Monte Carlo methods for model free RL, First visit and every visit Monte Carlo, Monte Carlo control, On policy and off policy learning, Importance sampling. <b>TD Methods</b> Incremental Monte Carlo Methods for Model Free Prediction, Overview TD(0), TD(1) and TD( $\lambda$ ), kstep estimators, unified view of DP, MC and TD evaluation methods, TD Control methods - SARSA, Q-Learning and their variants.	
<b>UNIT - V</b>	9 Hrs
<b>Policy Gradients</b> Getting started with policy gradient methods, Log-derivative trick, Naive REINFORCE algorithm, bias and variance in Reinforcement Learning, Reducing variance in policy gradient estimates, baselines, advantage function, actorcritic methods	
<b>Textbooks:</b>	

1. Sutton, Richard S., and Andrew G. Barto. Reinforcement learning: An introduction. MIT press, 2018.
2. Leon-Garcia, Alberto. Probability and random processes for electrical engineering. Pearson Education India, 1994
<b>Reference Books:</b>
1. Murphy, Kevin P. Machine learning: a probabilistic perspective. MIT press, 2012.
<b>Online Learning Resources:</b>
1. A brief introduction to reinforcement learning (freecodecamp.org)
2. Reinforcement learning - GeeksforGeeks

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1											
CO2	3	2		3							3		
CO3	3	2	3	2			2				2	1	
CO4	3	3		3							3		
CO5	3	3		3								1	

Correlation matrix

### Justification Statements:

**CO1: Understand** the Reinforcement learning problems with different branches of ML.

Unit No.	CO		Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Co's Action verb	BTL			
1	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Analyze(L4)	2 1
2	CO2: Evaluate	L5	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Formulate (L6) PO4: Analysis (L4) PO11: Thumb rule	3 2 3 3
3	CO3: Apply	L3	PO1 PO2 PO3 PO4 PO7 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop (L3) PO4: Analysis(L4) PO7: Thumb rule PO11: Thumb rule	3 2 3 2 2 2
4	CO4: Analyze	L4	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO4: Analyze (L4) PO11: Thumb rule	3 3 3 3
5	CO5: Analyze	L4	PO1 PO2 PO4	PO1: Apply(L3) PO2: Analyze(L4) PO4: Analysis (L4)	3 3 3

**Action Verb: Understand (L2)**

**PO1 Verb: Apply (L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)

**PO2 Verb: Analyze (L4)**

CO1 Action verb is less than PO2 verb by two levels. Therefore, the correlation is low (1)

**CO2: Evaluate** the various Tabular solution methods to Markov Decision process.

**Action Verb: Evaluate (L5)**

**PO1: Apply (L3)**

CO2 Action verb is more than PO1 verb. Therefore, the correlation is high (3)

**PO2: Formulate (L6)**

CO2 Action verb is less than PO2 verb by one levels. Therefore, the correlation is moderate (2)

**PO4: Analysis (L4)**

CO2 Action verb is more than PO4 verb. Therefore, the correlation is high (3)

**PO11: Thumb rule**

For some Tabular solution methods to Markov reward process to write programs. Therefore, the correlation is high (3)

**C03: Apply** the various Prediction and Control by Dynamic Programming  
**Action Verb: Apply (L3)**

**P01: Apply(L3)**

CO4 Action verb is same as P01 verb. Therefore, the correlation is high(3)

**P02: Analyze (L4)**

CO4 Action verb is less than P02 verb by one level. Therefore, the correlation is moderate (2)

**P03: Develop (L3)**

CO4 Action verb is same as P03 verb. Therefore, the correlation is high (3)

**P04: Analysis (L4)**

CO4 Action verb is less than P04 verb by one level. Therefore, the correlation is moderate (2)

**P07: Thumb rule**

For some of Real Time problems using in machine learning algorithm concept is indirectly used to sustainable environment development. Therefore, the correlation is moderate (2)

**P011: Thumb rule**

For some of various policy to gradient using to Reinforcement algorithm write programs and evaluation. Therefore, the correlation is moderate (2)

**C04: Analyze** the model free prediction and control using Monte carlo methods.

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

CO4 Action verb is more than po1 verb. Therefore, the correlation is high (3)

**P02: Analyze (L4)**

CO4 Action verb is same as P02 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

CO4 Action verb is same as P04 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

For some of Non-Linear Data Sets applications, concepts are used to lstm. Therefore, the correlation is high (3)

**C05: Analyze** the policy gradient methods to Perform Reinforcement algorithm.

**Action Verb: Analyze (L4)**

**P01: Apply(L3)**

CO5 Action verb is more than P01 verb. Therefore, the correlation is high (3)

**P02: Analyze (L4)**

CO5 Action verb is same as P02 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

CO5 Action verb is same as P04 verb. Therefore, the correlation is high (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science**

**(AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	DATA ANALYTICS	L	T/CLC	P	C
20APE3016	IV-I		4	2	0	3

**Course Outcomes:**

After Studying the Course, student will be able to

C01: **Understand** the basic concepts of R programming to perform statistical analysis.

C02: **Analyze** the Data Analytics by using Machine Learning algorithms like regression, multiple linear regression for estimation.

C03: **Apply** the linear model framework for Data Analytics using regression, linear models.

C04: **Evaluate** the simulation methods, optimization methods, forecasting analysis and survival analysis by using case studies.

C05: **Apply** the various analytics for real time applications.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	the basic concepts of R programming		to perform statistical analysis.	L2
C02	Analyze	the Data Analytics	By using Machine Learning algorithms like regression, multiple linear regression.	For estimation	L4
C03	Apply	the linear model framework	By using regression, linear models	for Data Analytics	L3
C04	Evaluate	the simulation methods, optimization methods, forecasting analysis and survival analysis	By using case studies		L5
C05	Apply	The various analytics		for real time applications.	L3

<b>UNIT - I</b>	<b>An overview of R</b>	10 Hrs
<b>An overview of R</b> , Vectors, factors, univariate time series, Data frames, matrices, Functions, operators, loops, Graphics, Revealing views of the data, Data summary, Statistical analysis questions, aims, and strategies; Statistical models, Distributions: models for the random component, Simulation of random numbers and random samples, Model assumptions		
<b>UNIT - II</b>	<b>Basic concepts of estimation</b>	9 Hrs
<b>Basic concepts of estimation</b> , Confidence intervals and tests of hypotheses, Contingency tables, One-way unstructured comparisons, Response curves, Data with a nested variation structure, Resampling methods for standard errors, tests, and confidence intervals, Theories of inference, Regression with a single predictor, multiple linear regressions.		
<b>UNIT - III</b>	<b>Exploiting the linear model framework</b>	9 Hrs
<b>Exploiting the linear model framework</b> : Levels of a factor – using indicator variables, Fitting multiple lines, Polynomial regression, Methods for passing smooth curves through data, Smoothing with multiple explanatory variables, Generalized linear models, Logistic multiple regression, Logistic models for categorical data, Poisson regression, Additional notes on generalized linear models, Models with an ordered categorical or categorical response, Survival analysis, Transformations for count data, Time series models.		
<b>UNIT - IV</b>	<b>Simulation</b>	8 Hrs
<b>Simulation</b> - Motivating Examples, Simulation Modeling Method, case study. Introduction to optimization – Introduction, Methods in Optimization- Linear Programming, Integer Programming—Enforcing Integrality Restrictions on Decision Variables, Nonlinear Optimization Models. Forecasting Analytics - Methods and Quantitative Approaches of Forecasting, Applied Forecasting Analytics Process, Applications, Evaluating Forecast Accuracy. Survival Analysis – Introduction, Motivating Business Problems, Methods of Survival Analysis, case study		
<b>UNIT - V</b>	<b>Applications</b>	9 Hrs

<b>Applications:</b> Retail Analytics, Marketing Analytics, Financial Analytics, Social Media and Web Analytics, Healthcare Analytics
<b>Textbooks:</b>
1. Data Analysis and Graphics Using R – an Example-Based Approach, John Maindonald, W. John Braun, Third Edition, 2010
2. Essentials of Business Analytics An Introduction to the Methodology and its Applications, Bhimasankaram Pochiraju, Sridhar Seshadri, Springer, 2019, <a href="https://doi.org/10.1007/978-3-319-68837-4">https://doi.org/10.1007/978-3-319-68837-4</a>
<b>Reference Books:</b>
1. Data Analytics Using R Paperback, Seema Acharya, McGraw Hill Education, Apr 2018
2. R for Everyone: Advanced Analytics and Graphics Paperback, Jared P. Lander, Pearson Education, 2018
4. Business Analytics for Decision Making, Regi Mathew, First Edition, Pearson Paperback, 2020

#### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	2	1											
C02	3	3				3					3		
C03	3	2				2						2	
C04	3	3	2	2	2			3				2	
C05	3	2									2		

#### Correlation matrix

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	14	23%	3	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Analyze(L4)	2 1
2	12	19%	2	CO2: Analyze	L4	PO1 PO2 PO6 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO6:Thumb Rule PO11:Thumb Rule	3 3 3 3
3	15	25%	3	CO3: Apply	L3	PO1 PO2 PO6	PO1: Apply(L3) PO2: Analyze(L4) PO6:Thumb Rule	3 2 2
4	15	25%	3	CO4: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO8	PO1: Apply(L3) PO2: Analyze(L4) PO3: Design (L6) PO4: Design (L6) PO5: Create(L6) PO8:Thumb Rule	3 3 2 2 2 3
5	5	8%	1	CO3: Apply	L3	PO1 PO2 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO11:Thumb Rule	3 2 2
	61	100 %						

#### Justification Statements :

**C01: Understand** the basic concepts of R programming

**Action Verb: Understand (L2)**

**P01: Apply (L3)**

C01 Action verb is less than P01 verb by one level. Therefore the correlation is moderate (2)

**P02: Analyze (L4)**

C01 Action verb is less than P02 verb by two levels. Therefore the correlation is low (1)

**C02: Analyze** the Data Analytics by using Machine Learning algorithms like regression, multiple linear regression for estimation.

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

C02 Action verb is greater than P01 verb. Therefore the correlation is high(3)

**P02: Analyze (L4)**

C02 Action verb is same as P02 verb . Therefore the correlation is high(3)

**P06: Thumb rule**

By using estimation concepts, the programmers are able to solve engineering problems using machine learning algorithms. Therefore the correlation is high(3)

**P011: Thumb rule**

Data Analytics estimation concepts are used for solving complex problems. Therefore the correlation is high(3)

**C03: Apply** the linear model framework for Data Analytics using regression, linear models.

**Action Verb : Apply(L3)**

**P01: Apply(L3)**

C03 Action verb is same level as P01 verb. Therefore the correlation is high (3)

**P02: Analyze (L4)**

C03 Action verb is less than P02 verb by one level. Therefore the correlation is moderate (2)

**P011: Thumb rule**

Linear models are used to create framework for generating hypotheses Therefore the correlation is moderate (2)

**C04: Evaluate** the simulation methods, optimization methods, forecasting analysis and survival analysis by using case studies.

**Action Verb : Evaluate(L5)**

**P01: Apply(L3)**

C04 Action verb is greater than P01 verb. Therefore the correlation is high (3)

**P02: Analyze (L4)**

C04 Action verb is greater than P02 verb. Therefore the correlation is high (3)

**P03: Design (L6)**

C04 Action verb is less than P03 verb by one level. Therefore the correlation is moderate (2)

**P04: Design (L6)**

C04 Action verb is less than P04 verb by one level. Therefore the correlation is moderate (2)

**P05: Create(L6)**

C04 Action verb is less than P05 verb by one level. Therefore the correlation is moderate (2)

**P08: Thumb rule**

Since ethical principles shall be followed in performing simulation, optimization and analysis. Therefore the correlation is high(3)

**C05: Apply** the various analytics for real time applications.

**Action Verb : Apply (L3)**

**P01: Apply(L3)**

C05 Action verb is same level as P01 verb. Therefore the correlation is high (3)

**P02: Analyze (L4)**

C05 Action verb is less than P02 verb by one level. Therefore the correlation is moderate (2)

**P011: Thumb rule**

For real time applications, Data Analytics concepts are used. Therefore the correlation is moderate (2)





**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	SOFTWARE PROJECT MANAGEMENT	L	T/CLC	P	C
20APE3017	IV-I		4	2	0	3

**Course Outcomes:**

**After Studying the Course, student will be able to**

**CO1: Understand** the purpose and importance of project management

**CO2: Evaluate** the economics for improving software project quality

**CO3: Analyze** the phases and process of software project management life cycle

**CO4: Analyze** process workflows and responsibilities

**CO5: Apply** process control and instrumentation for CCPDS-R

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the purpose and importance of project management			L2
CO2	Evaluate	The economics		for improving software project quality	L5
CO3	Analyze	the phases and process of software management life cycle			L4
CO4	Analyze	process workflows and responsibilities			L4
CO5	Apply	process control and instrumentation		for CCPDS-R	L3

<b>UNIT - I</b>	<b>Conventional Software Management</b>	9 Hrs
<b>Conventional Software Management:</b> The waterfall model, conventional software Management performance. Evolution of Software Economics: Software Economics, pragmatic software cost estimation		
<b>UNIT - II</b>	<b>Improving Software Economics</b>	9 Hrs
<b>Improving Software Economics:</b> Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections. <b>The old way and the new:</b> The principles of conventional software engineering, principles of modern software management, transitioning to an iterative process		
<b>UNIT - III</b>	<b>Life cycle phases</b>	9 Hrs
<b>Life cycle phases:</b> Engineering and production stages, inception, Elaboration, construction, transition phases. <b>Artifacts of the process:</b> The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts. Model based software architectures: A Management perspective and technical perspective.		
<b>UNIT - IV</b>	<b>Work Flows of the process</b>	9 Hrs
<b>Work Flows of the process:</b> Software process workflows, Inter Trans workflows. Checkpoints of the Process: Major Mile Stones, Minor Milestones, Periodic status assessments. <b>Iterative Process Planning:</b> Work breakdown structures, planning guidelines, cost and schedule estimating, Interaction planning process, Pragmatic planning. <b>Project Organizations and Responsibilities:</b> Line-of-Business Organizations, Project Organizations, evolution of Organizations. Process Automation: Automation Building Blocks, The Project Environment		
<b>UNIT - V</b>	<b>Project Control and Process instrumentation</b>	9 Hrs
<b>Project Control and Process instrumentation:</b> The server care Metrics, Management indicators, quality indicators, life cycle expectations pragmatic Software Metrics, Metrics automation. <b>Tailoring the Process:</b> Process discriminates, Example. Future Software Project Management: Modern Project Profiles Next generation Software economics, modern Process transitions. <b>Case Study:</b> The Command Center Processing and Display System-Replacement (CCPDS-R)		
<b>Textbooks:</b>		
1. Software Project Management, Walker Royce, Pearson Education. 2. Software Project Management, Bob Hughes & Mike Cotterell, fourth edition, Tata Mc- Graw Hill		
<b>Reference Books:</b>		
1. Applied Software Project Management, Andrew Stellman & Jennifer Greene, O'Reilly, 2006 2. Head First PMP, Jennifer Greene & Andrew Stellman, O'Reilly, 2007		

