ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)

B. Tech - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

(Effective for the batches admitted from 2021-22

Semester I (First year)

Sl.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P	C			
1	BS	20ABS9901	Algebra & 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	20AES3301	Problem Solving and Programming	4	2	0	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	20AES3302	Problem Solving and Programming Lab	0	0	3	1.5	30	70	100
			Total credits				**19.5**	**240**	**560**	**800**

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Semester II (First year)

Sl.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P	C			
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	20AES3303	Basics of Python Programming	4	2	0	3	30	70	100
4	ES	20AES3305	Data Structures	4	2	0	3	30	70	100
5	ES	20AES3307	Web Design	1	0	4	3	30	70	100
6	ES Lab	20AES3304	Basics Of Python Programming Lab	0	0	3	1.5	30	70	100
7	BS Lab	20ABS9918	Computational Lab –I	0	0	3	1.5	30	70	100
8	ES Lab	20AES3306	Data Structures Lab	0	0	3	1.5	30	70	100
9	MC	20AMC9903	Environmental Studies	3	0	0	0	30	0	30
			Total credits				**19.5**	**270**	**560**	**830**

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Semester III (Second year)

Sl.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P	C			
1	BS	20ABS9914	Discrete Mathematical Structures	4	2	0	3	30	70	100
2	PC	20APC3301	Digital Electronics and Microprocessors	4	2	0	3	30	70	100
3	PC	20APC3302	Database Management Systems	4	2	0	3	30	70	100
4	PC	20APC3304	Object Oriented Programming through Java	4	2	0	3	30	70	100
5	PC	20APC3306	Computer Organization and Architecture	4	2	0	3	30	70	100
6	PC Lab	20APC3303	Database Management Systems Lab	0	0	3	1.5	30	70	100
7	PC Lab	20APC3305	Object Oriented Programming through Java Lab	0	0	4	2	30	70	100
8	PC Lab	20APC3307	Computer Organization and Microprocessor Lab	0	0	2	1	30	70	100
9	SOC	20ASC3301	Client Side Scripting	1	0	2	2	100	0	100
10	MC	20AMC9902	Constitution of India	3	0	0	0	30	0	30
			Total credits				**21.5**	**370**	**560**	**930**

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Semester IV (Second year)

Sl.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P	C			
1	PC	20APC3308	Software Engineering for AI	4	2	0	3	30	70	100
2	PC	20APC3309	Artificial Intelligence	4	2	0	3	30	70	100
3	PC	20APC3311	Data Warehousing and Mining	4	2	0	3	30	70	100
4	PC	20APC3313	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		3	30	70	100
7	PC Lab	20APC3310	Artificial Intelligence Lab	0	0	3	1.5	30	70	100
8	PC Lab	20APC3312	Data Warehousing and Mining Lab	0	0	3	1.5	30	70	100
9	PC Lab	20APC3314	Operating Systems Lab	0	0	3	1.5	30	70	100
10	SOC	20ASC3302	Server Side Scripting	1	0	2	2	100	0	100
			Total credits				**24.5**	**370**	**630**	**1000**

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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B. Tech - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Semester V (Third year)

Sl.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P	C			
1	PC	20APC3315	Computer Networks & Cryptography	4	2	0	3	30	70	100
2	PC	20APC3316	Machine Learning	4	2	0	3	30	70	100
3	PC	20APC3317	Formal Languages And Automata Theory	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	20APE3301	Big Data Technologies	4	2	0	3	30	70	100
		20APE3302	Real Time Operating Systems	3	0	0				
		20APE3303	Distributed Computing	3	0	0				
		20APE3304	Ethics And Privacy In AI	3	0	0				
6	PC Lab	20APC3318	Computer Networks & Cryptography Lab	0	0	3	1.5	30	70	100
7	PC Lab	20APC3319	Machine Learning Lab	0	0	3	1.5	30	70	100
8	SC	20ASC3303	Conversational AI/ AI Chatbot	1	0	2	2	100	0	100
9	MC	20AMC9901	Biology for Engineers	3	0	0	0	30	0	30
10	CSP	20CSP3301	Evaluation of Community Service Project	0	0	0	1.5	100	0	100
			Total credits				21.5	440	490	930

OE for NPTEL

S. No	Open Elective (12 weeks)
1	Block chain 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 Behavior
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).

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Semester VI (Third year)

Sl.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P	C			
1	PC	20APC3320	Deep Learning Techniques	4	2	0	3	30	70	100
2	PC	20APC3321	Speech and Language Processing	4	2	0	3	30	70	100
3	PC	20APC3322	Big Data Analytics	4	2	0	3	30	70	100
4	PE – 2 MOOCS -II	20APE3305	Automation of Model Building	4	2	0	3	30	70	100
		20APE3306	Computer Vision	3	0	0				
		20APE3307	Robotic Process Automation	3	0	0				
		20MOC3302	Object-oriented system development using UML, java and patterns.							
5	PC Lab	20APC3323	Deep Learning Techniques Lab	0	0	3	1.5	30	70	100
6	PC Lab	20APC3324	Speech and Language Processing Lab	0	0	3	1.5	30	70	100
7	PC Lab	20APC3325	Big Data Analytics Lab	0	0	3	1.5	30	70	100
8	SC	20ASA0502	Soft Skills	1	0	2	2	100	0	100
9	MC	20AMC9904	Professional Ethics and Human Values	2	0	0	0	30	0	30
			Total credits				**21.5**	**340**	**490**	**830**
Industrial/Research Internship (Mandatory) 2 Months during summer vacation										

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Semester VII (Fourth year)

Sl.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P	C			
1	PE - 3	20APE3308	Advanced ML	4	2	0	3	30	70	100
		20APE3309	Recommender Systems	3	0	0				
		20APE3310	Reinforcement Learning in AI	3	0	0				
		20APE3311	Machine Learning for Unstructured Data	3	0	0				
2	PE - 4	20APE3312	Optimizing Techniques in AI	3	0	0	3	30	70	100
		20APE3313	AI for Image Analysis	3	0	0				
		20APE3314	Intelligent Information Retrieval System	3	0	0				
		20APE3315	Generative AI	4	2	0				
3	PE – 5 CBCC/ MOOCS-III	20APE3316	Data Analytics	4	2	0	3	30	70	100
		20APE3317	Software Project Management							
		20APE3318	Linux Environment System							
		20MOC3303	1. Data Analytics with Python 2. Software Testing							
4	JOE/OE-2	20AOE3301	Information Retrieval Techniques	3	0	0	3	30	70	100
		20AOE3302	Soft Computing	3	0	0				
		20AOE3303	Principles of Data science	4	2	0				
5	OE - 3	20APE0415	Digital Image Processing	3	0	0	3	30	70	100
		20AOE3004	Embedded Systems	3	0	0				
		20AOE3601	Enabling Technologies for data science and analytics :IOT	3	0	0				
		20APE0415	Wireless Communications	4	2	0				
6	HE	20AOE0302	Management Science	4	2	0	3	30	70	100
		20AOE9901	English for Research Paper Writing	3	0	0				
		20AHSMB02	Entrepreneurship Development	3	0	0				
7	SC	20ASC3305	Exploratory Data Analysis with R	1	0	2	2	100	0	100
8	INTERNSHIP	20APR3301	Evaluation of Industry Internship(III-I Summer Internship)	0	0	0	3	100	0	100
			Total credits				**23**	**380**	**420**	**800**

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B. Tech - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Semester VIII (Fourth year)

Sl. No	Category	CourseCode	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T	P	C			
1	OE-4	20MOC3301	MOOCS	0	0	0	3	25	75	100
2	PR	20APR3302	Internship	0	0	0	3	100	-	100
3	PR	20APR3303	Project work	0	0	0	9	60	140	200
			Total credits				**15**	**185**	**215**	**400**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY ANDSCIENCES, TIRUPATI (AUTONOMOUS)

B. Tech - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI&ML)

(Effective for the batches admitted from 2021-22)

Semester I (First year)

Sl.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T	P	C			
1	BS	20ABS9901	Algebra & 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	20AES3301	Problem Solving and Programming	4	2	0	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	20AES3302	Problem Solving and Programming Lab	0	0	3	1.5	30	70	100
			Total credits				**19.5**	**240**	**560**	**800**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI &ML)

Course Code	Year & Sem		L	T/CLC	P	C
20ABS9901	I-I	**Algebra and Calculus**	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- Orthoganality 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).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI &ML)

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	**Understand**	The properties of light and electromagnetic waves.			L2
2	**Analyze**	The fundamentals of Lasers and optical fibers.			L4
3	**Analyze**	The properties of dielectric and magnetic materials.			L4
4	**Analyze**	The charge carrier dynamics in semiconductors.	By implementing the equations of state.		L4
5	**Apply**	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.