3. Software Engineering Project Management, Richard H. Thayer & Edward Yourdon, second edition, Wiley India, 2004.
4. Agile Project Management, Jim Highsmith, Pearson education, 2004
5. The art of Project management, Scott Berkun, O'Reilly, 2005.
6. Software Project Management in Practice, Pankaj Jalote, Pearson Education, 2002

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2										2		
CO2	3	3	3						3		3		
CO3	2	2							3		3		
CO4	2	2		3					3		3		
CO5	3	3		2							2		

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	CO1 :Understand	L2	PO1 PO11	PO1: Apply(L3) PO11: Thumb rule	2 2
2	CO2 : Evaluate	L5	PO1 PO2 PO3 PO9 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3:Apply(L3) PO9: Thumb rule PO11: Thumb rule	3 3 3 3 3
3	CO3 : Analyze	L4	PO1 PO2 PO9 PO11	PO1: Apply(L3) PO2: Identify (L3) PO9: Thumb rule PO11: Thumb rule	3 3 3 3
4	CO4 : Analyze	L4	PO1 PO2 PO4 PO9 PO11	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze (L4) PO9: Thumb rule PO11: Thumb rule	3 3 3 3 3
5	CO5 : Apply	L3	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze (L4) PO11: Thumb rule	3 3 2 2

### Justification Statements:

**CO1:** Understand the purpose and importance of project management

**Action Verb: Understand (L2)**

PO1: Apply(L3)

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

PO11: Thumb rule

To understand the purpose and importance of project management, knowledge on projects and management principles are required. Therefore the correlation is medium (2)

**CO2:** Evaluate the economics for improving software project quality

**Action Verb: Evaluate (L5)**

PO1: Apply(L3)

CO2 Action verb is more than PO1 verb. Therefore the correlation is high (3)

PO2: Analyze (L4)

CO2 Action verb is more than PO2 verb. Therefore the correlation is high (3)

PO3: Apply(L3)

CO2 Action verb is more than PO3 verb. Therefore the correlation is high (3)

PO9: Thumb rule

To evaluate the economics for improving software project quality, teamwork and individual performance is required. Therefore the correlation is high(3)

PO11: Thumb rule

To evaluate the economics for improving software project quality, knowledge on projects and management principles are required. Therefore the correlation is high(3).

**C03:** Analyze the phases and process of software project management life cycle

**Action Verb : Analyze (L4)**

PO1: Apply(L3)

C03 Action verb is more than PO1 verb. Therefore the correlation is high (3)

PO2: Identify (L3)

C03 Action verb is more than PO2 verb. Therefore the correlation is high (3)

PO9: Thumb rule

To analyze the phases and process of software project management life cycle, teamwork and individual performance is required. Therefore the correlation is high (3)

PO11: Thumb rule

To analyze the phases and process of software project management life cycle, knowledge on projects and management principles are required. Therefore the correlation is high (3)

**C04:** Analyze process workflows and responsibilities

**Action Verb : Analyze(L4)**

PO1: Apply( L3)

C04 Action verb is more than PO1 verb. Therefore the correlation is high (3)

PO2: Identify (L3)

C04 Action verb is more than PO2 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

C04 Action verb is same as PO4 verb. Therefore the correlation is high (3)

PO9: Thumb rule

To analyze process workflows and responsibilities, teamwork and individual performance is required. Therefore the correlation is high(3).

PO11: Thumb rule

To analyze process workflows and responsibilities, knowledge on projects and management principles are required. Therefore the correlation is high(3).

**C05:** Apply process control and instrumentation for CCPDS-R

**Action Verb : Apply (L3)**

PO1: Apply( L3)

C05 Action verb is same as PO1 verb. Therefore the correlation is high (3)

PO2: Identify (L3)

C05 Action verb is same as PO2 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

C05 Action verb is less than PO4 verb by one level. Therefore the correlation is medium (2)

PO11: Thumb rule

To apply process control and instrumentation for CCPDS-R, knowledge on projects and management principles are required. Therefore the correlation is medium (2).



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	Linux Environment System	L	T/CLC	P	C
20APE3018	IV-I		4	2	0	3

**Course Outcomes:**

**After Studying the Course, student will be able to**

**CO1: Understand** the introductory concepts of LINUX operating system .

**CO2: Analyze** the procedure to install LINUX operating system.

**CO3: Apply** the procedure to configure various privileges for the user and system.

**CO4: Analyze** the various commands through console window.

**CO5: Evaluate** the file system services in real time applications.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the introductory concepts of LINUX operating system			L2
CO2	Analyze	the procedure to install LINUX operating system			L4
CO3	Apply	the procedure to configure various privileges		for the user and system	L3
CO4	Analyze	the various commands	through console window		L4
CO5	Evaluate	the file system services		in real time applications	L5

<b>UNIT - I</b>	<b>INTRODUCTION TO LINUX OPERATING SYSTEM</b>	9 Hrs
<b>INTRODUCTION TO LINUX OPERATING SYSTEM:</b> Introduction and Types of Operating Systems, Linux Operating System, Features, Architecture Of Linux OS and Shell Interface, Linux System Calls, Linux Shared Memory Management, Device and Disk Management in Linux, Swap space and its management. File System and Directory Structure in Linux. Multi-Processing, load sharing and Multi-Threading in Linux, Types of Users in Linux, Capabilities of Super Users and equivalents.		
<b>UNIT - II</b>	<b>INSTALLING LINUX AS A SERVER</b>	9 Hrs
<b>INSTALLING LINUX AS A SERVER :</b> Linux and Linux Distributions ; Major differences between various Operating Systems (on the basis of: Single Users vs Multiusers vs Network Users; Separation of the GUI and the Kernel; Domains; Active Directory;).		
<b>INSTALLING LINUX IN A SERVER CONFIGURATION :</b> Before Installation; Hardware; Server Design ;Dual-Bootting Issues; Modes of Installation; Installing Fedora Linux; Creating a Boot Disk; Starting the Installation; <b>GNOME AND KDE:</b> The History of X Windows; The Downside; Enter GNOME; About GNOME ; Starting X Windows and GNOME; GNOME Basics; The GNOME Configuration Tool.		
<b>UNIT - III</b>	<b>INSTALLING SOFTWARE</b>	9 Hrs
<b>INSTALLING SOFTWARE :</b> The Fedora Package Manager; Installing a New Package using dpkg and RPM; Querying a Package; Uninstalling a Package using dpkg and RPM; Compiling Software; Getting and Unpacking the Package; Looking for Documentation; Configuring the Package; Compiling Your Package; Installing the Package, Driver Support for various devices in linux. <b>MANAGING USERS:</b> Home Directories ;Passwords; Shells; Startup Scripts; Mail; User Databases; The / etc /passwd File; The / etc / shadow File; The / etc /group File; User Management Tools; Command-Line User Management; User LinuxConf to Manipulate Users and Groups; SetUID and SetGID Programs.		
<b>UNIT - IV</b>	<b>THE COMMAND LINE</b>	9Hrs
<b>THE COMMAND LINE :</b> An Introduction to BASH, KORN, C, A Shell etc. ; BASH commands: Job Control; Environment Variables; Pipes; Redirection; Command-Line Shortcuts; Documentation Tools; The man Command; the text info System; File Listings; Owner ships and permissions; Listing Files; File and Directory Types; Change Ownership; Change Group; Change Mode ; File Management and Manipulation; Process Manipulation; Miscellaneous Tools; Various Editors Available like: Vi and its		

modes, Pico, Joe and emacs, Su Command. BOOTING AND SHUTTING DOWN: LILO and GRUB; Configuring LILO; Additional LILO options; Adding a New Kernel to Boot ; Running LILO; The Steps of Booting; Enabling and disabling Services.

<b>UNIT – V</b>	<b>FILE SYSTEMS</b>	9 Hrs
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**FILE SYSTEMS:** The Makeup File Systems; Managing File Systems; Adding and Partitioning a Disk; Network File Systems; Quota Management; CORE SYSTEM SERVICES: The init Service; The inetd and xinetd Processes; The syslogd Daemon; The cron Program. PRINTING : The Basic of lpd; Installing LPRng; Configuring /etc/printcap; The /ETC/lpd.perms File; Clients of lpd, Interfacing Printer through Operating System.

**Textbooks:**

1. Linux Administration: A Beginner's Guide by Steve Shah , Wale Soyinka, ISBN 0072262591 (0-07-226259-1), McGraw-Hill Education.
2. Unix Shell Programming, Yashavant P. Kanetkar, BPB Publications, 2003.
3. UNIX Concepts and Applications by Sumitabha Das Tata McGraw-Hill, 2006.
4. Operating System Concepts 8<sup>th</sup> edition, by Galvin Wiley Global Education, 2012.

**Reference Books:**

1. Unix operating system, by Grace Todino, John Strang, Jerry D. Peek Oreily publications 1993.
2. Operating System Concepts 8<sup>th</sup> edition, by Galvin Wiley Global Education, 2012.

**Mapping of course outcomes with program outcomes**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3											
CO2	3	3									2		
CO3	3	3		2	3								
CO4	3	3									2		
CO5	3	3	3	3	3						2	2	2

**Correlation matrix**

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	CO2: Analyze	L4	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	3 3 2
3	CO3: Apply	L3	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO4: Analyze (L4) PO5: Apply(L3)	3 3 2 3
4	CO4: Analyze	L4	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	3 3 2
5	CO5: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb rule	3 3 3 3 3 2

## Justification Statements :

**C01: Understand** the introductory concepts of LINUX operating system

**Action Verb : Understand (L2)**

**P01 Verb : Apply(L3)**

C01 Action verb is Less than P01 verb by one level. Therefore, the correlation is Medium (2)

**P02 Verb : Review(L2)**

C01 Action verb is same level as P02 verb. Therefore the correlation is high(3)

**C02: Analyze** the procedure to install LINUX operating system.

**Action Verb : Analyze (L4)**

**P01: Apply(L3)**

C02 Action verb is greater than P01 verb. Therefore, the correlation is high (3)

**P02: Review(L2)**

C02 Action verb is greater than P02 verb. Therefore, the correlation is high(3)

**P011: Thumb rule**

Installations of operating systems are a continuous activity. Therefore the correlation is medium (2)

**C03: Apply** the procedure to configure various privileges for the user and system.

**Action Verb : Apply (L3)**

**P01: Apply(L3)**

C03 Action verb is same level as of P01 verb. Therefore, the correlation is High (3)

**P02: Review (L2)**

C03 Action verb is greater level as P02 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

C03 Action verb is less than P04 verb by one level. Therefore the correlation is medium(2)

**P05: Apply(L3)**

C03 Action verb is same level as P05 verb. Therefore the correlation is high(3)

**C04: Analyze** the various commands through console window.

**Action Verb : Analyze (L4)**

**P01: Apply(L3)**

C04 Action verb is greater than P01 verb. Therefore the correlation is high (3)

**P02: Review(L2)**

C04 Action verb is greater than P02 verb. Therefore the correlation is high(3)

**P011: Thumb rule**

Various commands using console window useful in future enhancements. Therefore the correlation is medium(2)

**C05: Evaluate** the file system services in real time applications.

**Action Verb : Evaluate (L5)**

**P01: Apply(L3)**

C05 Action verb is greater than P01 verb. Therefore the correlation is high(3)

**P02: Review (L2)**

C05 Action verb is greater than P02 verb. Therefore the correlation is high (3)

**P03: Develop (L3)**

C05 Action verb is greater than P03 verb. Therefore the correlation is high(3)

**P04: Analyze (L4)**

C05 Action verb is greater than P04 verb. Therefore the correlation is high(3)

**P05: Apply(L3)**

C05 Action verb is greater than P05 verb. Therefore the correlation is high (3)

**P011: Thumb rule**

File system services usage is a continuous process . Therefore the correlation is medium (2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	Data Science Applications	L	T/CLC	P	C
20APE3019	IV-I		4	2	0	3

**Course Outcomes:**

**After Studying the Course, student will be able to**

**C01: Understand** the data science applications and strategies in various domains

**C02: Apply** the data science tools and technologies for stock market analysis

**C03: Apply** the data science methodologies in education, social media to solve real time problems

**C04: Analyze** the data science concepts in Healthcare and Bioinformatics

**C05: Analyze** the various data optimization techniques using python programming

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	the data science applications and strategies		in various domains	L2
C02	Apply	the data science tools and technologies	for stock market analysis		L3
C03	Apply	the data science methodologies	in education, social media	to solve real time problems	L3
C04	Analyse	the data science concepts	in Healthcare and Bioinformatics		L4
C05	Analyse	the various data optimization techniques	using python programming		L4

**UNIT - I**

Data Science Applications in various domains, Challenges and opportunities, tools for data scientists, Recommender systems – Introduction, methods, application, challenges.

**UNIT - II**

Time series data – stock market index movement forecasting. Supply Chain Management – Real world case study in logistics.

**UNIT - III**

Data Science in Education, Social media.

**UNIT - IV**

Data Science in Healthcare, Bioinformatics.

**UNIT - V**

Case studies in data optimization using Python.