Unit IV: Semiconductors **8 Hrs**

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'seffect-BCSTheory(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
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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI &ML)

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

UNIT – I		10 Hours (4L+6P)

Lesson: On the Conduct of Life: William Hazlitt

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

Writing : Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph.

Grammar and Vocabulary- I : 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.

UNIT – II	**Probability**	10 Hours (4L+6P)

Lesson: The Brook: Alfred Tennyson

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts.

Speaking: Discussion in pairs/small groups on specific topics followed by short structured talks.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Writing: Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters.

Grammar & Vocabulary building-1: Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions.

Vocabulary building:2 Idioms and Phrases, Homonyms, Homophones and Homographs.

UNIT – III		10 Hours (4L+6P)

Lesson: The Death Trap: Saki

Listening: Listening for global comprehension and summarizing what is listened to.

Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed

Reading: Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension.

Writing: Summarizing – identifying main idea/s and rephrasing what is read.

Grammar and Vocabulary building-II: Direct and indirect speech, reporting verbs for academic purposes.

Technical Writing-1: personal experiences, unforgettable incidents, travelogues. (Imaginative, Narrative and Descriptive).

UNIT – IV	10 Hours (4L+6P)

Lesson: **Innovation: Muhammad Yunus**

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions

Reading: Studying the use of graphic elements in texts to convey information, reveal trends / patterns / relationships, communicate processes or display complicated data.

Writing: Letter Writing: Official Letters/Report writing, e-mail writing

Grammar and Vocabulary: Quantifying expressions - adjectives and adverbs; comparing and contrasting; Voice - Active & Passive Voice.

Vocabulary:2 : Jigsaw Puzzles, Vocabulary Activities through Web tools

UNIT – V	10 Hours (4L+6P)

Lesson: **Politics and the English Language: George Orwell**

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.

Speaking: Formal oral presentations on topics from academic contexts - without the use of PPT slides.

Reading: Reading for comprehension.

Writing: Writing structured essays on specific topics using suitable claims and evidences.

Grammar and Vocabulary: Editing short texts –identifying and correcting common errors in grammar and usage.

Technical Writing-2: Narrative short story, News paper articles on science fiction.

Textbooks:

1. Language and Life: A Skills Approach- I Edition 2019, Orient Black Swan

Reference Books:

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

Web Links

www.englishclub.com
www.easyworldofenglish.com
www.languageguide.org/english/
www.bbc.co.uk/learningenglish
www.eslpod.com/index.html
www.myenglishpages.com

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1									2				
CO2								2	2				
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)	%	corr	Verb	BTL			
1	10	20	2	Understand	L2	PO9	Communication	2
2	10	20	2,2	Apply	L3	PO8, PO9	Individual and Team work, Communication	2, 2
3	10	20	3	Analyze	L4	PO9	Communication	3
4	10	20	3	Evaluate	L5	PO9	Communication	3
5	10	20	3	Create	L6	PO9	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 MACHINE LEARNING (AI &ML)

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 lines and Plan.
CO3. **Analyze** the projection of 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.
a) Conic sections including the rectangular hyperbola- general method only,
b) 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:

1. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers
2. N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers
3. 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 PO9 PSO1 PSO2	Apply (L3) Develop (L3) TR TR TR	3 3 1 2 2
2	15	20	2	Understand	L2	PO1 PO3 PO9 PSO1 PSO2	Apply (L3) Develop (L3) TR TR TR	2 2 1 2 2
3	15	20	2	Analyze	L4	PO1 PO3 PO9 PSO1 PSO2	Apply (L3) Develop (L3) TR TR TR	3 3 1 2 2
4	15	20	2	Analyze	L4	PO1 PO3 PO9 PSO1 PSO2	Apply (L3) Develop (L3) TR TR TR	3 3 1 2 2
5	12	16	2	Apply	L3	PO1 PO3 PO9 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)
PO9 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)
PO9 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)
PO9 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)
PO9 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)
PO9 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 MACHINE LEARNING (AI &ML)

Course Code	Year & Sem	Problem Solving And Programming	L	T/CLC	P	C
20AES3301	I-I		4	2	0	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

UNIT – I		8 Hrs
Computer Fundamentals: 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. Introduction to Programming, Algorithms and Flowcharts: 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.		
UNIT – II		9 Hrs
Introduction to computer problem solving: Introduction, the problem-solving aspect, top-down design, implementation of algorithms, the efficiency of algorithms, and the analysis of algorithms. **Fundamental algorithms**: 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.		
UNIT – III		8 Hrs
Types, Operators, and Expressions: 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. **Input and output:** standard input and output, formatted output-Printf, formatted input-Scanf. Control Flow: Statements and blocks, if-else, else-if, switch, Loops-while and for, Loops-Do- while, break and continue, Goto and labels. **Functions and Program Structure**: Basics of functions, functions returning non-integers, external variables, scope variables, header variables, register variables, block structure, initialization, recursion, the C processor.		
UNIT – IV		9 Hrs
Factoring methods: 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

UNIT – V		9 Hrs

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

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 MACHINE LEARNING (AI &ML)

Course Code	Year & Sem		L	T/CLC	P	C
20AHS9902	I-I	COMMUNICATIVE ENGLISH LAB	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	Evaluate	Awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.			L5
2	Understand	The different aspects of the language with emphasis on LSRW skills and make use of different strategies in discussions.			L2
3	Apply	knowledge of vocabulary and skills in various language learning activities			L3
4	Analyze	Speech sounds, stress, rhythm, intonation and syllable division for Better listening and speaking comprehension.			L4
5	Evaluate	The acceptable etiquette essentials in social and professional presentations.			L5

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

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**	PO9	Thumb Rule	3
2	6	16	2	**Understand**	**L2**	PO8	Thumb Rule	2
3	6	16	2	**Apply**	**L3**	PO9	Thumb Rule	2
4	6	16	3	**Analyze**	**L4**	PO9	Thumb Rule	3
5	9	25	3	**Evaluate**	**L5**	PO9	Thumb Rule	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		L	T/CLC	P	C
20ABS9907	I-I	Applied Physics Lab	0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

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

CO2: Understand the basic concepts of electromagnetic induction.

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

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

CO5: 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. **(CO1)**
2. Determination of the radius of curvature of the lens by Newton's ring method. **(CO1)**
3. Determination of wavelength by plane diffraction grating method. **(CO1)**
4. Dispersive power of a diffraction grating. **(CO1)**
5. Study of the Magnetic field along the axis of a circular coil carrying current. **(CO2)**
6. Study the variation of B versus H of the magnetic material (B-H curve) **(CO4)**
7. Determination of the numerical aperture of a given optical fiber and angle of acceptance. **(CO1)**
8. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect. **(CO5)**
9. Determination of the energy gap of a semiconductor. **(CO5)**
10. Determination of crystallite size using X-Ray diffraction spectra. **(CO3)**
11. Determination of Wavelength of LASER using diffraction grating. **(CO1)**
12. Determination of particle size using LASER. **(CO1)**
13. Determination of the resistivity of semiconductor by Four probe method. **(CO5)**
14. Determination of dielectric constant by charging and discharging method. **(CO4)**
15. Study the temperature dependence of resistance of a thermister. **(CO5)**

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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3			3									
CO2	2			1									
CO3	3			3									
CO4	3			3									
CO5	3			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)	%	correlation	Verb	BTL			
1	9	25	3	Analyze	L4	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
2	6	16	2	Understand	L2	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	2 1
3	6	16	2	Evaluate	L5	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
4	9	25	3	Analyze	L4	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
5	6	16	2	Evaluate	L5	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 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 MACHINE LEARNING (AI &ML)

Course Code	Year & Sem	Problem Solving And Programming Lab	L	T/CLC	P	C
20AES3302	I-I		0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO1: Analyze the basics of computer and concepts of C for writing simple programs.

CO2: Analyze the control statements for solving the problems using C

CO3: Design the algorithm for implementing complex problems using C.

CO4: Analyze the arrays to store and retrieve the elements.

CO5: 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 ← b ← c ← d ← 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 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 – x2/2! + x4/4! – x6/6! +.....**(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 1and100 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 starts 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)
CO2 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO2 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)

PO4: Analyze (L4)
CO2 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO2 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

CO3: Design the algorithm for implementing complex problems using C.
Action Verb: Design (L6)
PO1: Apply (L3)
CO3 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Formulate(L6)
CO3 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
PO3: Design (L6)
CO3 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is greater than as PO4 verb. Therefore, the correlation is high (3)
PO5: create (L6)
CO3 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

PO11: Thumb rule
Algorithms analysis is learning process to find the solution better manner the correlation is high (3)

CO4: Analyze the arrays to store and retrieve the elements.