**Textbooks:**

1. Aakanksha Sharaff, G.K.Sinha, "Data Science and its applications ", CRC Press, 2021.
2. Q. A. Menon, S. A. Khoja, "Data Science: Theory, Analysis and Applications", CRC Press, 2020.

**Mapping of course outcomes with program outcomes**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	2	2									2		1
C02	3	2		2	3						2		2
C03	3	2		2							2		
C04	3	3	3	3							3		
C05	3	3		3	3						3		1

## Correlation Matrix

Unit No.	co		Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Co's Action verb	BTL			
1	CO1: Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Identify(L3) PO11: Thumb rule	2 2 2
2	CO2: Apply	L3	PO1 PO2 PO4 PO5 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO4: Analysis (L4) PO5: Apply(L3) PO11: Thumb rule	3 2 2 3 2
3	CO3: Apply	L3	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO4: Analysis (L4) PO11: Thumb rule	3 2 2 2
4	CO4: Analyse	L4	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Design (L3) PO4: Analysis (L4) PO11: Thumb rule	3 3 3 3 3
5	CO5: Analyse	L4	PO1 PO2 PO4 PO5 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO4: Analysis (L4) PO5: Apply(L3) PO11: Thumb rule	3 3 3 3 3

### Justification Statements:

**CO1: Understand** the data science applications and strategies in various domains

**Action Verb: Understand (L2)**

**PO1 Verb: Apply (L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)

**PO2 Verb: Identify (L3)**

CO1 Action verb is less than PO2 verb by one level. Therefore, the correlation is moderate (2)

**PO11: Thumb rule**

For various domains data science applications are used. Therefore, the correlation is moderate (2)

**CO2: Apply** the data science tools and technologies for stock market analysis

**Action Verb: Apply (L3)**

**PO1: Apply (L3)**

CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

**PO2: Analyze (L4)**

CO2 Action verb is less than PO2 verb by one level. Therefore, the correlation is moderate (2)

**PO4: Analysis (L4)**

CO2 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)

**PO5: Apply (L3)**

CO2 Action verb is same level as PO5 verb. Therefore, the correlation is high (3)

**PO11: Thumb rule**

For stock market analysis data science tools are applied. Therefore, the correlation is moderate (2)

**CO3: Apply** the data science methodologies in education, social media to solve real time problems

**Action Verb: Apply (L3)**

**PO1: Apply (L3)**

CO3 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

**PO2: Analyze (L4)**

CO3 Action verb is less than PO2 verb by one level. Therefore, the correlation is moderate (2)



**P04: Analysis (L4)**

C03 Action verb is less than P04 verb by one level. Therefore, the correlation is moderate (2)

**P011: Thumb rule**

For some education and social media applications data science concepts are used. Therefore, the correlation is moderate (2)

**C04: Analyse** the data science concepts in Healthcare and Bioinformatics

**Action Verb: Analyse (L4)**

**P01: Apply (L3)**

C04 Action verb is more than P01 verb. Therefore, the correlation is high(3)

**P02: Analyze (L4)**

C04 Action verb is same level as P02 verb. Therefore, the correlation is high (3)

**P03: Design (L3)**

C04 Action verb is more than P03 verb. Therefore, the correlation is high (3)

**P04: Analysis (L4)**

C04 Action verb is same level as P04 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

For some Healthcare and Bioinformatics applications data science concepts are used. Therefore, the correlation is high (3)

**C05: Analyse** the various data optimization techniques using python programming

**Action Verb: Analyse (L4)**

**P01: Apply (L3)**

C05 Action verb is less than P01 verb by one level. Therefore, the correlation is high (3)

**P02: Analyze (L4)**

C05 Action verb is same level as P02 verb. Therefore, the correlation is high (3)

**P04: Analysis (L4)**

C05 Action verb is same level as P02 verb. Therefore, the correlation is high (3)

**P05: Apply (L3)**

C05 Action verb is less than P05 verb by one level. Therefore, the correlation is high (3)

**P011: Thumb rule**

For stock market analysis data science tools are applied. Therefore, the correlation is high (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science**

**(AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	Data Science For Business	L	T/CLC	P	C
20APE3020	IV-I		4	2	0	3

**Course Outcomes:**

**After Studying the Course, student will be able to**

**CO1: Understand** the fundamentals of business intelligence.

**CO2: Evaluate** the data mining concepts with business intelligence.

**CO3: Understand** the modeling techniques to generate an analytical model.

**CO4: Analyze** the text mining with data analysis and knowledge delivery stages.

**CO5: Apply** the suitable business intelligence methods and techniques for different conditions.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the fundamentals of business intelligence.			L2
CO2	Evaluate	the data mining concepts	with business intelligence.		L5
CO3	Understand	the modeling techniques	.	to generate an analytical model.	L2
CO4	Analyze	the text mining with data analysis and knowledge delivery stages.			L4
CO5	Apply	the suitable business intelligence methods and techniques		for different conditions.	L3

<b>UNIT - I</b>	
<b>Introduction</b> – Business problems and Data Science Solutions, Introduction to Predictive modeling: From Correlation to Supervised Segmentation	
<b>UNIT - II</b>	
<b>Fitting the Data-</b> Fitting a Model to Data, Overfitting and its Avoidance	
<b>UNIT - III</b>	
Similarity, Neighbors, and Clusters, <b>Decision Analytic Thinking:</b> What is a Good model	
<b>UNIT - IV</b>	
Representing and Mining text, <b>Decision Analytic Thinking II:</b> Toward Analytic Engineering.	
<b>UNIT - V</b>	
Other Data Science Tasks and Techniques, Data Science and Business Strategy	
<b>Textbooks:</b>	
1. Foster Provost and Tom Fawcett, Data Science for Business, O'Reilly, 2013.	
<b>Reference Books:</b>	
1. Efraim Turban, Ramesh Sharda, DursunDelen, "Decision Support and Business Intelligence Systems", 9 th Edition, Pearson 2013.	
2. Larissa T. Moss, S. Atre, "Business Intelligence Roadmap: The Complete ProjectLifecycle of Decision Making", Addison Wesley, 2003.	
3. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for DecisionMaking", Wiley Publications, 2009.	
4. David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Manager'sGuide", Second Edition, 2012.	
<b>Online Learning Resources:</b>	
1. Edx: IBM Data Warehousing and BI Analytics	

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	2										
CO2	3	2	2			2					2		
CO3	2	1						2	1				
CO4	3	1	1	1	1			3	3				
CO5	2	3					3				2		

Correlation matrix

Unit No.	CO		Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Co's Action verb	BTL			
1	CO1 :Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO11: Thumb rule	2 1 2
2	CO2 : Evaluate	L5	PO1 PO2 PO3 PO6 PO11	PO1: Apply(L3) PO2: Formulate (L6) PO3: Design (L6) PO6: Thumb rule PO11: Thumb rule	3 2 2 3 3
3	CO3 : Understand	L2	PO1 PO2 PO8 PO9	PO1: Apply(L3) PO2: Analyze (L4) PO8: Thumb rule PO9: Thumb rule	2 1 2 2
4	CO4 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO8 PO9	PO1: Apply(L3) PO2: Analyze (L4) PO3: Design (L6) PO4: Design (L6) PO5: Create(L6) PO8: Thumb rule PO9: Thumb rule	3 3 1 1 1 3 3
5	CO5 : Apply	L3	PO1 PO2 PO6 PO11	PO1: Analyze(L4) PO2: Identify (L2) PO7: Thumb rule PO11: Thumb rule	2 3 2 2

Justification Statements :

**CO1: Understand** the fundamentals of business intelligence.

**Action Verb : Understand(L2)**

**PO1 Verb : Apply(L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is moderate (2)

**PO2 Verb : Analyze(L4)**

CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

**PO11: Thumb rule**

Identify the fundamental components to meet desired requirements in business applications. Therefore, the correlation is moderate(2)

**CO2: Evaluate** the data mining concepts with business intelligence.

**Action Verb : Evaluate (L5)**

**PO1: Apply(L3)**

CO2 Action verb is more than PO1 verb. Therefore the correlation is high (3)

**PO2: Formulate (L6)**

CO2 Action verb is less than PO2 verb by one level. Therefore the correlation is moderate (2)

**PO3: Design (L6)**

CO2 Action verb is less than PO3 verb by one level. Therefore the correlation is moderate (2)

**PO6: Thumb rule**

For some of computer applications, Various operations are evaluated for mining. Therefore, the correlation is high(3)

**PO11: Thumb rule**

Identify the deficiencies and demonstrate the need of updating the mining concepts to meet desired requirements. Therefore the correlation is high(3)

**C03: Understand** the modeling techniques to generate an analytical model.

**Action Verb : Understand (L2)**

**P01: Apply(L3)**

C03 Action verb is less than P01 verb level by one level. Therefore the correlation is moderate (2)

**P02: Analyze (L4)**

C03 Action verb is less than P02 verb by two level. Therefore the correlation is low (1)

**P08 : Thumb rule**

Since ethical principles should be followed to generate modeling techniques. Therefore the correlation is moderate (2)

**P09 : Thumb rule**

Team work is required to understand and demonstrate the models in computer system. Hence the correlation is moderate (2)

**C04: Analyze** text mining with data analysis and knowledge delivery stages.

**Action Verb : Analyze(L4)**

**P01: Apply(L3)**

C04 Action verb is more than P01. Therefore the correlation is high (3)

**P02: Analyze (L4)**

C04 Action verb is same as P02 verb. Therefore the correlation is high (3)

**P03: Design (L6)**

C04 Action verb is less than P03 verb by two levels. Therefore the correlation is low (1)

**P04: Design (L6)**

C04 Action verb is less than P04 verb by two levels. Therefore the correlation is low (1)

**P05: Create(L6)**

C04 Action verb is less than P05 verb by two levels. Therefore the correlation is low (1)

**P08 : Thumb rule**

Since ethical principles should be followed in data analysis and knowledge discovery. Therefore the correlation is high(3)

**P09 : Thumb rule**

Team work is required to provide the solutions caused due to text mining. Hence the correlation is high (3)

**C05: Apply** suitable business intelligence methods and techniques for different conditions.

**Action Verb : Apply(L3)**

**P01: Analyze (L4)**

C05 Action verb is less than P01 verb by one level. Therefore the correlation is moderate (2)

**P02: Identify (L2)**

C05 Action verb is more than P02 verb. Therefore the correlation is high (3)

**P07 : Thumb rule**

creating different architecture's to provide multitasking and multi-processing. Therefore the correlation is moderate (2).

**P011 : Thumb rule**

Identify the deficiencies and demonstrate the need of updating the business techniques at different conditions. Therefore the correlation is moderate (2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	Data Stream Mining	L	T/CLC	P	C
20APE3021	IV-I		4	2	0	3

**Course Outcomes:**

After Studying the Course, student will be able to

C01: **Understand** the fundamental process of data stream to Perform Testing Framework .

C02: **Apply** the various methods to solve real world problems.

C03: **Analyze** the stream data using prediction strategies in data stream mining.

C04: **Evaluate** the results of data stream mining using various methods.

C05: **Apply** the adaptive Hoeffding trees using decision trees.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	the fundamental process of data stream		to Perform Testing Framework	L2
C02	Apply	the Various methods		to solve real world problems	L3
C03	Analyze	the Stream data	using Prediction Strategies	in data stream mining	L4
C04	Evaluate	the Results of data stream mining	using various methods		L5
C05	Apply	the Adaptive Hoeffding trees	using decision trees		L3

<b>UNIT - I</b>	
MOA Stream Mining, Assumptions, Requirements, Mining Strategies, Change Detection Strategies, MOA Experimental Settings, Previous Evaluation Practices, Evaluation Procedures for Data Streams, Testing Framework, Environments, Data Sources, Generation Speed and Data Size, Evolving Stream Experimental Setting.	
<b>UNIT - II</b>	
Hoeffding Trees, The Hoeffding Bound for Tree Induction, The Basic Algorithm, Memory Management, Numeric Attributes, Batch Setting Approaches, Data Stream Approaches.	
<b>UNIT - III</b>	
Prediction Strategies, Majority Class, Naïve Bayes Leaves, Adaptive Hybrid, Hoeffding Tree Ensembles, Data Stream Setting, Realistic Ensemble Sizes.	
<b>UNIT - IV</b>	
Evolving Data Streams, Algorithms for Mining with Change, A Methodology for Adaptive Stream Mining, Optimal Change Detector and Predictor, Adaptive Sliding Windows, Introduction, Maintaining Updated Windows of Varying Length.	
<b>UNIT - V</b>	
Adaptive Hoeffding Trees, Introduction, Decision Trees on Sliding Windows, Hoeffding Adaptive Trees, Adaptive Ensemble Methods, New methods of Bagging using trees of different size, New method of bagging using ADWIN, Adaptive Hoeffding Option Trees, Method performance.	
<b>Textbooks:</b>	
1. DATA STREAM MINING: A Practical Approach by Albert Bifet and Richard Kirkby.	
<b>Reference Books:</b>	
1. Knowledge discovery from data streams by Gama João. ISBN: 978-1-4398-2611-9.	
2. Machine Learning for Data Streams by Albert Bifet, Ricard Gavaldà; MIT Press, 2017.	

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2											
CO2	3	3		2	3						2		
CO3	3	3		3							3		
CO4	3	3		3							3		
CO5	3	3		2							2	1	

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Identify(L3)	2 2
2	CO2: Apply	L3	PO1 PO2 PO4 PO5 PO11	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze (L4) PO5: Select(L3) PO11: Thumb rule	3 3 2 3 2
3	CO3: Analyze	L4	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO4: Analysis (L4) PO11: Thumb rule	3 3 3 3
4	CO4: Evaluate	L5	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Identify (L3) PO4: Analysis(L4) PO11: Thumb rule	3 3 3 3
5	CO5: Apply	L3	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Identify(L3) PO4: Analysis(L4) PO11: Thumb rule	3 3 2 2

**Justification Statements:**

CO1: **Understand** the fundamental process of data stream to Perform Testing Framework .

**Action Verb: Understand (L2)**

**PO1 Verb: Apply (L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)

**PO2 Verb: Identify (L3)**

CO1 Action verb is less than PO2 verb by one level. Therefore, the correlation is moderate (2)

CO2: **Apply** the various methods to solve real world problems.