Action Verb: Analyze (L4)
PO1: Apply (L3)
CO4 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: idetify(L3)
CO4 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is greater than as 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 as PO5 verb. Therefore, the correlation is high (3)

PO11: Thumb rule
Data analysis is the trending approach in the current days Therefore, the correlation is high (3)

CO5: Apply the different sorting techniques for solving real world problems.

Action Verb: Apply (L3)
PO1: Apply (L3)
CO5 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2: idetify(L3)
CO5 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO5 Action verb is same 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)
PO5: Apply (L3)
CO5 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY ANDSCIENCES, TIRUPATI
(AUTONOMOUS)
B. Tech - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI & ML) (Effective for the batches admitted from 2021-22)

Semester II (First year)

Sl. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P	C			
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	20AES3303	Basics of Python Programming	4	2	0	3	30	70	100
4	ES	20AES3305	Data Structures	4	2	0	3	30	70	100
5	ES	20AES3307	Web Design	1	0	4	3	30	70	100
6	ES LAB	20AES3304	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	20AES3306	Data Structures Lab	0	0	3	1.5	30	70	100
9	MC	20AMC9903	Environmental Studies	3	0	0	0	30	0	30
			Total credits				**19.5**	**270**	**560**	**830**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI &ML)

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**

UNIT – I	**Descriptive statistics and methods for data science**	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

UNIT – II	**Probability**	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.

UNIT – III	**Probability distributions**	9 Hrs

Probability distribution - Binomial, Poisson approximation to the binomial distribution and normal distribution-their properties.

UNIT – IV	**Estimation and Testing of hypothesis, large sample tests**	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.

UNIT – V	**Small sample tests**	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.

Textbooks:

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.

Reference Books:

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 MACHINE LEARNING (AI &ML)

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

UNIT – I		
Errors in Numerical computations: Errors and their Accuracy, Mathematical Preliminaries, Errors and their Analysis, Absolute, Relative and Percentage Errors, A general error formula, Error in a series approximation.		
UNIT – II		
Solution of Algebraic and Transcendental Equations: The Bisection Method – The Method of False Position– Newton-Raphson Method, Solution of linear simultaneous equation: Crout's triangularisation method, Gauss - Seidal iteration method.		
UNIT – III		
Interpolation: Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.		
UNIT – IV		
Curve fitting: 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.		
UNIT – V		
Numerical solution of Ordinary Differential equations: 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				BTL	Program Outcom e (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb				
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 approximation
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 MACHINE LEARNING (AI &ML)

Course Code	Year & Sem	Basics of Python Programming	L	T/CLC	P	C
20AES3303	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

UNIT – I		9Hrs
Introduction: What is a program, Running python, Arithmetic operators, Value and Types. **Variables, Assignments and Statements:** Assignment statements, Script mode, Order of operations, string operations, comments. **Functions**: 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.		
UNIT – II		9 Hrs
Case study: The turtle module, Simple Repetition, Encapsulation, Generalization, Interface design, Refactoring, docstring. **Conditionals and Recursion**: floor division and modulus, Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, Recursion, Infinite Recursion, Keyboard input. **Fruitful Functions:** Return values, Incremental development, Composition, Boolean functions, more recursion, Leap of Faith, Checking types		
UNIT – III		9 Hrs
Iteration: Reassignment, Updating variables, The while statement, Break, Square roots, Algorithms. **Strings**: 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. **Case Study**: Reading word lists, Search, Looping with indices. **Lists**: 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.		
UNIT – IV		8 Hrs
Dictionaries: A dictionary is a mapping, Dictionary as a collection of counters, Looping and dictionaries, Reverse Lookup, Dictionaries and lists, Memos, Global Variables. **Tuples:** Tuples are immutable, Tuple Assignment, Tuple as Return values, Variable-length argument tuples, Lists and tuples, Dictionaries and tuples, Sequences of sequences. **Files:** Persistence, Reading and writing, Format operator, Filename and paths, Catching exceptions, Databases, Pickling, Pipes, Writing modules. **Classes and Objects**: Programmer-defined types, Attributes, Instances as Return values, Objects are mutable, Copying.		
UNIT – V		10Hrs
Classes and Functions: Time, Pure functions, Modifiers, Prototyping versus Planning **Classes and Methods**: Object oriented features, Printing objects, The init method, The __str__method, Operator overloading, Type-based Dispatch, Polymorphism, Interface and Implementation **Inheritance**: Card objects, Class attributes, Comparing cards, decks, Printing the Deck, Add Remove shuffle and sort, Inheritance, Data encapsulation. **The Goodies:** Conditional expressions, List comprehensions, Generator expressions, any and all, Sets, Counters, default dict, Named tuples, Gathering keyword Args		
Textbooks:		
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 MACHINE LEARNING (AI &ML)

Course Code	Year & Sem	Data Structures	L	T/CLC	P	C
20AES3305	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

UNIT – I	9 Hrs
Introduction 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	
UNIT – II	9 Hrs
Stack, Queue and Linked lists 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.	
UNIT – III	9 Hrs
Trees 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.	
UNIT – IV	9 Hrs
Graphs and Hashing 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.	
UNIT – V	9 Hrs
Files and Advanced sorting 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.	
Textbooks:	
1. Ellis Horowitz and Sartaj Sahni, "Fundamentals of Data Structures in C", 2nd Edition, Galgotia Book Source, Pvt. Ltd., 2004. 2. Alan L. Tharp, "File Organization and Processing", Wiley and Sons, 1988.	
Reference Books:	
1. D. Samanta, "Classic Data Structures", 2nd 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	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 PO11	PO1: Apply(L3) PO2: Formulate (L6) PO3: Develop (L3) PO4: Analyze(L4) PO11: Thumb rule	1 2 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)
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)

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI &ML)

Course Code	Year & Sem	Web Design	L	T/CLC	P	C
20AES3307	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 colors 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

UNIT – I	9 Hrs

Where Do I Start-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)

HTML Markup for Structure: 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

UNIT – II	9 Hrs

HTML Markup for Structure: 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

HTML Markup for Structure: 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

UNIT – III	9 Hrs

CSS for Presentation: 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 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

<table>
<tr><th>Student</th><th>Maths</th><th>Physics</th><th>Chemistry</th><th>Computer</th></tr>
<tr><td rowspan="2">I-R2C1</td><td>I-R1C1</td><td rowspan="4">I-R4C1</td><td colspan="2">I-C2</td></tr>
<tr><td>II-C1</td><td>II-C2</td><td rowspan="3">II-R1C5</td></tr>
<tr><td colspan="2" rowspan="3">III-R2C2</td><td>III-C1</td></tr>
<tr><td>IV-C1</td></tr>
</table>

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 and 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, 5 th 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
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	**CO1: Understand**	L2	PO1 PO3 PO8	PO1: Apply(L3) PO3: Design(L6) PO8: Thumb Rule	2 2 3
2	**CO2: Apply**	L3	PO1 PO3 PO8	PO1: Apply(L3) PO3: Design(L6) PO8: Thumb Rule	3 2 3
3	**CO3: Apply**	L3	PO1 PO3 PO8 PO9 PO10	PO1: Apply(L3) PO3: Design(L6) PO8: Thumb Rule PO9: Thumb Rule PO10: Thumb Rule	3 2 3 3 3
4	**CO4: Apply**	L3	PO1 PO3 PO8 PO9 PO10 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	**CO5: Create**	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)
PO8: 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)
PO8: 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)
PO8: Thumb rule
CO3 Styling and decorating with box dimensions, padding. Websites plays very crucial role in present days, therefore the correlation is high (3)
PO9: Thumb rule

CO3 Web pages are used to create blogs to share effective content, therefore the correlation is high (3)

PO10: Thumb rule

CO3 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)

CO4: Apply Advanced CSS to style effective presentation of webpage

Action Verb: Apply(L3)

PO1: Apply (L3)

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

PO3: Design(L6)

CO4 Action verb is lesser than as PO3 verb. Therefore, the correlation is medium (2)

PO8: Thumb rule

CO4 Using advanced CSS style presentations, therefore the correlation is high (3)

PO9: Thumb rule

CO4 Using advanced CSS techniques, therefore the correlation is high (3)

PO10: Thumb rule

CO4 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

CO4 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)

CO5: Create HTML and CSS Programs to create registration form, to show India map

Action Verb: Create(L6)

PO1: Apply (L3)

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

PO3: Design(L6)

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

PO4: Design(L6)

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

PO8: Thumb rule

CO5 Creating HTML and CSS programs, therefore the correlation is high (3)

PO9: Thumb rule

CO5 Creating HTML and CSS programs, therefore the correlation is high (3)

PO10: Thumb rule

CO5 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

CO5 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 MACHINE LEARNING (AI &ML)

Course Code	Year & Sem	Basics of Python Programming Lab	L	T/CLC	P	C
20AES3304	I-II		0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO1: Analyze the basic concepts of Python Programming

CO2: Apply the loops and conditional statements of python using IDLE and programs.

CO3: Analyze the compound data using Lists, Tuples and dictionaries using functions.

CO4: Apply the development applications using python data types to read and write data from files.

CO5: Design the solutions using OOPs concepts for real world problems in python.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Analyze	the basic concepts of Python Programming			L4
CO2	Apply	the loops and conditional statements of python	using IDLE and programs.		L3
CO3	Analyze	the compound data using Lists, Tuples and dictionaries	using functions.		L4
CO4	Apply	the development applications	using python datatypes	to read and write data from files	L3
CO5	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 the operations present in a Scientific Calculator **(CO1)**
2. Write a function that draws a grid like the following:**(CO1)**

```
+ - - - - + - - - - +
|         |         |
|         |         |
|         |         |
|         |         |
+ - - - - + - - - - +
|         |         |
|         |         |
|         |         |
|         |         |
+ - - - - + - - - - +
```

3. Write a function that draws a Pyramid with # symbols**(CO1)**

```
       #
     # # #
   # # # # #
 # # # # # # #
```

4. Using turtles concept draw a wheel of your choice**(CO1)**
5. Write a program that draws Archimedean Spiral**(CO1)**
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.**(CO1)**
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.**(CO1)**

8. Given n+r+1 <= 2r . n is the input and r is to be determined. Write a program which computes minimum

value of r that satisfies the above**(CO2)**

value of r that satisfies the above**(CO2)**

9. Write a program that evaluates Ackermann function**(CO2)**

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

Write a function called estimate_pi that uses this formula to compute and return an estimate of π.

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

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.**(CO2)**

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.**(CO2)**

12. Given a text of characters, Write a program which counts number of vowels, consonants and special characters.**(CO2)**

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.**(CO2)**

14. Given rows of text, write it in the form of columns.**(CO2)**

15. Given a page of text. Count the number of occurrences of each latter (Assume case insensitivity and don't consider special characters). Draw a histogram to represent the same**(CO2)**

16. Write program which performs the following operations on list's. Don't use built-in functions**(CO3)**

a) Updating elements of a list
b) Concatenation of list's
c) Check for member in the list
d) Insert into the list
e) Sum the elements of the list
f) Push and pop element of list
g) Sorting of list
h) Finding biggest and smallest elements in the list
i) Finding common elements in the list

17. Write a program to count the number of vowels in a word.**(CO3)**

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.**(CO4)**

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.**(CO4)**

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.**(CO4)**

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.**(CO4)**

22. Consider turtle object. Write functions to draw triangle, rectangle, polygon, circle and sphere. Useobject oriented approach.**(CO5)**

23. Write a program illustrating the object oriented features supported by Python.**(CO5)**

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.**(CO5)**

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.**(CO5)**

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)**(CO5)**

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	2										
CO3	3	3	2	2				1			1		
CO4	3	2											
CO5		1	3	3	3		2	1			2		

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

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
			PO8	PO8: Thumb rule	1
			PO11	PO11: 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
			PO7	PO7: Thumb rule	2
			PO8	PO8: Thumb rule	1
			PO11	PO11: Thumb rule	2

Justification Statements :

CO1: 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)

CO2: 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)

CO3: Analyze the compound data using Lists, Tuples and dictionaries using functions. 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 higher level as PO2 verb. Therefore the correlation is high
(3) PO3: Design (L6)
CO3 Action verb is less than PO3 verb by one level. Therefore the correlation is medium
(2) PO4: Design (L6)
CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is medium
(2) PO8: 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)

CO4: Apply the development applications using python datatypes to read and write data from files. Action Verb : Apply (L3)
PO1: Apply(L3)
CO4 Action verb is same level as PO1 verb. Therefore the correlation is high
(3) PO2: Analyze (L4)
CO4 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)

CO5: Design the solutions using OOPs concepts for real world problems in python. Action Verb : Design (L6)
PO2: Analyze (L4)
CO5 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)
PO3: Design (L6)
CO5 Action verb is same level as PO3 verb. Therefore the correlation is high
(3) PO4: Design (L6)
CO5 Action verb is same level as PO4 verb. Therefore the correlation is high
(3) PO5: Develop(L6)
CO5 Action verb is same level as PO5 verb. Therefore the correlation is high
(3) PO7: 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 MACHINE LEARNING (AI &ML)

Course Code	Year & Sem		L	T/CLC	P	C
20ABS9918	I-II	Computational Lab -1	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 inlarge 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 insmall 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,42nd Edition .
2. Miller and Freunds, 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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
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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI &ML)

Course Code	Year & Sem	Data Structures Lab	L	T/CLC	P	C
20AES3306	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

1. String operations using array of pointers **(CO1)**
2. Searching Algorithms (With the Number of Key Comparisons) Sequential, Binary and Fibonacci Search Algorithms. **(CO1)**
3. 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)**
4. Implementation of Singly Linked List, Doubly Linked List, Circular Linked List**(CO2)**
5. Stack implementation using arrays**(CO3)**
6. Stack implementation using linked lists**(CO3)**
7. 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)**
8. Queue implementation using linked lists**(CO3)**
9. Creation of binary search tree, performing operations insertion, deletion, and traversal. **(CO4)**
10. Breadth first search**(CO4)**
11. Depth first search**(CO4)**
12. Travelling sales man problem**(CO4)**
13. File operations**(CO4)**
14. Indexing of a file**(CO4)**
15. Reversing the links (not just displaying) of a linked list. **(CO4)**
16. 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)**
17. 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)**
18. 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
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 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 3 3 3
2	**CO2: Design**	L6	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Develop (L3) PO3: Design (L6) PO4: Design (L6) PO5:Create(L6) PO11: Thumb rule	3 3 3 3 3 3
3	**CO3: Design**	L6	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Develop (L3) PO3: Design (L6) PO4: Design (L6) PO5:Create(L6) PO11: Thumb rule	3 3 3 3 3 3
4	**CO4: Evaluate**	L5	PO1 PO2 PO3 PO4 PO5 PO7 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Design (L6) PO4: Analysis(L4) PO5:Create(L6) PO7: Thumb rule PO11: Thumb rule	3 3 3 2 2 3 3
5	**CO5: Design**	L6	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Design(L6) PO4: Analysis(L4) PO5:Create(L6) PO11: 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)
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 greater than PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: Develop(L3)
CO1 Action verb is greater than 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)

CO2: Design the algorithms to solve real time problems using Linked lists
Action Verb: Design (L6)
PO1: Apply (L3)
CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Develop (L6)

CO2 Action verb is same level PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: Design(L3)
CO2 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO4: Design (L6)
CO2 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
PO5 Verb: Create(L6)
CO1 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO11: 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)

CO3: Design the solutions for computational problems using stacks and queues
Action Verb: Design (L6)
PO1: Apply (L3)
CO3 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Develop (L3)
CO3 Action verb is same level PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: Design(L6)
CO3 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO4: Design (L6)
CO3 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
PO5 Verb: Create(L6)
CO3 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
For some of Data Structure applications, stacks concepts are used to manage data in the memory. Therefore, the correlation is high (3)

CO4: Evaluate the operations of breadth first search using queues
Action Verb: Evaluate (L5)
PO1: Apply(L3)
CO4 Action verb is greater than PO1 verb by two levels. Therefore, the correlation is high (3)
PO2: Review (L2)
CO4 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)
PO3: Design (L6)
CO4 Action verb is less than PO3 verb by one level. Therefore, the correlation is medium (2)
PO4: Analysis (L4)
CO4 Action verb is greater than PO4 verb by one level. Therefore, the correlation is high (3)
PO5 Verb: Create(L6)
CO4 Action verb is greater than PO5 verb. Therefore, the correlation is medium (2)
PO7: 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)
PO11: 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)

CO5: Design the algorithms to perform operations on trees and graphs
Action Verb: Design (L6)
PO1: Apply(L3)
CO5 Action verb is greater than PO1 verb. Therefore, the correlation is high (3)
PO2: Review (L2)
CO5 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO3: Design (L6)
CO4 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)
PO4: Analysis (L4)
CO5 Action verb is greater than PO4 verb. Therefore, the correlation is high (3)
PO5 Verb: Create(L6)
CO1 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO11: 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
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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI &ML)