**Action Verb: Apply (L3)**

**PO1: Apply (L3)**

CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

**PO2: Identify (L3)**

CO2 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

**PO4: Analyze (L4)**

CO2 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)

**PO5: Select (L3)**

CO2 Action verb is same level as PO5 verb. Therefore, the correlation is high (3)

**PO11: Thumb rule**

For use various methods to solve real world problems. Therefore, the correlation is moderate (2)

CO3: **Analyze** the stream data using prediction strategies in data stream mining.

**Action Verb: Analyze (L4)**

**PO1: Apply (L3)**

CO3 Action verb is more than PO1 verb. Therefore, the correlation is high (3)

**PO2: Analyze (L4)**

CO3 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

**P04: Analysis (L4)**

CO3 Action verb is same level as PO4 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

For Use Analyze stream data using prediction strategies in data stream mining  
Therefore, the correlation is high(3)

CO4: **Evaluate** the results of data stream mining using various methods.

**Action Verb: Evaluate (L5)**

**P01: Apply(L3)**

CO4 Action verb is more than PO1 verb. Therefore, the correlation is high (3)

**P02: Identify (L3)**

CO4 Action verb is more than PO2 verb. Therefore, the correlation is high (3)

**P04: Analysis (L4)**

CO4 Action verb is more than PO4 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

For use Evaluate results of data stream mining using various methods. Therefore, the correlation is high (3)

CO5: **Apply** the adaptive Hoeffding trees using decision trees.

**Action Verb:Apply (L3)**

**P01: Apply(L3)**

CO5 Action verb is same level PO1 verb . Therefore, the correlation is high (3)

**P02: Identity (L3)**

CO5 Action verb is same level PO2 verb . Therefore, the correlation is high (3)

**P04: Analysis (L4)**

CO2 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)

**P011: Thumb rule**

For use Apply adaptive Hoeffding trees using decision trees. Therefore, the correlation is moderate (2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	Process Mining	L	T/CLC	P	C
20APE3022	IV-I		4	2	0	3

**Course Outcomes:**

After Studying the Course, student will be able to

C01: **Understand** the fundamentals elements for process mining

C02: **Apply** the process mining tools to automate the data collection process.

C03: **Analyze** the various process models in real world process mining problems.

C04: **Evaluate** the various modern technologies to discovery Process Techniques.

C05: **Apply** the Outlook future for process mining in various case studies.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	the fundamentals elements	for process mining		L2
C02	Apply	the Process mining tools		to automate the data collection process	L3
C03	Analyze	the Various process models	in real world process mining		L4
C04	Evaluate	the various modern technologies		to discovery Process Techniques	L5
C05	Apply	the Outlook future for process mining		in various case studies	L3

<b>UNIT - I</b>	
<b>Introduction:</b> Process Mining in a Nutshell, Purpose: Identifying the Right Use Cases, Challenges, Pitfalls, and Failures. Process Mining, RPA, BPM, and DTO.	
<b>UNIT - II</b>	
<b>Process Mining:</b> The Missing Link- Limitations of Modelling, Process Mining, Analysing an Example Log, Play-In, Play-Out, and Replay, Positioning Process Mining. <b>Process Modelling and Analysis:</b> The Art of Modelling, Process Models, Model-Based Process Analysis	
<b>UNIT - III</b>	
<b>Process Discovery:</b> A Simple Algorithm for Process Discovery, Rediscovering Process Models, Challenges. <b>Advanced Process Discovery Techniques:</b> Characteristics, Heuristic Mining, Genetic Process Mining, RegionBased Mining, Inductive Mining.	
<b>UNIT - IV</b>	
<b>Process Mining Software:</b> Process Mining Not Included, Different Types of Process Mining Tools, ProM: An OpenSource Process Mining Platform, Commercial Software. <b>Process Mining in the Large:</b> BigEventData, Case-Based Decomposition, Activity-Based Decomposition, Process Cubes, Streaming Process Mining.	
<b>UNIT - V</b>	
<b>Process Mining Software:</b> Process Mining Not Included, Different Types of Process Mining Tools, ProM: An OpenSource Process Mining Platform, Commercial Software. <b>Process Mining in the Large:</b> BigEventData, Case-Based Decomposition, Activity-Based Decomposition, Process Cubes, Streaming Process Mining.	
<b>Textbooks:</b>	
1. Reinkemeyer, Lars. "Process mining in action." Principles, Use Cases and Outlook, Santa Barbara, 2020. 2. Aalst, Wil van der. "Data science in action." Process mining. Springer, Berlin, Heidelberg, 2016.	
<b>Reference Books:</b>	
1. Ferreira, Diogo R. A primer on process mining: Practical skills with python and graphviz. Cham: Springer International Publishing, 2017. 2. Burattin, Andrea. "Process mining techniques in business environments." volume 207 of Lecture Notes in Business Information Processing. Springer International Publishing, 2015. 3. Huser, Vojtech. "Process mining: Discovery, conformance and enhancement of business processes." 2012.	



**Online Learning Resources:**

1. Process Mining: Data science in Action | Coursera
2. Process Mining with Celonis | Udemy

**Mapping of course outcomes with program outcomes**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2										2	
CO2	3	3		2	3						2		
CO3	3	3		3							3		
CO4	3	3		3							3	2	1
CO5	3	3		2							2	2	

**Correlation matrix**

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Identify(L3)	2 2
2	CO2: Apply	L3	PO1 PO2 PO4 PO5 PO11	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze (L4) PO5: Select(L3) PO11: Thumb rule	3 3 2 3 2
3	CO3: Analyze	L4	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO4: Analysis (L4) PO11: Thumb rule	3 3 3 3
4	CO4: Evaluate	L5	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Identify (L3) PO4: Analysis(L4) PO11: Thumb rule	3 3 3 3
5	CO5: Apply	L3	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Identify(L3) PO4: Analysis(L4) PO11: Thumb rule	3 3 2 2

**Justification Statements:**

CO1: **Understand** the fundamentals elements for process mining

**Action Verb: Understand (L2)**

**P01 Verb: Apply (L3)**

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)

**P02 Verb: Identify (L3)**

CO1 Action verb is less than PO2 verb by one level. Therefore, the correlation is moderate (2)

CO2: **Apply** the process mining tools to automate the data collection process.

**Action Verb: Apply (L3)**

**P01: Apply (L3)**

CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

**P02: Identify (L3)**

CO2 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

**P04: Analyze (L4)**

CO2 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)

**P05: Select (L3)**

CO2 Action verb is same level as PO5 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

For use some different technologies to handling process mining. Therefore, the correlation is moderate (2)

C03: **Analyze** the various process models in real world process mining problems.

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

C03 Action verb is more than P01 verb. Therefore, the correlation is high (3)

**P02: Analyze (L4)**

C03 Action verb is same level as P02 verb. Therefore, the correlation is high (3)

**P04: Analysis (L4)**

C03 Action verb is same level as P04 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

For use various process models in process mining. Therefore, the correlation is high(3)

C04: **Evaluate** the various modern technologies to discovery Process Techniques.

**Action Verb: Evaluate (L5)**

**P01: Apply(L3)**

C04 Action verb is more than P01 verb. Therefore, the correlation is high (3)

**P02: Identify (L3)**

C04 Action verb is more than P02 verb. Therefore, the correlation is high (3)

**P04: Analysis (L4)**

C04 Action verb is more than P04 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

For use process mining software and various modern technologies Therefore, the correlation is high (3)

C05: **Apply** the Outlook future for process mining in various case studies.

**Action Verb: Apply (L3)**

**P01: Apply(L3)**

C05 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P02: Identity (L3)**

C05 Action verb is same as P02 verb. Therefore, the correlation is high (3)

**P04: Analysis (L4)**

C05 Action verb is less than P04 verb by one levels. Therefore, the correlation is moderate (2)

**P011: Thumb rule**

For use to Apply Outlook future for process mining Therefore, the correlation is moderate (2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science**

**(AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	Computer Vision	L	T/CLC	P	C
20APE3023	IV-I		3	0	0	3

**Course Outcomes:**

After Studying the Course, student will be able to

C01: **Understand** the differences between bitmap and vector graphics in common digital image formats

C02: **Apply** the image enhancement techniques to improve the visual quality of digital images.

C03: **Analyze** the various noise models for removing interfering signals at specific frequencies

C04: **Apply** the image morphing techniques to generate compelling 2D transitions between images.

C05: **Analyze** the Feature Extraction techniques to extract relevant features from raw data

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	the differences between bitmap and vector graphics		in common digital image formats	L2
C02	Apply	the image enhancement techniques		to improve the visual quality of digital images	L3
C03	Analyze	the various noise models		for removing interfering signals at specific frequencies	L4
C04	Apply	the image morphing techniques		to generate compelling 2D transitions between images.	L3
C05	Analyze	the Feature Extraction techniques		to extract relevant features from raw data	L4

<b>UNIT - I</b>	<b>Digital image fundamentals</b>	<b>9 Hrs</b>
<b>Digital image fundamentals</b> A simple image formation model, Image sampling and quantization, Some basic relationships between pixels, Basic intensity transformation functions, Sampling and fourier transform of sampled functions, The discrete fourier transform of one variable, Extensions to functions of two variables(2-D discrete fourier transform, Properties of 2-D DFT and IDFT, 2-D Discrete Convolution Theorem.		
<b>UNIT - II</b>	<b>Image Enhancement (spatial domain)</b>	<b>9Hrs</b>
<b>Image Enhancement (spatial domain)</b> Histogram processing, Fundamentals of spatial filtering, Smoothing spatial filters, Sharpening spatial filters, The Laplacian-use of second order derivative for image sharpening, The Gradient-use of first order derivative for image sharpening.		
<b>Image Enhancement (frequency domain)</b> Basics of filtering in frequency domain, Image smoothing using lowpass frequency domain filters, Image sharpening using highpass filters.		
<b>UNIT - III</b>	<b>Image restoration</b>	<b>9 Hrs</b>
<b>Image restoration</b> Noise Models, Restoration in the presence of noise only – Spatial filters, Periodic noise reduction using Frequency domain filtering, Estimating the degradation function, inverse filtering, Minimum Least square error filtering, constrained least square filters.		
<b>Wavelet and Multiresolution processing</b> Matrix-based transform, Walsh-Hadamard Transform, Slant transform, Haar transform.		
<b>UNIT - IV</b>	<b>Image compression</b>	<b>9 Hrs</b>

<b>Image compression</b> Lossy and lossless compression schemes: Huffman coding, Run-length coding, Arithmetic coding, Block transform coding, JPEG.		
<b>Image Morphology:</b> Fundamental operations, Morphological Algorithms.		
<b>Image segmentation:</b> Point, Line and Edge detection, Canny edge detection, Hough Transform, Edge linking, Thresholding, Region-based segmentation, Pixel-based segmentation.		
<b>UNIT - V</b>	<b>Feature Extraction</b>	<b>9 Hrs</b>
<b>Feature Extraction</b> Boundary preprocessing, Boundary feature descriptor, Region feature descriptor, Principal components as feature descriptor, Whole image feature.		
<b>Video Processing:</b> Video Formats, Video Enhancement and Restoration, Video Segmentation.		
<b>Textbooks:</b>		
1. Digital Image Processing, R. C. Gonzalez and R. E. Woods, Pearson Education.		
2. Handbook of Image and Video Processing, AL Bovik, Academic Press.		
<b>Reference Books:</b>		
1. Digital Image Processing and Analysis, B. Chanda and D. Dutta Mazumdar, PHI.		
2. Digital Image Processing, W. K. Pratt, Wiley-Interscience.		
3. Fundamentals of Digital Image Processing, A. K. Jain, Pearson India Education.		
4. Pattern Classification and Scene Analysis, R. O. Duda and P. E. Hart, Wiley.		

#### Mapping of course outcomes with program outcomes

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2
CO 1	2	3											
CO 2	3	3		3	3								
CO 3	3	3		3	3						2		
CO 4	3	3	3	3	3			2					
CO 5	3	3	3	3	3						2		

#### Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	CO1 :Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	CO2 : Apply	L3	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO4:Interpret(L2) PO5:Apply(L3)	3 3 3 3
3	CO3 : Analyze	L4	PO1 PO2 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review (L2) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb rule	3 3 3 3 2
4	CO4 : Apply	L3	PO1 PO2 PO3 PO4 PO5 PO8	PO1: Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO4: Interpret (L2) PO5: Apply(L3) PO8: Thumb rule	3 3 3 3 3 2
5	CO5 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply (L3) PO2: Review(L2) PO3: Develop (L6) PO4: Analyze(L3) PO5:Apply(L3) PO11:Thumb Rule	3 3 3 3 3 2

#### Justification Statements :

CO1: Understand the differences between bitmap and vector graphics in common digital image

**formats**

**Action Verb: Understand(L2)**

**P01 Verb:Apply(L3)**

C01 Action verb is greater than P01 verb by one level. Therefore the correlation is medium (2)

**P02 Verb : Review(L2)**

C01 Action verb is same level as P02 verb . Therefore the correlation is high(3)

**C02:Apply** the image enhancement techniques to improve the visual quality of digital images

**Action Verb : Apply(L3)**

**P01: Apply(L3)**

C02 Action verb is same as P01 verb. Therefore the correlation is high (3)

**P02: Review (L2)**

C02 Action verb is grater than P02 verb. Therefore the correlation is high (3)

**P04: Interpret (L2)**

C02 Action verb is greater than P04 verb. Therefore the correlation is high (3)

**P05: Apply(L1)**

C02 Action verb is same as P05 verb. Therefore the correlation is high(3)

**C03: Analyze the various noise models for removing interfering signals at specific frequencies**

**Action Verb : Analyze(L4)**

**P01: Apply(L3)**

C03 Action verb is greater than P01 verb. Therefore the correlation is high (3)

**P02: Review (L2)**

C03 Action verb is less than as P02 verb by one level. Therefore the correlation is high (3)

**P04: Analyze (L4)**

C03 Action verb is same as P04 verb. Therefore the correlation is high (3)