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

UNIT – I	9 Hrs
Multidisciplinary Nature of Environmental Studies : Introduction Multidisciplinary Nature of Environmental Studies-Definition, Scope and Importance – Need for Public Awareness. **Natural Resources**: Renewable and non-renewable energy resources – Natural resources and associated problems. **Forest resources**: Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people. **Water resources**: Use and over utilization of surface and sub-surface – Floods, drought, conflicts over water, dams – benefits and problems. **Mineral resources:** Use and exploitation, environmental effects of extracting and using mineral resources, case studies. **Food resources**: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticides problems, water logging, salinity, case studies. **Energy resources**: Renewable and non-renewable energy resources.	
UNIT – II	9 Hrs
Ecosystems: 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). **Biodiversity And Its Conservation**: 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-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	
UNIT – III	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						
CO3						2	2						
CO4						2	2						
CO5							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	Thumb Rule Thumb Rule	2, 2
2	15	15	28	3	Understand	L2	PO7	Thumb Rule	2
3	8	8	15	2	Apply	L3	PO6 PO7	Thumb Rule Thumb Rule	2, 2
4	9	10	19	2	Apply	L3	PO6,PO7	Thumb Rule Thumb Rule	2, 2
5	8	8	15	2	Understand	L2	PO7	Thumb Rule	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 ANDSCIENCES, TIRUPATI
(AUTONOMOUS)
B. Tech - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI &ML)
(Effective for the batches admitted from 2021-22)

Semester III (Second year)

Sl.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P	C			
1	BS	20ABS9914	Discrete Mathematical Structures	4	2	0	3	30	70	100
2	PC	20APC3301	Digital Electronics and Microprocessors	4	2	0	3	30	70	100
3	PC	20APC3302	Database Management Systems	4	2	0	3	30	70	100
4	PC	20APC3304	Object Oriented Programming through Java	4	2	0	3	30	70	100
5	PC	20APC3306	Computer Organization and Architecture	4	2	0	3	30	70	100
6	PC Lab	20APC3303	Database Management Systems Lab	0	0	3	1.5	30	70	100
7	PC Lab	20APC3305	Object Oriented Programming through Java Lab	0	0	3	2	30	70	100
8	PC Lab	20APC3307	Computer Organization and Microprocessor Lab	0	0	2	1	30	70	100
9	SOC	20ASC3301	Client Side Scripting	1	0	2	2	100	0	100
10	MC	20AMC9902	Constitution of India	2	0	0	0	30	0	30
			Total credits				**21.5**	**370**	**560**	**930**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI &ML)

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 Combinatory	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: Analyze (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).

Course Code	Year & Sem	Digital Electronics & Microprocessors	L	T/CLC	P	C
20APC3301	II-I		4	2	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the different logic circuits using concepts of Boolean algebra.

CO2: Analyze the different logic circuit by combining sequential and combinational circuits.

CO3: Evaluate the different sequential logic circuits for construct complex circuits like counters and registers.

CO4: Apply the 8086 microprocessors to design application for real world issues.

CO5: Apply the 8051 micro controllers to construct complex microprocessor working model for real world problems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the different logic circuits	using concepts of Boolean algebra		L2
CO2	Analyze	the different logic circuit	by combining sequential and combinational circuits		L4
CO3	Evaluate	the different sequential logic circuits		for construct complex circuits like counters and registers.	L5
CO4	Apply	the 8086 microprocessors		to design application for real world issues	L3
CO5	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				2	3	
CO2	3		2				2				2	2	
CO3	3		3				2				2	2	
CO4	3		3				2	2			2	2	
CO5	2		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 PO8	PO1: Apply(L3) PO2: Identify(L3) PO8: Thumb Rule	2 2 2
2	10	17%	2	CO2: Analyze	L4	PO1 PO3 PO8	PO1: Apply(L3) PO2: Identify(L3) PO8: Thumb Rule	3 3 2
3	12	20%	2	CO3: Evaluate	L3	PO1 PO2 PO8 PO9	PO1: Apply(L3) PO2: Identify(L3) PO8: Thumb Rule PO9: Thumb Rule	3 3 2 2
4	10	17%	2	CO4: Apply	L3	PO1 PO3 PO8 PO9	PO1: Apply(L3) PO3: Develop(L3) PO8: Thumb Rule PO9: Thumb Rule	3 3 2 2
5	14	23%	3	CO5: Analyze	L4	PO1 PO3 PO4 PO9	PO1: Apply(L3) PO3: Develop(L3) PO4: Apply(L3) PO9: 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)

PO8: 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)

PO8: 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)

PO8: Develop (L3)

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

PO9: 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)

PO8: 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)

PO9: 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)

PO8: 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
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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI &ML)

Course Code	Year & Sem	Database Management Systems	L	T/CLC	P	C
20APC3302	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

UNIT – I	Introduction, Introduction to Relational Model	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		
UNIT – II	**Introduction to SQL, Advanced SQL**	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.		
UNIT – III	**Database Design and the E-R Model, Relational Database Design**	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.		
UNIT – IV	**Query Processing, Query optimization**	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.		
UNIT – V	**Transaction Management, Concurrency control and Recovery System**	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, StevenMorris, 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

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

Unit No.	CO				BTL	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				
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 PO7 PO8 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO7: Thumb rule PO8: 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 PO7	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO7: Thumb rule	3 3 3 3 3 3
5	25	27%	3	CO5 :Analyze	L4	PO2 PO3 PO4 PO5 PO7 PO8 PO11	PO2: Analyze(L4) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO7: Thumb rule PO8: Thumb rule PO11: Thumb rule	3 3 3 3 2 2 2
	93	100 %						

Justification Statements :

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

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 SQL and PL/SQL concepts to formulate queries.
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 greater than PO2 verb. Therefore the correlation is high (3)
PO11: 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)
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 higher level as 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 PO4 verb by one level. Therefore the correlation is medium (2)
PO5: Apply(L3)
CO3 Action verb is same level as PO5 verb. Therefore the correlation is high (3)
PO8 : Thumb rule
Since ethical principles should be followed to create a database. Therefore the correlation is medium(2)
PO9 : Thumb rule
Team work is required between DBA and Database designer to create a database. Hence the correlation is medium (2)
PO11: 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)
PO1: Apply(L3)
CO4 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2: Analyze (L4)
CO4 Action verb is same level 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)
PO7: 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)
PO2: Analyze (L4)
CO5 Action verb is same level as 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)
PO5: Apply(L3)
CO5 Action verb is greater than PO5 verb. Therefore the correlation is high (3)
PO7 : Thumb rule
Since ethical principles should be followed for transaction management. Therefore the correlation is medium(2)
PO8 : Thumb rule
Team work is required for transaction management and recovery of failure transactions. Hence the correlation is medium (2)
PO11: Thumb rule
In real time transaction management is continuously updating. Therefore the correlation is medium (2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI &ML)

Course Code	Year & Sem		L	T/CLC	P	C
20APC3304	II-I	**Object Oriented Programming through Java**	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

UNIT – I	9Hrs
Object Oriented Thinking: 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.	
UNIT – II	9 Hrs
Inheritance: Inheritance Basics, Using Super, Multilevel Hierarchy, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Using final with Inheritance, Object Class. **Packages:** Packages, Access Protection, Importing Packages. **Interfaces:** Defining an Interface, Implementing Interface, Applying Interface, Variables in Interfaces, Interfaces can be extended.	
UNIT – III	8Hrs
Exception Handling: 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. **Input and Output Operations**: I/O basics, reading console input, writing console output, the PrintWriter class, reading and writing files, automatically closing a file. **Generic Programming** : Generic classes, generic methods, Bounded Types, Restrictions and Limitations.	
UNIT – IV	8 Hrs
Multithreading: 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. **Collection Framework:** Collection Overview, Collection Interfaces: The Collection Interface, the List Interface, the Queue Interface, Collection Classes: Array List Class, Linked List Class, String Tokenizer, Scanner.	
UNIT – V	10Hrs
Applets: Applet Basics, Life Cycle of an Applet, Simple Applet Display Methods, The HTML APPLET tag, Passing Parameters to Applets. **Swing:** Introduction to Swing Model-View, Controller design pattern button, layout management, Swing Components.	
Textbooks:	
Herbert Schildt, Java. The complete reference, TMH. 9thEdition, 2014 Cay. S. Horstmann and Gary Cornell Core Java 2, Vol 2, Advanced Features, Pearson Education, 7thEdition, 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

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	
CO2		3	3	2	3				3	3		1	
CO3	2	3	3	3	3							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	PO1: Apply(L3) PO2: Review (L2) PO4: Analyze(L4) PO5: Apply(L3)	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)

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 MACHINE LEARNING (AI &ML)

Course Code	Year & Sem	Computer Organization and Architecture	L	T/CLC	P	C
20APC3306	II-I		4	2	0	3

Course Outcomes:

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 input/output organizations and memory system.
CO4: Analyze the pipeline hazards and possible solutions to data hazards
CO5: Apply the parallel and scalable architectures for multiprocessors.

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 input/output organizations and memory system.	.		L2
CO4	Analyze	the pipeline hazards and possible solutions		to data hazards	L4
CO5	Apply	the parallel and scalable architectures		for multiprocessors	L3

UNIT – I	Basic Structure of Computer, Machine Instructions and Programs	
Basic Structure of Computer: Computer Types, Functional Units, Basic operational Concepts, Bus Structure, Software, Performance . **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.		
UNIT – II	**Arithmetic, Basic Processing Unit**	
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.		
UNIT – III	**The Memory System, Input/Output Organization**	
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. Input/Output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces.		
UNIT – IV	**Pipelining, Large Computer Systems**	
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.		
UNIT – V	**Computer Architecture**	
Parallel and Scalable Architectures, Multiprocessors and Multi computers, cache coherence and synchronization mechanism, Three Generations of Multi computers, Message-passing Mechanisms, Multivetor and SIMD computers, Vector Processing Principals, Multivector Multiprocessors, Compound Vector processing, SIMD computer Organizations.		
Textbooks:		
1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, —Computer Organization!, 5th Edition, McGraw Hill Education, 2013. 2. M.Morris Mano, —Computer System Architecturel, 3rd Edition, Pearson Education, 2017. 3. Advanced Computer Architecture Second Edition, Kai Hwang, Tata McGraw Hill Publishers.		
References:		

1. Themes and Variations, Alan Clements, —Computer Organization and Architecturel, CENGAGE Learning. 2. SmrutiRanjanSarangi, —Computer Organization and Architecturel, McGraw Hill Education. 3. John P.Hayes, —Computer Architecture and Organization , McGraw Hill Education
Online Learning Resources: https://nptel.ac.in/courses/106/103/106103068/

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			3					3		
CO3	2	1					2	2					
CO4	3	3	3	1	1		3	3					
CO5	2	3									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	09	20%	2	CO1 :Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO11: Thumb rule	2 1 2
2	09	20%	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	09	20%	2	CO3 : Understand	L2	PO1 PO2 PO7 PO8	PO1: Apply(L3) PO2: Analyze (L4) PO7: Thumb rule PO8: Thumb rule	2 1 2 2
4	09	20%	2	CO4 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO7 PO8	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO4: Design (L6) PO5: Create(L6) PO7: Thumb rule PO8: Thumb rule	3 3 3 1 1 3 3
5	09	20%	2	CO5 : Apply	L3	PO1 PO2 PO6 PO11	PO1: Analyze(L4) PO2: Develop (L3) PO11: Thumb rule	2 3 2
	45	100 %						

Justification Statements:

CO1: Understand 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 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 deficiencies and demonstrate the need of updating the computer components to meet desired requirements moderate (2)

CO2: Evaluate Arithmetic operations for understanding execution 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 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 arithmetic operations are evaluated for understanding execution process of computer systems. Therefore, the correlation is high (3)

PO11: Thumb rule

Identify the deficiencies and demonstrate the need of updating the computer instruction set to meet desired requirements. Therefore the correlation is high (3)

CO3: Understand the hardware requirements of input/output organizations and memory system.

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: Analyze (L4)

CO3 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

PO7 : Thumb rule

Since ethical principles should be followed to while creating the primary and secondary memories. Therefore the correlation is moderate (2)

PO8 : Thumb rule

Team work is required to understand and demonstrate the secondary memories in computer system. Hence the correlation is moderate (2)

CO4: Analyze pipeline hazards and possible solutions to those hazards.

Action Verb : Analyze(L4)

PO1: Apply(L3)

CO4 Action verb is more than PO1verb. Therefore the correlation is high (3)

PO2: Analyze (L4)

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

PO3: Devleop (L3)

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

PO4: Design (L6)

CO4 Action verb is less than PO4 verb by two levels. Therefore the correlation is moderate (2)

PO5: Create(L6)

CO4 Action verb is less than PO5 verb by two levels. Therefore the correlation is low (1)

PO7 : Thumb rule

Team work is required to provide the solutions caused due to pipeline hazards. Hence the correlation is high (3)

CO5: Apply parallel and Scalable architecture for multiprocessors

Action Verb : Apply (L3)

PO1: Analyze(L4)

CO5 Action verb is less than PO1verb by one level. Therefore the correlation is moderate (2)

PO2: Develop (L3)

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

PO11 : Thumb rule Identify the deficiencies and demonstrate the need of updating the parallel instruction set to meet desired requirements. Therefore the correlation is moderate (2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI &ML)

Course Code	Year & Sem	Database Management System Lab	L	T/CLC	P	C
20APC3303	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 is19. **(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 dept no 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)

a. Insert records into the table.
b. Add salary column to the table.
c. Alter the table column domain.
d. Drop salary column of the customer table.
e. Delete the rows of customer table whose ust_city is 'hyd'. **(CO1)**

4. Create a table called branch table. **(CO1)**

Name	Type
Branch_name	Varchar2(20)
Branch_city	Varchar2(20)
asserts	Number

5. Increase the size of data type for asserts to the branch.
   a. Add and drop a column to the branch table.
   b. Insert values to the table.
   c. Update the branch name column
   d. Delete any two columns from the table **(CO1)**

6. Create a table called sailor table

Name	Type
Sid	Number
Sname	Varchar2(20)
rating	Varchar2(20)

a. Add column age to the sailor table.
b. Insert values into the sailor table.
c. Delete the row with rating>8.
d. Update the column details of sailor.
e. Insert null values into the table. **(CO1)**

7. Create a table called reserves table

Name	Type
Boat_id	Integer
sid	Integer
day	Integer

a. Insert values into the reserves table.
b. Add column time to the reserves table.
c. Alter the column day data type to date.
d. Drop the column time in the table.
e. Delete the row of the table with some condition. **(CO1)**

Week-2: QUERIES USING DDL AND DML

1. a. Create a user and grant all permissions to the user.
   b. Insert the any three records in the employee table and use rollback. Check the result.
   c. Add primary key constraint and not null constraint to the employee table.
   d. Insert null values to the employee table and verify the result. **(CO1)**
2. a. Create a user and grant all permissions to the user.
   b. Insert the any three records in the employee table and use rollback. Check the result.
   c. Add primary key constraint and not null constraint to the employee table.
   d. Insert null values to the employee table and verify the result. **(CO1)**
3. a. Create a user and grant all permissions to the user.
   b. Insert values in the department table and use commit.
   c. Add constraints like unique and not null to the department table.
   d. Insert repeated values and null values into the table. **(CO1)**
4. a. Create a user and grant all permissions to the user.
   b. 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. **(CO1)**
   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. **(CO1)**

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 **(CO1)**

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 dept name to dept table and insert deptname for each 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. **(CO1)**

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 **(CO1)**

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. **(CO1)**

4. a. Count the number of employees in department20 **(CO1)**

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. **(CO1)**

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 two such 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. **(CO1)**

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**(CO1)**

Week-4: PROGRAMS ON PL/SQL

1. a. Write a PL/SQL program to swap two numbers. **(CO2)**
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. **(CO2)**

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. **(CO2)**

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 thanor 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 o pint 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 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 thenapply 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 fist 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 bythe 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 a 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 on 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 particularsubject 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**(CO5)**

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 personaldetails 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**(CO5)**

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 andinsurance details. It is the company policy not to keep any car for a period exceeding one year. Allmajor 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 detailssuch 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**(CO5)**

Week-12: **CASE STUDY: STUDENT PROGRESS MONITORING SYSTEM**

A database is to be designed for a college to monitor students' progress throughout their course ofstudy. 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 theycome 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. Studentsare 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 aboutstudents 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: **(CO5)**

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 aught.
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.

References:

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.

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	
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)

CO2: Evaluate the simple mathematical operations using PL/SQL.

Action Verb: Evaluate (L5)

PO1 Verb: Apply (L3)

CO2 Action verb is is less than PO2 verb by two levels. Therefore, the correlation is low (1)

PO2 Verb : Formulate(L6)

CO2 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)

PO5 Verb: Create(L6)

CO2 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

CO3: Apply the Triggers to automate the actions on database

Action Verb: Apply(L3)

PO1 Verb: Apply (L3)

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

PO2 Verb: Review(L2)

CO3 Action verb is is less than PO2 verb by one level. Therefore, the correlation is Medium(2)

PO4 Verb: Design (L6)

CO3 Action verb is greater than as PO4 verb. Therefore, the correlation is high (3)

PO5 Verb: Create (L6)

CO3 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

CO4: Apply the cursors to access system memory in PL/SQL Programs.