**P05: Apply(L3)**

C03 Action verb is same as P05 verb. Therefore the correlation is high (3)

**P011: Thumb rule**

In computer vision the noise models are to remove the interfering signals. Therefore the correlation is medium (2)

**C04: Apply** the image morphing techniques to generate compelling 2D transitions between images

**Action Verb : Apply (L3)**

**P01: Apply(L3)**

C04 Action verb is same as P01 verb. Therefore the correlation is high (3)

**P02: Review (L2)**

C04 Action verb is greater than P02 verb. Therefore the correlation is high (3)

**P03: Develop (L3)**

C04 Action verb is same as P03 verb. Therefore the correlation is high (3)

**P04: interpret (L2)**

C04 Action verb is greater than P04 verb. Therefore the correlation is high (3)

**P05: Apply(L3)**

C04 Action verb is same as P05 verb. Therefore the correlation is high(3)

**P08: Thumb rule**

The image morhing techniques are used in generate 2D transitions in the computer vision applications by following professional ethics. Therefore the correlation is medium(2)

**C05: Analyze** the Feature Extraction techniques to extract relavent features from raw data

**Action Verb : Analyze (L4)**

**P01: Apply(L3)**

C04 Action verb is greater than P01 verb. Therefore the correlation is high (3)

**P02: Review (L2)**

C05 Action verb is greater than P02 verb. Therefore the correlation is high(3)

**P03: Develop (L3)**

C05 Action verb is greater than as P03 verb. Therefore the correlation is high(3)

**P04: Analyze (L4)**

C05 Action verb is same as P04 verb. Therefore the correlation is high(3)

**P05: Apply(L3)**

C05 Action verb is greater than as P05 verb. Therefore the correlation is high (3)

**P011: Thumb rule**

We will apply these feature extraction techniques to predictions on problem statement. Therefore the correlation is medium (2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)  
Artificial Intelligence and Data Science**

**(AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	Digital Image Processing	L	T/CLC	P	C
20APE0407	IV-I		4	2	0	3

**Course Outcomes:**

After Studying the Course, student will be able to

CO1: **Understand** the fundamental concepts of digital image processing

CO2: **Analyze** the images in frequency domain using image transforms

CO3: **Apply** the techniques for image enhancement in spatial and frequency domains

CO4: **Analyze** various image restoration and image segmentation techniques

CO5: **Evaluate** different coding methods for image compression to save memory & bandwidth.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the fundamental concepts of digital image processing			L2
CO2	Analyze	the images in frequency domain	using image transforms		L4
CO3	Apply	the techniques for image enhancement		in spatial and frequency domains	L3
CO4	Analyze	the various image restoration and image segmentation techniques.			L4
CO5	Evaluate	the different coding methods	for image compression	to save memory & bandwidth	L5

<b>UNIT - I</b>	15Hrs
<b>IMAGE PROCESSING FUNDAMENTALS:</b> Introduction to Digital Image processing – Example fields of its usage- Fundamental steps in ImageProcessing, Components of general image processing system, Image sensing and Acquisition-image Modeling- Sampling, Quantization and Digital Image representation - Basic relationships between pixels, -Mathematicaltools/ operations applied on images-imaging geometry	
<b>UNIT - II</b>	14Hrs
<b>IMAGE TRANSFORMS:</b> Discrete Fourier Transform- Discrete Cosine Transforms- Discrete Sine Transform, Walsh- Hadamard Transforms- Haar Transform- Hotelling Transform, Comparison of properties of the above.	
<b>UNIT - III</b>	15Hrs
<b>IMAGE ENHANCEMENT TECHNIQUES:</b> Background enhancement by point processing Histogram processing, Spatial filtering, Enhancement in frequency Domain, Image smoothing, Image sharpening, Color image enhancement	
<b>UNIT - IV</b>	16Hrs
<b>IMAGE RESTORATION:</b> Degradation model, Algebraic approach to restoration-Inverse filtering-Least Mean Square filters, Constrained Least square restoration, Blind Deconvolution. <b>IMAGE SEGMENTATION:</b> Edge detection-, Edge linking, Threshold based segmentation methods-Region based Approaches -Template matching-use of motion in segmentation.	
<b>UNIT - V</b>	15Hrs
<b>IMAGE COMPRESSION:</b> Redundancies in Images - Compression models, Information theoretic perspective- Fundamental coding theorem. Huffman Coding, Arithmetic coding, Bit plane coding, Run length coding, Transform coding, Image Formats and compression standards.	
<b>Textbooks:</b>	
1. R.C .Gonzalez & R.E. Woods, “Digital Image Processing”, Addison Wesley/Pearson education, 3 <sup>rd</sup> Edition, 2010.	
2. A.K.Jain, “Fundamentals of Digital Image processing”, PHI.	
<b>Reference Books:</b>	
1. Rafael C. Gonzalez, Richard E woods and Steven L.Eddins, “Digital Image processing using MATLAB”, Tata McGrawHill, 2010.	
2. S Jayaraman, S Esakkirajan, T Veerakumar, “Digital Image processing”, Tata McGrawHill	
3. William K.Pratt, “Digital Image Processing”, John Wiley, 3rd Edition, 2004.	
<b>Online Learning Resources:</b>	
nptel videos	

### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3				2					1		
CO2	2	1											
CO3	3		3		3	2	1				2		
CO4	3			3	3	2	1				3		
CO5	3	2	2			2					2		

### Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	15	20%	2	Understand	L2	PO1, PO2, PO6, PO11,	PO1: Apply (L3) PO2: Review (L2) PO6:Thumb rule PO11:Thumb rule	2 3 2 1
2	14	19%	2	Analyze	L4	PO1, PO2	PO1: Apply (L3) PO2: Formulate(L6)	3 1
3	15	20%	2	Apply	L3	PO1, PO3, PO5, PO6, PO7, PO11	PO1: Apply(L3) PO3: Develop(L3) PO5: Apply(L3) PO6:Thumb rule PO7:Thumb rule PO11:Thumb rule	3 3 3 2 1 2
4	16	21%	3	Analyze	L4	PO1, PO4, PO5, PO6, PO7, PO11	PO1: Apply(L3) PO4: Analyze(L4) PO5: Apply(L3) PO6:Thumb rule PO7:Thumb rule PO11:Thumb rule	3 3 3 2 1 3
5	15	20%	2	Evaluate	L5	PO1, PO2, PO3, PO6, PO11	PO1: Apply(L3) PO2: Formulate(L6) PO3: Develop (L6) PO6:Thumb rule PO11:Thumb rule	3 2 2 2 2
	75	100%						

### Justification Statements :

#### CO1: Understand the fundamental concepts of digital image processing.

##### Action Verb: Understand (L2)

PO1 Verbs: Apply (L3)

CO1 Action Verb is less than PO1 verb by one level. Therefore, the correlation is medium (2).

PO2 Vers: Review (L2)

CO1 Action Verb is in the same level of less than PO2 verb. Therefore, the correlation is high (3).

PO6: CO1 using Thumb rule, L2 correlates PO6 as medium (2).

PO11: CO1 using Thumb rule, L1 correlates PO11 as low (1).

#### CO2: Analyze the images in frequency domain using image transforms.

##### Action Verb: Analyze(L4)

PO1 Verbs: Apply (L3)

CO2 Action Verb is more than the PO1 verb. Therefore, the correlation is high (3).

PO2 Verbs: Formulate(L6)

CO2 Action Verb is less than the PO2 verb by two levels. Therefore the correlation is low (1).

#### CO3: Apply the techniques for image enhancement in spatial and frequency domains.

##### Action Verb: Apply(L3)

PO1 Verbs: Apply (L3)

CO3 Action Verb is equal to PO1 verb. Therefore the correlation is high (3).

PO3 Verb: Develop (L3)



C03 Action Verb level is in the same level of P03 verb. Therefore, the correlation is high (3).

P05 Verb: Apply (L3)

C03 Action Verb is equal to P05 verb. Therefore, the correlation is high (3).

P06: C03 using Thumb rule, L2 correlates P06 as medium (2).

P07: C03 using Thumb rule, L1 correlates P07 as low (1).

P011: C03 using Thumb rule, L3 correlates P011 as medium (2).

**C04: Analyze various image restoration and image segmentation techniques.**

**Action Verb: Analyze (L4)**

P01 Verbs: Apply (L3)

C04 Action Verb is more than the P01 verb. Therefore, the correlation is high (3).

P04 Verb: Formulate (L4)

C04 Action Verb level is equal to P04 verb. Therefore, the correlation is high (3).

P05 Verbs: Develop (L3)

C04 Action Verb is more than the P05 verb. Therefore, correlation is high (3).

P06: C04 using Thumb rule, L2 correlates P06 as medium (2).

P07: C04 using Thumb rule, L1 correlates P07 as low (1).

P011: C04 using Thumb rule, L4 correlates P011 as high (3).

**C05: Evaluate different coding methods for image compression to save memory & bandwidth.**

**Action Verb: Evaluate (L5)**

P01 Verb: Apply (L3)

C05 Action verb is more than the P01 verb. Therefore, the correlation is high (3).

P02 verb: Formulate (L6)

C05 Action verb is less than the P02 verb by one level. Therefore, the correlation is medium(2).

P03 verb: Develop (L6)

C05 Action verb is less than the P03 verb by one level. Therefore, the correlation is medium (2)

P06: C05 using Thumb rule, L2 correlates P06 as medium (2).

P011: C05 using Thumb rule, L3 correlates P011 as medium (2).



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	EMBEDDED SYSTEMS	L	T/CLC	P	C
20APE0411	IV-I		4	2	0	3

**Course Outcomes:**

**After Studying the Course, student will be able to**

CO1: **Understand** the fundamental concepts of embedded systems, programming languages and tools.

CO2: **Analyze** the architecture of TM4C, instruction set, and its addressing modes for developing embedded systems.

CO3: **Understand** the microprocessor interfacing concepts and the design cycle for embedded systems

CO4: **Analyze** the microcontroller internal blocks for basic programming of embedded system

CO5: **Analyze** the real-world embedded communication protocols enabling microcontrollers to interact with external sensors and actuators.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The fundamental concepts of Embedded systems.			L2
CO2	Analyze	The architecture of TM4C, instruction set, and its addressing modes	.	For Developing embedded systems	L4
CO3	Understand	The microprocessor interfacing concepts and the design cycle			L2
CO4	Analyze	The microcontroller internal blocks	For basic programming of embedded system		L4
CO5	Analyze	The real-world embedded communication protocols	Enabling Microcontrollers to interact with external sensors and actuators.		L4

<b>UNIT - I</b>	<b>INTRODUCTION TO EMBEDDED SYSTEMS</b>	<b>9 Hrs</b>
Embedded system introduction, host and target concept, embedded applications, features and architecture considerations for embedded systems- ROM, RAM, timers; data and address bus concept, Embedded Processor and their types, Memory types, overview of design process of embedded systems, programming languages and tools for embedded design		
<b>UNIT - II</b>	<b>EMBEDDED PROCESSOR ARCHITECTURE</b>	<b>9Hrs</b>
CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture. Introduction to ARM architecture and Cortex – M series, Introduction to the TM4C family viz. TM4C123x & TM4C129x and its targeted applications. TM4C block diagram, address space, on-chip peripherals (analog and digital) Register sets, addressing modes and instruction set basics.		
<b>UNIT - III</b>	<b>OVERVIEW OF MICROCONTROLLER AND EMBEDDED SYSTEMS</b>	<b>9 Hrs</b>
Embedded hardware and various building blocks, Processor Selection for an Embedded System, Interfacing Processor, Memories and I/O Devices, I/O Devices and I/O interfacing concepts, Timer and Counting Devices, Serial Communication and Advanced I/O, Buses between the Networked Multiple Devices. Embedded System Design and Co-design Issues in System Development Process, Design Cycle in the Development Phase for an Embedded System, Uses of Target System or its Emulator and In-Circuit Emulator (ICE), Use of Software Tools for Development of an Embedded System Design metrics of embedded systems - low power, high performance, engineering cost, time-to-market.		
<b>UNIT - IV</b>	<b>MICROCONTROLLER FUNDAMENTALS FOR BASIC PROGRAMMING</b>	<b>9 Hrs</b>
I/O pin multiplexing, pull up/down registers, GPIO control, Memory Mapped Peripherals, programming System registers, Watchdog Timer, need of low power for embedded systems, System Clocks and control, Hibernation Module on TM4C, Active vs Standby current consumption. Introduction to Interrupts, Interrupt vector table, interrupt programming. Basic Timer, Real Time Clock (RTC), Motion Control Peripherals: PWM Module & Quadrature Encoder Interface (QEI).		
<b>UNIT - V</b>	<b>EMBEDDED COMMUNICATIONS PROTOCOLS AND INTERNET OF THINGS</b>	<b>9 Hrs</b>

Synchronous/Asynchronous interfaces (like UART, SPI, I2C, USB), serial communication basics, baud rate concepts, Interfacing digital and analog external device, Implementing and programming UART, SPI and I2C, SPI interface using TM4C. Case Study: Tiva based embedded system application using the interface protocols for communication with external devices "Sensor Hub Booster Pack" Embedded Networking fundamentals, IoT overview and architecture, Overview of wireless sensor networks and design examples. Adding Wi-Fi capability to the Microcontroller, Embedded Wi-Fi, User APIs for Wireless and Networking applications Building IoT applications using CC3100 user API. Case Study: Tiva based Embedded Networking Application: "Smart Plug with Remote Disconnect and Wi-Fi Connectivity"

#### Textbooks:

1. Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers, 2014, Create space publications ISBN: 978-1463590154.
2. Embedded Systems: Introduction to ARM Cortex - M Microcontrollers, 5th edition Jonathan W Valvano, Create space publications ISBN-13: 978-1477508992
3. Embedded Systems 2E Raj Kamal, Tata McGraw-Hill Education, 2011 ISBN-0070667640, 9780070667648

#### Reference Books:

1. [http://processors.wiki.ti.com/index.php/HandsOn\\_Training\\_for\\_TI\\_Embedded\\_Processors](http://processors.wiki.ti.com/index.php/HandsOn_Training_for_TI_Embedded_Processors)
2. [http://processors.wiki.ti.com/index.php/MCU\\_Day\\_Internet\\_of\\_Things\\_2013\\_Workshop](http://processors.wiki.ti.com/index.php/MCU_Day_Internet_of_Things_2013_Workshop)
3. [http://www.ti.com/ww/en/simplelink\\_embedded\\_wi-fi/home.html](http://www.ti.com/ww/en/simplelink_embedded_wi-fi/home.html)
4. CC3100/CC3200 SimpleLink™ Wi-Fi® Internet-on-a-Chip User Guide Texas Instruments Literature Number: SWRU368A April 2014–Revised August 2015

#### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	1									
CO2	2	2	2	2	2								
CO3	2	2	2	3	2								
CO4	2	2	2	1	2								
CO5	2	2	2	1	2								

#### Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	CO1 :Understand	L2	PO1 PO2 PO3 PO4	PO1: Apply(L3) PO2 : Identify (L3) PO3: Develop (L3) PO4 : Analyze (L4)	2 2 2 1
2	CO2 : Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO 3: Develop (L3) PO4: Interpret (L2) PO5: Apply(L3)	2 2 2 2 2
3	CO3 : Understand	L2	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO 3: Develop (L3) PO4: Interpret (L2) PO5: Apply(L3)	2 2 2 3 2
4	CO4 :Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO 3: Develop (L3) PO4: Interpret (L2) PO5: Apply(L3)	2 2 2 1 2
5	CO5 : Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO 3: Develop(L3) PO4: Interpret (L2) PO5: Apply(L3)	2 2 2 1 2

#### Justification Statements :

**CO1: Understand** the fundamental concepts of embedded systems, programming languages and tools.

**Action Verb: Understand(L2)**

**PO1 Verb:Apply(L3)**

CO1 Action verb is greater than PO1 verb by one level. Therefore the correlation is medium (2)

**PO2 Verb :Identify (L3)**

CO1 Action verb is greater than PO1 verb by one level. Therefore the correlation is medium (2)

**PO3Verb :Develop (L3)**

C01 Action verb is greater than PO1 verb by one level. Therefore the correlation is moderate (2)

**PO4 Verb : Analyze (L4)**

C01 Action verb is greater than PO1 verb by two level. Therefore the correlation is low (1)

**CO2:Analyze** the architecture of TM4C, instruction set, and its addressing modes for developing embedded systems.

**Action Verb : Analyze(L4)**

**PO1: Apply(L3)**

C02 Action verb is less than PO1 verb by one level. Therefore the correlation is Medium (2)

**PO2 Verb : Identify (L3)**

C02 Action verb is less than PO1 verb by one level. Therefore the correlation is Medium (2)

**PO 3 Verbs: Develop (L3)**

C01 Action Verb is greater than PO 3 verb by onelevel; therefore correlation is moderate (2).

**PO4: Interpret (L2)**

C02 Action verb is greater than PO4 verb by two levels. Therefore the correlation is moderate (2)

**PO5: Apply(L3)**

C02 Action verb is less than PO1 verb by one level. Therefore the correlation is Medium (2)

**CO3: Understand** the microprocessor interfacing concepts and the design cycle for embedded systems

**Action Verb :Understand(L2)**

**PO1: Apply(L3)**

C03 Action verb is greaterthan PO1 verb by one level. Therefore the correlation is moderate (2)

**PO2 Verb : Identify (L3)**

C03 Action verb is greater than as PO2 verb by one level. Therefore the correlation is moderate (2)

**PO 3 Verbs: Develop (L3)**

C01 Action Verb is greater than PO 3 verb by one level; therefore correlation is moderate (2).

**PO4: Interpret (L2)**

C03 Action verb is samePO4 verb. Therefore the correlation is high (3)

**PO5: Apply(L3)**

C03 Action verb is same as PO5 verb by one level. Therefore the correlation is moderate (2)

**CO4: Analyze** microcontroller internal blocks for basic programming of embedded system

**Action Verb :Analyze(L4)**

**PO1: Apply(L3)**

C04 Action verb is greater than PO1 verb by one level. Therefore the correlation is moderate(2)

**PO2 Verb : Identify (L3)**

CO Action verb is greater than as PO2 verb by one level. Therefore the correlation is moderate(2)

**PO 3 Verbs: Develop (L3)**

C04 Action Verb is greater than as PO2 verb by one level. Therefore the correlation is moderate(2)

**PO4: Interpret (L2)**

C04 Action verb is greater than PO4 verb by two levels. Therefore the correlation is low (1)

**PO5: Apply(L3)**

C04 Action verb is same as PO5 verb by one level. Therefore the correlation is moderate (2)

**CO5:Analyze** real-world embedded communication protocols enabling microcontrollers to interact with external sensors

**Action Verb :Analyze (L4)**

**PO1: Apply(L3)**

C05 Action verb is greater than PO1 verb by one level. Therefore the correlation is moderate (2)

**PO2 Verb : Identify (L3)**

C05 Action verb is greater than as PO2 verb by one level. Therefore the correlation is moderate(2)

**PO 3 Verbs: Develop (L3)**

C05 Action Verb is greater than as PO2 verb by one level. Therefore the correlation is moderate(2)

**PO4: Interpret (L2)**

C05 Action verb is greater than PO4 verb by two levels. Therefore the correlation is low (1)

**PO5: Apply(L3)**

C05 Action verb is greater than as PO2 verb by one level. Therefore the correlation is moderate (2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	Enabling Technologies for Data Science & Analytics: IoT	L	T/CLC	P	C
20AOE3601	IV-I		4	2	0	3

**Course Outcomes:**

After Studying the Course, student will be able to

CO1: **Understand** the application and characteristics of IoT

CO2: **Apply** the network protocols to establish communication between M2M and IoT systems

CO3: **Analyze** the behaviour of IoT devices and sensors based on real time case studies

CO4: **Apply** the Map Reduce algorithm on large volume of IoT data for online analytical data processing

CO5: **Analyze** the Zigbee Standards for controlling and sensing of IoT network

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The Application and Characteristics of IoT			L2
CO2	Apply	The Network Protocols to establish communication between M2M and IoT Systems			L3
CO3	Analyze	The behaviour of IoT devices and Sensors	based on real time Case Studies		L4
CO4	Apply	Map Reduce Algorithm on Large volume of IoT data		for online analytical data processing	L3
CO5	Analyze	The Zigbee Standards		for controlling and Sensing of IoT network	L4

<b>UNIT - I</b>	<b>Introduction to Internet of Things</b>	9 Hrs
<b>Introduction to Internet of Things</b> Introduction, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies. Domain Specific IoTs Introduction, Home Automation, cities, Environment, Retail, Agriculture, Industry, Health & Lifestyle.		
<b>UNIT - II</b>	<b>IoT and M2M</b>	9 Hrs
<b>IoT and M2M:</b> Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT. IoT System Management with NETCONF-YANG Need for IoT Systems Management, Simple Network Management Protocol (SNMP), Network Operator requirements, NETCONF, YANG, IoT System Management with NETCONF-YANG		
<b>UNIT - III</b>	<b>Developing Internet of Things</b>	9 Hrs
<b>Developing Internet of Things:</b> Introduction, IoT Design Methodology, Case Study on IoT System for Weather Monitoring. Case Studies Illustrating IoT Design: Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications.		
<b>UNIT - IV</b>	<b>Advanced Topics</b>	9 Hrs
<b>Advanced Topics:</b> Introduction, Apache Hadoop, Using Hadoop Map Reduce for Batch Data Analysis. IEEE 802.15.4: The IEEE 802 committee family of protocols, The physical layer, The Media Access control layer, Uses of 802.15.4, The Future of 802.15.4: 802.15.4e and 802.15.4g.		
<b>UNIT - V</b>	<b>ZigBee</b>	9 Hrs
<b>ZigBee:</b> Development of the standard, ZigBee Architecture, Association, The ZigBee network layer, The ZigBee APS Layer, The ZigBee Devices Object (ZDO) and the ZigBee Device Profile (ZDP), Zigbee Security, The ZigBee Cluster Library (ZCL), ZigBee Applications profiles, The ZigBee Gateway Specifications for network devices.		
<b>Textbooks:</b>		
1. Internet of Things a Hands-on Approach by Arshdeep Bahga and Vijay Madisetti. University Press. 2. The Internet of Things key applications and protocols by Oliver Hersent, David Boswarthick and Omar elloumi, Wiley Student Edition.		
<b>Reference Books:</b>		
1. Internet of Things: Architecture, Design Principles and Applications by Raj Kamal MCGraw Hill Edition.		

### Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	2	1										1	
C02	3		3	2	3	2						1	
C03	3	3	3	3		3		3					1
C04	3	3	3	2		2							1
C05		3	3	3		3					3	1	1

### Correlation Matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	11	20%	2	C01 : Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Analyze(L4)	2 1
2	11	20%	2	C02 :Apply	L3	PO1 PO3 PO4 PO5 PO6	PO1: Apply(L3) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO6: Thumb rule	3 3 2 3 2
3	11	20%	2	C03 : Analyze	L4	PO1 PO2 PO3 PO4 PO6 PO8	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze(L4) PO6: Thumb rule PO8: Thumb rule	3 3 3 3 3 3
4	11	20%	2	C04 : Apply	L3	PO1 PO2 PO3 PO4 PO6	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze(L4) PO6: Thumb rule	3 3 3 2 2
5	11	20%	2	C05 : Analyze	L4	PO2 PO3 PO4 PO6 PO11	PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze(L4) PO6: Thumb rule PO11: Thumb rule	3 3 3 3 3
	55	100%						

### Justification Statements:

**C01: Understand** the application and characteristics of IoT

**Action Verb : Understand(L2)**

**P01 Verb : Apply(L3)**

C01 Action verb is less than P01 verb by one level. Therefore the correlation is medium (2)

**P02 Verb : Analyze(L4)**

C01 Action verb is less than P02 verb by two levels. Therefore the correlation is low (1)

**C02: Apply** the network protocols to establish communication between M2M and IoT systems

**Action Verb : Apply (L3)**

**P01: Apply(L3)**

C02 Action verb is same level as P01 verb. Therefore the correlation is high (3)

**P03: Develop(L3)**

C02 Action verb is same level as P03 verb. Therefore the correlation is high (3)

**P04: Analyze(L4)**

C02 Action verb is greater than P04 verb . Therefore the correlation is high (3)

**P05: Apply(L3)**

C02 Action verb is same level as P01 verb. Therefore the correlation is high (3)

**P06: Thumb rule**

Some of IoT applications are used in society for health, safety, legal and cultural issues, . Therefore the correlation is moderate(2)

**C03: Analyze** the behaviour of IoT devices and sensors based on real time case studies

**Action Verb : Analyze(L4)**

**P01: Apply(L3)**

C03 Action verb is greater than P01 verb . Therefore the correlation is high (3)

**P02: Identify (L3)**

C03 Action verb is greater than P02 verb . Therefore the correlation is high (3)

**P03: Develop(L3)**

C02 Action verb is greater than P03 verb . Therefore the correlation is high (3)

**P04: Analyze(L4)**

C02 Action verb is same as P04 verb . Therefore the correlation is high(3)

**P06 : Thumb rule**

It is used to illustrating the IoT design in Home automation, Cities, Environment, agriculture, productivity applications Therefore the correlation is high(3)

**P08: Thumb rule**

Since ethical principles should be followed by IoT Technologies. Hence the correlation is high(3)

**C04: Apply** the Map Reduce algorithm on large volume of IoT data for online analytical data processing

**Action Verb : Apply(L3)**

**P01: Apply(L3)**

C04 Action verb is same level as P01 verb. Therefore the correlation is high (3)

**P02: Identify (L3)**

C03 Action verb is same as P02 verb . Therefore the correlation is high(3)

**P03: Develop(L3)**

C02 Action verb is same as P03 verb . Therefore the correlation is high(3)

**P04: Analyze(L4)**

C02 Action verb is less than P04 verb by one level . Therefore the correlation is medium(2)

**P05: Apply(L3)**

C04 Action verb is same level as P05 verb. Therefore the correlation is high (3)

**P06: Thumb rule**

Since ethical principles shall be followed in IEEE protocols. Therefore the correlation is medium(2)

**C05: Analyze** the Zigbee Standards for controlling and sensing of IoT network

**Action Verb : Analyze(L4)**

**P02: Identify (L3)**

C03 Action verb is greater than P02 verb . Therefore the correlation is high(3)

**P03: Develop(L3)**

C02 Action verb is greater than P02 verb. Therefore the correlation is high(3)

**P04: Analyze(L4)**

C02 Action verb is same as P04 verb. Therefore the correlation is high(3)

**P05: Apply(L3)**

C04 Action verb is greater than P02 verb. Therefore the correlation is high (3)

**P06 : Thumb rule**

Since ethical principles should be followed to Zigbee devices. Therefore the correlation is high(3)

**P011: Thumb rule**

To create robust and scalable networks by Zigbee. Therefore the correlation is high(3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	WIRELESS COMMUNICATIONS	L	T/CLC	P	C
20APE0415	IV-I		4	2	0	3

**Course Outcomes:**

Mapping of course outcomes with program outcomes

CO1: **Understand** the effective bandwidth utilization to accommodate large number of mobile users by using various accessing techniques.

CO2: **Analyze** networking considerations, practical networking approaches with mobile data services.

CO3: **Understand** WAP architecture and services, WML scripts.

CO4: **Analyze** the protocols used in wireless LAN technologies.