Action Verb: Apply (L3)

PO1 Verb: Apply (L3)

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

PO2 Verb: Review(L2)

CO4 Action verb is is less than PO2 verb by one level. Therefore, the correlation is Medium(2)

PO4 Verb: Design (L6)

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

PO5 Verb: Create (L6)

CO4 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

CO5: Apply the Entity-Relationship for real time applications

Action Verb: Apply (L3)

PO3 Verb: Design (L6)

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

PO5 Verb: Create (L6)

CO5 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

PO6 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)

PO11: Verb: Thumb rule

Modeling is a continuous learning activity for the user, the correlation is medium (2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI &ML)

Course Code	Year & Sem	OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB	L	T/CLC	P	C
20APC3305	II-II		0	0	4	2

Course Outcomes:

CO1: Understand the java compiler and learn how to use eclipse or net beans IDE.
CO2: Apply the class concepts for developing simple java applications.
CO3: Apply the oops concepts for implementing java programs.
CO4: Analyze the concepts of multithreading and collection frameworks for writing simple programs.
CO5: Create the applets and GUI based applications using swings.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the java compiler and learn how to use eclipse or net beans IDE.			L2
CO2	Apply	the class concepts		for developing simple java applications.	L3
CO3	Apply	the oops concepts		for implementation java programs.	L3
CO4	Analyze	the concepts of multithreading and collection frameworks		for writing simple programs.	L4
CO5	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.**(CO1)**

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). Commute 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. **(CO2)**

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**(CO2)**

Week-4:(Unit-2)

Write a Java Program to implement multilevel inheritance. **(CO3)**
Write a Java program to implement the method overriding. **(CO3)**
Write a Java program to implement dynamic method dispatch. **(CO3)**
Week-5:(Unit-2)

Write a Java program to implement abstract class. **(CO3)**
Write a Java Program to implement Packages. **(CO3)**
Write a Java Program to implement Access Protection in Packages. **(CO3)**
Week-6:(Unit-2)

Write a Java program to demonstrate interfaces. **(CO3)**
Write a Java program to implement the multiple inheritance using interfaces. **(CO3)**
Week-7:(Unit-3)

Write a Java program to implement the exception handling mechanism. **(CO3)**
Write a Java program to implement the nested try statement. **(CO3)**
Write a Java program to implement your own exception class. **(CO3)**
Week-8:(Unit-3)

Write a Java Program to demonstrate the following String Handlings. **(CO3)**
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. **(CO4)**
Write a Java program to implement producer consumer problem using inter-thread communication mechanism. **(CO4)**
Week-10:(Unit-4)

Practice any two Programs on Collections. **(CO4)**
Practice any two Programs on String Tokenizer & Scanner. **(CO4)**
Week-11:(Unit-5)

Write a Java Program to develop an applet that displays a simple message. **(CO5)**
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 —Computel is clicked. **(CO5)**
Write a java program to handle keyboard events. **(CO5)**
Write a java program to handle Mouse events**(CO5)**
Week-12:(Unit-5)

Write a Java Program to demonstrate AWT Label & Button. **(CO5)**
Write a Java Program to demonstrate JLabel, JTextField & JButton. **(CO5)**
Write a program to design a calculator using event driven programming paradigm of java**(CO5)**

Reference Books:

1. Herbert Schildt.Java. The complete reference, TMH. 9thEdition.
2. H.M.Dietel and P.J.Dietel, Java How to Program 6thEdition,PearsonEducation/PHI
3. Y.Daniel Liang, Introduction to Java programming, Pearson Education, 6thEdition.
4. Cay Horstmann, Big Java, 2ndedition, Wiley Student Edition, Wiley India Private Limited.

Online Learning Resources/Virtual Labs:

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		3			2							3	
CO2		3	3	2	3							2	
CO3			3	2	3							2	
CO4		3	3	3	3							2	
CO5			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	PO2 PO5	PO2: Review(L2) PO5: Apply(L3)	3 2
2	CO2 :Apply	L3	PO2 PO3 PO4 PO5	PO2: Review(L2) PO3: Develop (L3) PO4: Analyze(L4) PO5: Apply(L3)	3 3 2 3
3	CO3: Apply	L3	PO3 PO4 PO5	PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3)	3 2 3
4	CO4: Analyze	L4	PO2 PO3 PO4 PO5	PO2: Analyze (L4) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3)	3 3 3 3
5	CO5 :Create	L6	PO3 PO5	PO3: Design (L6) PO5: Create(L6)	3 3

Justification Statements :

CO1: Understand the java compiler and learn how to use eclipse or net beans IDE.

Action Verb : Understand(L2)

PO2: Review(L2)

CO1 Action verb is same 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 class concepts for developing simple java applications.

Action Verb : Apply (L3)

PO2: Review(L2)

CO2 Action verb is greater than PO2 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 levels. 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: Apply the oops concepts for implementing java programs.

Action Verb : Apply(L3)

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 PO4 verb by one level. Therefore the correlation is medium(2)

PO5: Apply (L3)

CO3 Action verb is same as PO5 verb. Therefore the correlation is high(3)

CO4: Analyze the concepts of multithreading and collection frameworks for writing simple programs.

Action Verb :Analyze (L4)

PO2: Analyze (L4)

CO4 Action verb is same 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)

CO5: Create the applets and GUI based applications using swings.

Action Verb : Create (L6)

PO3: Design (L6)

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

PO5: Create(L6)

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

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI &ML)

Course Code	Year & Sem		L	T/CLC	P	C
20APC3307	II-I	**Computer Organization and Micro process Lab**	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. **(CO5)**
- Implement a C program to perform division of two binary numbers (Unsigned) using non-restoring

division algorithm. **(CO5)**

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
CO1	3	3	3	3								1	1
CO2	3	3	3	3	3							1	1
CO3	3	3	3	3	3						3	2	
CO4	3	3	3	3	3						3	2	2
CO5	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: Analyze	L4	PO1	PO1: Apply(L3)	3
			PO2	PO2: Review(L2)	3
			PO3	PO3: Develop(L3)	3
			PO4	PO4: Interpret (L2)	3
2	CO2: Design	L6	PO1	PO1: Apply(L3)	3
			PO2	PO2: Formulate (L6)	3
			PO3	PO3: Design(L6)	3
			PO4	PO4: Analyze (L4)	3
			PO5	PO5: Create (L6)	3
			PO11	PO11: Thumb rule	3
3	CO3: Apply	L3	PO1	PO1: Apply(L3)	3
			PO2	PO2: Review (L2)	3
			PO3	PO3: Develop(L3)	3
			PO4	PO4: Interpret (L2)	3
			PO5	PO5: Apply (L3)	3
4	CO4: Apply	L3	PO1	PO1: Apply(L3)	3
			PO2	PO2: Review (L2)	3
			PO3	PO3: Develop(L3)	3
			PO4	PO4: Interpret (L3)	3
			PO5	PO5: Apply (L3)	3
			PO11	PO11: Thumb rule	3
5	CO5: Apply	L3	PO1	PO1: Apply(L3)	3
			PO2	PO2: Review (L2)	3
			PO3	PO3: Develop(L3)	3
			PO4	PO4: Interpret (L2)	3
			PO5	PO5: Apply (L3)	3

Justification Statements :

CO 1: Analyze the numbers systems to perform arithmetic operations.

Action Verb: Analyze(L4)
PO1 Verb: Apply (L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is high (3)
PO2 Verb: Review(L2)
CO1 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: Develop (L3)

CO1 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO4: Interpret (L2)
CO1 Action verb is same as PO4 verb. Therefore, the correlation is high (3)

CO 2: Design the half adder and full adder using combinational circuit.
Action Verb: CO2: Apply (L3)
PO1: Apply (L3)
CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Review(L2)
CO2 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO2 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
PO4: Interpret (L2)
CO2 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO2 Action verb is greater than as PO5 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)
PO1: Apply (L3)
CO3 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Formulate(L6)
CO3 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
PO3: Design (L6)
CO3 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is greater than as PO4 verb. Therefore, the correlation is high (3)
PO5: create (L6)
CO3 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO11: 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)
PO1: Apply (L3)
CO4 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Review(L2)
CO4 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
PO4: Interpret (L3)
CO4 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO4 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)
PO11: 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)
PO1: Apply (L3)
CO5 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2: Review(L2)
CO5 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO5 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO4: Interpret (L2)
CO5 Action verb is less than PO4 verb by one level. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO5 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI &ML)

Course Code	Year & Sem	Client-Side Scripting	L	T/CLC	P	C
20ASC3301	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

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.