CO5: **Apply** Various services in mobile data networks and HIPER LAN.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom level
CO1	Understand	The effective bandwidth utilization to accommodate large number of mobile users		using various accessing techniques	L2
CO2	Analyze	Networking considerations, practical networking approaches with mobile data services.			L4
CO3	Understand	WAP architecture and services, WML scripts			L2
CO4	Analyze	the protocols used in wireless LAN technologies			L4
CO5	Apply	Various services in mobile data networks and HIPER LAN			L3

<b>UNIT-I</b>	<b>INTRODUCTION TO WIRELESS COMMUNICATIONS AND MULTIPLE ACCESS TECHNIQUES</b>	9Hrs
<b>INTRODUCTION TO WIRELESS COMMUNICATIONS AND MULTIPLE ACCESS TECHNIQUES:</b> Evolution of mobile radio communications, examples of Wireless Communication systems, comparison of common Wireless Communication systems, Multiple access techniques: Introduction, FDMA, TDMA, Spread Spectrum, Multiple Access, SDMA, Packet radio, Packet radio protocols, CSMA protocols, Reservation protocols.		
<b>UNIT -II</b>	<b>WIRELESS NETWORKING AND DATA SERVICES</b>	9Hrs
<b>WIRELESS NETWORKING AND DATA SERVICES:</b> Wireless Networking: Difference between wireless and fixed telephone networks, Development of wireless networks, Traffic routing in wireless networks. Data Services: Data services, CCS, BISDN and ATM, Signalling System No7		
<b>UNIT-III</b>	<b>MOBILE IP AND WIRELESS ACCESS PROTOCOL</b>	9Hrs
<b>MOBILE IP AND WIRELESS ACCESS PROTOCOL:</b> <b>Mobile IP:</b> Mobile IP Operation of mobile IP, Co-located address, Registration, Tunneling. WAP: WAP Architecture, overview, WML scripts, WAP service, WAP session protocol.		
<b>UNIT-IV</b>	<b>WIRELESS LAN TECHNOLOGY AND BLUETOOTH</b>	9Hrs
<b>WIRELESS LAN TECHNOLOGY AND BLUETOOTH:</b> Wireless LAN: Infrared LANs, Spread spectrum LANs, Narrow band micro wave LANs, IEEE802.11 Protocol architecture and services. Bluetooth: Overview, Radio specification, Base band specification, Links manager specification, Logical link control and adaptation protocol.		
<b>UNIT -V</b>	<b>MOBILE DATA NETWORKS AND HIPERLAN</b>	9Hrs
<b>MOBILE DATA NETWORKS AND HIPERLAN:</b> Mobile Data Networks: GPRS and higher data rates, Short messaging service in GSM, HIPERLAN: HIPERLAN-1.		
<b>Textbooks:</b>		
1. Wireless Communications, Principles, Practice – Theodore S. Rappaport, PHI, 2nd Ed., 2002. 2. Wireless Communication and Networking – William Stallings, PHI, 2003. 3. Principles of Wireless Networks – Kaveh Pahlavan and P. Krishna Murthy, Pearson Education, 2002.		
<b>Reference Books:</b>		
1. Wireless Digital Communications – Kamilo Feher, PHI, 1999.		



## Mapping of course outcomes with program outcomes

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2				2					2
CO2		3				3					3
CO3	3					2					2
CO4		2				3					3
CO5	3					2					2

### Correlation Matrix

CO	CO					Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	13	22	2	Understand	L2	PO1 PO2 PO6 PO11	PO1:Apply (L3) PO2:Identify (L3) PO6 PO11	3 2 2 2
2	12	20	3	Analyze	L4	PO2 PO6 PO11	PO2: Identify (L3) PO6 PO11	3 3 3
3	11	18	2	Understand	L2	PO1 PO6 PO11	PO1:Apply(L3) PO6 PO11	3 2 2
4	12	20	2	Analyze	L4	PO2 PO6 PO11	PO2: Identify (L3) PO6 PO11	2 3 3
5	12	20	2	Apply	L3	PO6 PO6 PO11	PO6: Apply (L3) PO6 P11	2 2 2
	60							

### Justification Statements:

**CO1:** Understand the effective bandwidth utilization to accommodate large number of mobile users by using various accessing techniques.

#### Action Verb: Understand (L2)

PO1 Verbs: Apply (L3)

CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).

PO2 Verbs: Review (L2)

CO2 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

PO6 from thumb rule L2 correlation is moderate (2)

PO11 from thumb rule L2 correlation is moderate (2)

**CO2:** Analyze networking considerations, practical networking approaches with mobile data services.

#### Action Verb: Analyze (L4)

PO2 Verbs: Identify (L3)

CO2 Action Verb is greater than PO2 verb; Therefore correlation is high (3).

PO6 from thumb rule L4 the correlation is high (3)

PO11 from thumb rule L4 the correlation is high (3)

**CO3:** Understand WAP architecture and services, WML scripts.

#### Action Verb: Understand (L2)

PO1 Verbs: Apply (L3)

C01 Action Verb is less than P01 verb by one level; Therefore correlation is moderate (2).

P06 from thumb rule L2 correlation is moderate (2)

P011 from thumb rule L2 correlation is moderate (2)

**C04:** Analyze the protocols used in wireless LAN technologies.

**Action Verb: Analyze (L4)**

P02 Verb: Identify (L3)

C04 Action Verb is less than P02 verb; Therefore correlation is moderate(2).

P06 from thumb rule L4 the correlation is high (3)

P011 from thumb rule L4 the correlation is high (3)

**C05:** Apply Various services in mobile data networks and HIPER LAN.

**Action Verb: Apply (L3)**

P06 Verb: Apply (L3)

C05 Action verb is greater to P01 verb; therefore the correlation is high (3).

P06 from thumb rule L2 correlation is moderate (2)

P011 from thumb rule L2 correlation is moderate (2)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
(AUTONOMOUS)**

**Artificial Intelligence and Data Science (AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	Management science	L	T/CLC	P	C
20AOE0302	IV-I		4	2	0	3

**Course Outcomes:**

After Studying the Course, student will be able to

- CO1 Understand the management principles to take the decisions in all levels for productivity
- CO2 Analyse the available facilities for location of the industrial plant and also deal the ergonomics to improve the efficiency and safety
- CO3 Apply the mathematical knowledge to identify the shortest routes to achieve the goals set by the management and to improve the quality of the products in an industry
- CO4 Understand the materials requirement to minimize the inventory costs and to maximize the profit
- CO5 Apply the knowledge of the human resources principles in motivating the workers in the industry

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the management principles to take the decisions in all levels for productivity		In industry	L2
CO2	Analyse	the available facilities for location of the industrial plant and also deal the ergonomics to improve the efficiency and safety		in manufacturing -	L4
CO3	Apply	the mathematical knowledge to identify the shortest routes to achieve the goals set by the management and to improve the quality of the products in an industry		In industry	L3
CO4	Understand	the materials requirement to minimize the inventory costs and to maximize the profit		in industries	L2
CO5	Apply	the knowledge of the human resources principles in motivating the workers in the industry		In recruitment of manpower	L3

<b>UNIT - I</b>	<b>CONCEPTS OF MANAGEMENT AND ORGANISATION</b>	12 Hrs
<b>CONCEPTS OF MANAGEMENT AND ORGANISATION:</b> Functions of management, evolution of management thought, Taylor's scientific management, fayol's principles of management, Hertzberg's Maslow's hierarchy of human needs, theory x and y, Hawthorne experiment, morale, motivation, working environmental conditions, systems approach to management.		
<b>UNIT - II</b>	<b>PLANT LOCATION &amp; WORK STUDY</b>	10 Hrs
<b>PLANT LOCATION:</b> Definition, factors affecting the plant location, comparison of rural and urban sites, methods for selection of plant- matrix approach. Plant layout - definition, objectives, types of plant layout, various data analysing forms travel chart.		
<b>WORK STUDY:</b> Definition, objectives, method study - definition, objectives, steps involved- various types of associated charts, difference between micro motion and memo motion studies. Work measurement- definition, time study, steps involved, equipment, different methods of performance rating, allowances, standard time calculation. Work Sampling - definition, steps involved, standard		

time calculations, and differences with time study

<b>UNIT - III</b>	<b>INTRODUCTION TO PERT / CPM</b>	8 Hrs
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**INTRODUCTION TO PERT / CPM:** Project management, network modelling-probabilistic model, various types of activity times estimation, programme evaluation review techniques, critical path, probability of completing the project, deterministic model, critical path method (CPM), critical path calculation, crashing of simple of networks.

**INSPECTION AND QUALITY CONTROL:** Types of inspections, statistical quality control, techniques, variables and attributes, assignable and non-assignable causes, variable control charts, and R charts, attributes control charts, p charts and c charts. Acceptance sampling plan, single sampling and double sampling plans, OC curves. Introduction to TQM - quality circles, ISO 9000 series procedures.

<b>UNIT - IV</b>	<b>MATERIALS MANAGEMENT</b>	8 Hrs
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**MATERIALS MANAGEMENT:** Objectives, inventory functions, types, associated costs, inventory classification techniques-ABC and VED analysis. Inventory control systems, continuous review system, periodical review system. Stores management and stores records. Purchase management, duties of purchase of manager, associated forms.

<b>UNIT – V</b>	<b>INTRODUCTION TO HUMAN RESOURCE MANAGEMENT</b>	10 Hrs
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**INTRODUCTION TO HUMAN RESOURCE MANAGEMENT:** Functions of HRM, job evaluation, different types of evaluation methods. Job description, merit rating, different methods of merit ratings, wage incentives, different types of wage incentive schemes. Marketing, selling, marketing mix, product life cycle.

## Textbooks:

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1. O. P. Khanna (2004), Industrial Engineering and Management, Dhanpat Rai, New Delhi

## Reference Books:

1. Stoner, Freeman (2005), Gilbert, Management, 6th edition, Pearson Education, New Delhi.
2. Panner Selvam (2004), Production and Operations Management, Prentice Hall of India, New Delhi.
3. Ralph M. Barnes (2004), Motion and Time Studies, John Wiley and Sons.

### Mapping of course outcomes with program outcomes

Course Title	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
Management science 20AOE0302	CO1	2			1								3	2
	CO 2	3			3	3							3	2
	CO 3	3	3		1								3	2
	CO 4	2	2		2									2
	CO 5	3	3										3	2

### Correlation matrix

CO	CO					Program Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO5)	Level of Correlation
	Lesson Plan (Hrs)	%	Correlation	Verb	BTL			
1	-	-	-	Understand	L2	PO1 PO4	Apply (L3) Design (L6)	2 1
2	-	-	-	Analyse	L4	PO1 PO4 PO5	Apply (L3) Analyse (L4) Apply (L3)	3 3 3
3	-	-	-	Apply	L3	PO1 PO2 PO4	Apply (L3) Identify (L3) Design (L6)	3 3 1
4	-	-	-	Understand	L2	PO1 PO2 PO4	Apply (L3) Identify (L3) Interpret (L2)	2 2 2
5	-	-	-	Apply	L3	PO1 PO2	Apply (L3) Identify (L3)	3 3

### Justification Statements:

**C01: Understand** the management principles to take the decisions in all levels for productivity

**Action Verb: Understand (L2)**

PO1 Verb: **Apply (L3)**

C01 Action verb is same (lower) level as PO1 verb. Therefore, the correlation is low (2).

PO4 Verb: **Design (L6)**

C01 Action verb is same (lower) level as PO4 verb. Therefore, the correlation is low (1).

**C02: Analyse** the available facilities for location of the industrial plant and also deal the ergonomics to improve the efficiency and safety.

**Action Verb: Analyse (L4)**

PO1 Verb: **Apply (L3)**

C02: Action verb is same (greater) level as PO1 verb. Therefore, the correlation is high (3).

PO4 Verb: **Analyse (L4)**

C02: Action verb is same level as PO4 verb. Therefore, the correlation is high (3).

PO5 Verb: **Apply (L3)**

C02: Action verb is same (greater) level as PO5 verb. Therefore, the correlation is high (3).

**C03: Apply** the mathematical knowledge to identify the shortest routes to achieve the goals set by the management and to improve the quality of the products in an industry.

**Action Verb: Apply (L3)**

PO1 Verb: **Apply (L3)**

C03: Action verb is same level as PO1 verb. Therefore, the correlation is high (3).

PO2 Verb: **Identify (L3)**

C03: Action verb is same level as PO2 verb. Therefore, the correlation is high (3).

PO4 Verb: **Design (L6)**

C03: Action verb is same (lower) level as PO4 verb. Therefore, the correlation is low (1).

**C04: Understand** the materials requirement to minimize the inventory costs and to maximize the profit.

**Action Verb: Understand (L2)**

PO1 Verb: **Apply (L3)**

C03: Action verb is same (lower) level as PO1 verb. Therefore, the correlation is low (2).

P02 Verb: **Identify (L3)**

C03: Action verb is same (lower) level as P02 verb. Therefore, the correlation is low (2).

P04 Verb: **Interpret (L2)**

C03: Action verb is same level as P04 verb. Therefore, the correlation is low (2).

**C05: Apply** the knowledge of the human resources principles in motivating the workers in the industry.

**Action Verb: Apply (L3)**

P01 Verb: **Apply (L3)**

C05: Action verb is same level as P01 verb. Therefore, the correlation is high (3).

P02 Verb: **Identify (L3)**

C05: Action verb is same level as P02 verb. Therefore, the correlation is high (3).

ATSTPT-AIDS



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
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**Artificial Intelligence and Data Science**

**(AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	English For Research Paper Writing	L	T/CLC	P	C
20AOE9901	IV-I		4	2	0	3

**Course Outcomes:**

After Studying the Course, student will be able to

C01: **Understand** the writing skills and level of readability.

C02: **Apply** the rules, principles for writing abstract and introduction part of research article.

C03: **Apply** the right methods to write the review of literature, results and conclusions.

C04: **Apply** the special skills for writing a title, abstract, review and introduction of literature.

C05: **Apply** the key skills for results in discussion and conclusion.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	the writing skills and level of readability			L2
2	Apply	the rules, principles	for writing abstract and introduction part of research article		L3
3	Apply	the right methods	to write the review of literature, results and conclusions		L3
4	Apply	the special skills.	for writing a title, abstract, review and introduction of literature		L3
5	Apply	the key skills	for results in discussion and conclusion.		L3

**Unit -1**

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

**Unit -2**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction.

**Unit -3**

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

**Unit - 4**

Key skills for writing a title- an abstract - an introduction - review of literature

**Unit:5**

Key skills for writing methodology - results - discussions - conclusions.

**References:**

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4. AdrianWallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

**Mapping of COs to POs and PSOs**

CO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011
1										2	2
2					3					2	
3		2									2
4										2	
5										2	2

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

### Correlation Matrix:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	15	20	2	Understand	L2	PO10, PO11	Thumb Rule Thumb Rule	2, 2
2	18	23	3	Apply	L3	PO5, PO10	Thumb Rule Thumb Rule	2, 1
3	14	18.4	2	Apply	L3	PO2, PO11	Thumb Rule Thumb Rule	2, 2
4	14	18.4	2	Apply	L3	PO10	Thumb Rule	2
5	14	18.4	2	Apply	L3	PO10, PO11	Thumb Rule Thumb Rule	2, 2
	76							

### CO-PO mapping justification:

**C01: Understand writing skills and level of readability.**

**Action Verb: Understand (L2)**

C01 Action Verb is Understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

**C02: Apply the rules, principles for writing abstract and introduction part of research article.**

**Action Verb: Apply (L3)**

C02 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).

C02 Action Verb is Apply of BTL 3. Using Action verb, Modern Tool usage L3 correlates PO5, CO level is two less than PO, so correlation is low(1).

**C03: Apply the right methods to write the review of literature, results and conclusions.**

**Action Verb: Apply (L3)**

C03 Action Verb is Apply of BTL 3. Using Action verb, Problem Analysis L3 correlates PO2, CO level is one less than PO, so Correlation is Moderate (2)

C03 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2)

**C04: Apply special skills for writing a title, abstract, review and introduction of literature.**

**Action Verb: Apply (L3)**

C04 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).

**C05: Apply key skills for results in discussion and conclusion.**

**Action Verb: Apply (L3)**

C05 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).





**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
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**Artificial Intelligence and Data Science (AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	ENTREPRENEURSHIP DEVELOPMENT	L	T/CLC	P	C
20AHSMB02	IV-I		4	2	0	3

**Course Outcomes:**

**After Studying the Course, student will be able to**

- C01. **Understand** the concept and process of Entrepreneurship to develop entrepreneurial skills
- C02. **Analyze** the different feasibility studies to start a new enterprise.
- C03. **Analyze** the various sources of finance to entrepreneurs.
- C04. **Analyze** the role of central government and state government in promoting women Entrepreneurship.
- C05. **Analyze** the role of incubations in fostering startups.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Understand	the concept and process of Entrepreneurship		to develop entrepreneurial skills	L2
C02	Analyze	the different feasibility studies		to start a new enterprise	L4
C03	Analyze	the various sources of finance to entrepreneurs			L4
C04	Analyze	the role of central government and state government		in promoting women Entrepreneurship	L4
C05	Analyze	the role of incubations		in fostering startups	L4

**Unit-1 Introduction to Entrepreneurship**

Entrepreneurship - Concept, knowledge and skills requirement - Characteristics of successful entrepreneurs - Entrepreneurship process - Factors impacting emergence of entrepreneurship - Differences between Entrepreneur and Intrapreneur - Understanding individual entrepreneurial mindset and personality - Recent trends in Entrepreneurship.

**Unit-II Formulation of Business Idea**

Starting the New Venture - Generating business idea - Sources of new ideas & methods of generating ideas - Opportunity recognition - Feasibility study - Market feasibility, technical/operational feasibility - Financial feasibility - Drawing business plan - Preparing project report - Presenting business plan to investors.

**Unit-III Financial Aspects of Promotion**

Sources of finance - Various sources of Finance available - Long term sources - Short term sources - Institutional Finance - Commercial Banks, SFC's in India - NBFC's in India - their way of financing in India for small and medium business - Entrepreneurship development programs in India - The entrepreneurial journey- Institutions in aid of entrepreneurship development.

**Unit-IV Women Entrepreneurship**

Women Entrepreneurship - Entrepreneurship Development and Government - Role of Central Government and State Government in promoting women Entrepreneurship - Introduction to various incentives, subsidies and grants - Export- oriented Units - Fiscal and Tax concessions available - Women entrepreneurship - Role and importance - Growth of women entrepreneurship in India - Issues & Challenges - Entrepreneurial motivations.

## Unit-V Startups and Incubation

Startups – Definition, Role of startups in India, Governmental initiatives to foster entrepreneurship across sectors. Funding opportunities for startups. Business Incubation and its benefits, Pre-Incubation and Post - Incubation process.

### Textbooks:

1. D F Kuratko and T V Rao, "Entrepreneurship" - A South-Asian Perspective – Cengage Learning, 2012. (For PPT, Case Solutions Faculty may visit : [login.cengage.com](http://login.cengage.com))
2. Nandan H, " Fundamentals of Entrepreneurship", PHI, 2013.

### References:

1. Vasant Desai, "Small Scale Industries and Entrepreneurship", Himalaya Publishing 2012.
2. Rajeev Roy "Entrepreneurship", 2nd Edition, Oxford, 2012.
3. B.Janakiram and M.Rizwanal "Entrepreneurship Development: Text & Cases", Excel Books, 2011.
4. Stuart Read, Effectual "Entrepreneurship", Routledge, 2013.

### Online Learning Resources:

1. Entrepreneurship-Through-the-Lens-of-venture Capital
2. <http://www.onlinevideolecture.com/?course=mba-programs&subject=entrepreneurship>
3. [http://nptel.ac.in/courses/122106032/Pdf/7\\_4.pdf](http://nptel.ac.in/courses/122106032/Pdf/7_4.pdf)
4. <http://freevideolectures.com/Course/3514/Economics/-/Management/-/Entrepreneurship/50>

### Mapping of course outcomes with program outcomes

Course Title	COs													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
ENTREPRENEURSHIP DEVELOPMENT	CO1	2												
	CO2			3	3						3			
	CO3	3										3		
	CO4	3												
	CO5	3												

### Correlation Matrix

Course Outcome (CO)	Percentage of contact hours over the total planned contact hours	CO: Action verb and BTL	Program Outcome(PO)	PO: Action verb and BTL	Level of correlation (0-3)
CO1	18.86	Understand	PO1	Apply (L3)	2
CO2	18.86	Analyze	PO3 PO4 PO10	Apply (L3) Apply (L3) Thumb Rule	3 3 3
CO3	20.75	Analyze	PO1 PO11	Apply (L3) Thumb Rule	3 3
CO4	18.86	Analyze	PO1	Apply (L3)	3
CO5	22.64	Analyze	PO1	Apply (L3)	3

### Justification Statements:

**CO1: Understand** the concept and process of Entrepreneurship to develop entrepreneurial skills

**Action Verb: Understand (L2)**

PO1 Verb : Apply(L3)

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)

**CO2: Analyze** the different feasibility studies to start a new enterprise.

**Action Verb: Analyze (L4)**

P03: Apply (L3)

C02 Action verb is more than P03 verb. Therefore, the correlation is High (3)

P04: Apply (L3)

C02 Action verb is more than P04 verb. Therefore, the correlation is High (3)

P010: Thumb Rule

As using thumb rule C02 correlates with P010. Therefore, the correlation is High (3)

**C03: Analyze** the various sources of finance to entrepreneurs.

**Action Verb: Analyze (L4)**

P01: Apply (L3)

C03 Action verb is more than P01 verb by one level. Therefore, the correlation is High (3)

P011: Thumb Rule

C03 Action verb blooms level 4 correlates with P011. Therefore, the correlation is High (3)

**C04: Analyze** the role of central government and state government in promoting women Entrepreneurship.

**Action Verb: Analyze (L4)**

P01: Apply (L3)

C04 Action verb is more than P01 verb by one level. Therefore, the correlation is High (3)

**C05: Analyze** the role of incubations in fostering startups.

**Action Verb: Analyze (L4)**

P01: Apply (L3)

C05 Action verb is more than P01 verb. Therefore, the correlation is High (3)



**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI  
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**Artificial Intelligence and Data Science (AI&DS)**

**Year: IV**

**Semester: I**

**Branch of Study: AIDS**

Course Code	Year & Sem	Exploratory Data Analysis with R	L	T/CLC	P	C
20ASC3004	IV-I		1	0	2	2

**Course Outcomes:**

After Studying the Course, student will be able to

C01: **Evaluate** the installation of R to Perform simple R Programming's.

C02: **Analyze** the Functionality of R by using add-on Packages.

C03: **Apply** the Extracted data from files and other sources to perform data Manipulation Tasks.

C04: **Analyze** the R Graphics and Tables to visualize results of various stastical operations on Data.

C05: **Apply** the knowledge of R gained to data analytics for real life applications.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
C01	Evaluate	the installation of R		to Perform simple R Programming's	L5
C02	Analyze	the Functionality of R	by using add-on Packages		L4
C03	Apply	the Extracted data from files and other sources		to perform data Manipulation Tasks	L3
C04	Analyze	the R Graphics and Tables		to visualize results of various stastical operations on Data.	L4
C05	Apply	the knowledge of R gained		to data analytics for real life applications.	L3

**1: INTRODUCTION TO COMPUTING (CO1)**

- Installation of R
- The basics of R syntax, workspace
- Matrices and lists
- Subsetting
- System-defined functions; the help system
- Errors and warnings; coherence of the workspace

**2: GETTING USED TO R: DESCRIBING DATA(CO1)**

- Viewing and manipulating Data
- Plotting data
- Reading the data from console, file (.csv) local disk and web
- Working with larger datasets

**3: SHAPE OF DATA AND DESCRIBING RELATIONSHIPS (CO1)**

- Tables, charts and plots.
- Univariate data, measures of central tendency, frequency distributions, variation, and Shape.
- Multivariate data, relationships between a categorical and a continuous variable,
- Relationship between two continuous variables – covariance, correlation coefficients, comparing multiple correlations.
- Visualization methods – categorical and continuous variables, two categorical variables, two continuous variables.

**4: PROBABILITY DISTRIBUTIONS (CO2)**

- Sampling from distributions – Binomial distribution, normal distribution
- tTest, zTest, Chi Square test
- Density functions
- Data Visualization using ggplot – Box plot, histograms, scatter plotter, line chart, bar chart, heat maps

**5: EXPLORATORY DATA ANALYSIS (CO2)**

Demonstrate the range, summary, mean, variance, median, standard deviation, histogram, box plot, scatter plot using population dataset.

**6: TESTING HYPOTHESES (CO3)**

- Null hypothesis significance testing
- Testing the mean of one sample
- Testing two means

**7: PREDICTING CONTINUOUS VARIABLES(CO3)**

- Linear models
- Simple linear regression
- Multiple regression
- Bias-variance trade-off – cross-validation



## Correlation Matrix

Unit No.	CO		Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Co's Action verb	BTL			
1	CO1:Evaluate	L5	PO1 PO2	PO1: Apply(L3) PO2: Analyze(L4)	3 3
2	CO2:Analyze	L4	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Formulate (L6) PO4: Analysis (L4) PO11: Thumb rule	3 1 3 3
3	CO3:Apply	L3	PO1 PO2 PO3 PO4 PO7 PO11	PO1: Apply(L3) PO2: Identify(L2) PO3: Develop (L3) PO4: Analyze(L4) PO7: Thumb rule PO11: Thumb rule	3 3 3 2 2 2
4	CO4:Analyze	L4	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Formulate (L6) PO4: Analysis (L4) PO11: Thumb rule	3 1 3 3
5	CO5:Apply	L3	PO1 PO2 PO4	PO1: Apply(L3) PO2: Identify(L2) PO4: Analysis (L4)	3 3 2

### Justification Statements:

**CO1: Evaluate** the installation of R to Perform simple R Programming's.

**Action Verb: Evaluate (L5)**

**PO1 Verb: Apply (L3)**

CO1 Action verb is more than PO1 verb. Therefore, the correlation is high (3)

**PO2 Verb: Analyze (L4)**

CO1 Action verb is more than PO2 verb. Therefore, the correlation is high (3)

**CO2: Analyze** the Functionality of R by using add-on Packages.

**Action Verb: Analyze (L4)**

**PO1: Apply (L3)**

CO2 Action verb is more than PO1 verb. Therefore, the correlation is high (3)

**PO2: Formulate (L6)**

CO2 Action verb is less than PO2 verb by two levels. Therefore, the correlation is low (1)

**PO4: Analysis (L4)**

CO2 Action verb is same as PO4 level. Therefore, the correlation is high (3)

**PO11: Thumb rule**

For some Packages are using creating the R Programming indirectly suitable for environment development therefore the correlation is High(3)

**CO3: Apply** the Extracted data from files and other sources to perform data Manipulation Tasks.

**Action Verb: Apply (L3)**

**PO1: Apply(L3)**

CO3 Action verb is same as PO1 verb. Therefore, the correlation is high (3)

**PO2: Identify (L2)**

CO4 Action verb is more than PO2 verb. Therefore, the correlation is high (3)

**PO3: Develop (L3)**

CO4 Action verb is same as PO3 verb. Therefore, the correlation is high(3)

**PO4: Analysis (L4)**

CO4 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)

**PO7: Thumb rule**

For some of Real Time problems using in R Programming concept is indirectly used to sustainable environment development. Therefore, the correlation is moderate (2)

**PO11: Thumb rule**

For some of various R Programming used to write programs and evaluation. Therefore, the correlation is moderate (2)

**CO4: Analyze** the R Graphics and Tables to visualize results of various stastical operations on Data.

**Action Verb: Analyze (L4)**

**P01: Apply (L3)**

CO4 Action verb is more than as P01 verb. Therefore, the correlation is high (3)

**P02: Formulate (L6)**

CO4 Action verb is less than P02 verb by two levels. Therefore, the correlation is low (1)

**P04: Analysis (L4)**

CO4 Action verb is same as P04 verb. Therefore, the correlation is high (3)

**P011: Thumb rule**

For some of R Graphics and Tables concepts are used to create programs. Therefore, the correlation is high (3)

**C05: Apply** the knowledge of R gained to data analytics for real life applications.

**Action Verb: Apply (L3)**

**P01: Apply(L3)**

C05 Action verb is same as P01 verb. Therefore, the correlation is high (3)

**P02: Identify (L2)**

C05 Action verb is more than P02 verb. Therefore, the correlation is high (3)

**P04: Analysis (L4)**

C05 Action verb is less than P04 verb by one levels. Therefore, the correlation is moderate (2)