- WAP to print hello world
- WAP to use comments in JavaScript.
- WAP to add a noscript block.
- Write a Script in <head>...</head> section.
- Write a Script in <body>...</body> section.
- Write a Script in <body>...</body> and <head>...</head> sections.
- Write a Script using arithmetic, Comparison, Logical, Bitwise, and Assignment operators
- Write code to understand how the Conditional Operator and typeof operator works in JavaScript.
- Write code to understand the working of if statement, if...else statement, and if...else if... statement.
- Implement switch-case statement.
- Implement while loop, do-while and for loop in JavaScript.
- WAP to print the web browser's Navigator object using for loop.
- WAP To implement break, continue and label in JavaScript.
- Write code to call the function that displays the text message on clicking a button.

UNIT – II	Array, Function and String	3+6 Hrs

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 – charCodeAt(), fromCharCode().

- Write code to call the function that displays the text message on clicking a button.
- WAP to call a function that takes two parameters, name and age. Print the same.
- Define a function that takes two parameters and concatenates them before returning the resultant in the calling program.

UNIT – III	Form and Event Handling	3+6 Hrs

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.

- Write code to implement the following events – onclick, onsubmit, onmouseover and onmouseout.
- Design a Registration form (include email id and password) and perform validation to all its fields.

UNIT – IV	Objects	3+6 Hrs

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.

UNIT – V	Cookies and Browser Data	3+6 Hrs

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.

- Set a customer name in an input cookie.
- WAP to get all the cookies.
- Extend the expiry date of a cookie by 1 Month.
- Delete a cookie by setting its expiry date to one month behind the current date.
- Do a page redirect using JavaScript at client side.
- 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.
- Redirect your site visitors onto a different page based on their browsers.
- Use an alert box to give a warning message.
- Implement a confirmation dialog box to take user's consent on any option.
- Use a prompt dialog box.
- Use of void is to purposely generate the undefined value.
- Demonstrates how to create an Object.
- Create an object with a User-Defined Function.
- Write code to add a function along with an object.
- Demonstrate with keyword in JavaScript.

Textbooks:

1. Javascript Beginners Guide, John Pollock, TMH, 4th Edition
2. JavaScript. Demystified, JIM KEOGH , McGraw-Hill.

Reference Books:

1. JavaScript™ For Dummies,® 4th Edition, by Emily Vander Veer, Published by Wiley Publishing, Inc © 2005.
2. JavaScript for impatient programmers (beta), by Dr. Axel Rauschmayer © 2019.
3. Javascript: Beginners Guide on Javascript Programming, by Nick Goddard © 2016.

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							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 PO9	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO9: 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 PO10	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Create(L6) PO10: 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)

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 PO1 verb. Therefore, the correlation is high (3)

PO4: Analyze (L4)

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

PO5: Apply(L3)

CO3 Action verb is same as PO5 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)

PO1: Apply(L3)

CO3 Action verb is greater than 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)

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 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)

PO9: 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)

PO1: Apply(L3)

CO4 Action verb is same as PO1 verb. 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(L2)

CO4 Action verb is same as PO3 verb. 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 PO1 verb. Therefore, the correlation is high (3)

PO11: 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)

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

PO5: Create(L6)

CO5 Action verb is less than PO5 verb by one level. Therefore the correlation is high (2)

PO11: 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 MACHINE LEARNING (AI &ML)

Course Code	Year & Sem	CONSTITUTION OF INDIA	L	T/CLC	P	C
20AMC9902	II-I		2	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

UNIT – I		
History of Making of the Indian Constitution - History Drafting Committee, (Composition & Working)		
UNIT – II		
Philosophy of the Indian Constitution - Preamble Salient Features		
UNIT – III		
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.		
UNIT – IV		
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.		
UNIT – V		
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.		

Textbooks:

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 ANDSCIENCES, TIRUPATI
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B. Tech - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI & ML)

(Effective for the batches admitted from 2021-22)

Semester IV (Second year)

Sl.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P	C			
1	PC	20APC3308	Software Engineering for AI	4	2	0	3	30	70	100
2	PC	20APC3309	Artificial Intelligence	4	2	0	3	30	70	100
3	PC	20APC3311	Data Warehousing and Mining	4	2	0	3	30	70	100
4	PC	20APC3313	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 Lab	20APC3310	Artificial Intelligence Lab	0	0	3	1.5	30	70	100
8	PC Lab	20APC3312	Data Warehousing and Mining Lab	0	0	3	1.5	30	70	100
9	PC Lab	20APC3314	Operating Systems Lab	0	0	3	1.5	30	70	100
10	SOC	20ASC3302	Server Side Scripting	1	0	2	2	100	0	100
			Total credits				**24.5**	**370**	**630**	**1000**

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
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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI &ML)

Course Code	Year & Sem	Software Engineering for AI	L	T/CLC	P	C
20APC3308	II-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	**Understand**	the Artificial Intelligence problems and software methods			L2
CO 2	**Analyse**	the software system to introduce new paradigms	for System Engineering		L4
CO 3	**Analyse**	the utilization of exploratory programming in machine learning	by assessing the performance of machine learning models.		L4
CO 4	**Apply**	the knowledge for software development	through expert systems		L3
CO 5	**Evaluate**	the integration of AI into practical software	to reduce complexity		L5

UNIT - I	**Introduction to Computer Software for AI, AI Problems and Conventional SE Problems, Software Engineering Methodology**	

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.

UNIT - II	**An Incremental and Exploratory Methodology, New Paradigms for System Engineering**	

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

UNIT- III	**Towards a Discipline of Exploratory Programming, Machine Learning: Much Promise, Many Problems**	

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
CO1	2	1											
CO2		3	1		1								
CO3		3	1		1	3							
CO4	3				3	1				2			
CO5		3		3									

Correlation matrix

Unit no	CO				BTL	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				
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 PO10	PO1: Apply(L3) PO5:Apply (L3) PO6:Thumb rule PO10: Thumb rule	3 3 1 2
5	15	21	3	CO5 :Evaluate	L5	PO2 PO4	PO2: Evaluate (L5) PO4: Evaluate (L5)	3 3
	73	100 %						

Justification Statements:

CO 1: Understand the Artificial Intelligence problems and software methods.
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: Analyse (L4)
CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

CO 2: Analyse the software system to introduce new paradigms for System Engineering.
Action Verb:Analyse (L4)
PO2: Analyse (L4)
CO2 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO3: Create (L6)
CO2 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)
PO5: Create(L6)
CO2 Action verb is less than PO5 verb by two levels. Therefore the correlation is low (1)

CO 3: Analyse the utilization of exploratory programming in Machine Learning by assessing the performance of ML models.
Action Verb : Analyse (L4)
PO2: Analyze(L4)
CO3 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO3: Create (L6)
CO3 Action verb is less than PO3 verb by two levels. Therefore the correlation is low (1)
PO5: Create (L6)
CO3 Action verb is less than PO5 verb by two levels. Therefore the correlation is low (1)
PO6: 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).

CO 4: Apply the knowledge for software development through expert systems.
Action Verb : Apply (L3)
PO1: Apply(L3)
CO4 Action verb is same level as PO1 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
Apply reasoning informed by the contextual knowledge to asses expert systems. Therefore the correlation is moderate (2)
PO10: 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)
PO2: Evaluate (L5)
CO5 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO4: Evaluate (L5)
CO5 Action verb is same level as PO4 verb. Therefore the correlation is high (3)

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI &ML)

Course Code	Year & Sem		L	T/CLC	P	C
20APC3309	II-II	**Artificial Intelligence**	4	2	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the basic concepts of artificial intelligence and intelligent agents

CO2: **Apply** the searching techniques for solving searching problems.

CO3: **Analyze** the concepts of Reinforcement Learning and NLP Models.

CO4: **Evaluate** Natural Language Interfaces and perception mechanisms for Machines understanding.

CO5: **Analyze** the robotic designing modules and philosophy constraints for artificial intelligence.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	The basics concepts of artificial intelligence and intelligent agents			L2
CO2	**Apply**	the searching techniques		For Solving searching problems	L3
CO3	**Analyze**	The concepts of Reinforcement Learning and NLP Models			L4
CO4	**Evaluate**	Natural Language Interfaces and perception mechanisms		For Machines understanding	L5
CO5	**Analyze**	the robotic designing modules and philosophy constraints		for artificial intelligence.	L4

UNIT – I	9 Hrs
Introduction: What is AI, Foundations of AI, History of AI, The State of Art. **Intelligent Agents**: Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The Structure of Agents.	
UNIT – II	9Hrs
Solving Problems by searching: 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.	
UNIT – III	9 Hrs
Reinforcement Learning: Introduction, Passive Reinforcement Learning, Active Reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, applications of RL **Natural Language Processing**: Language Models, Text Classification, Information Retrieval, Information Extraction.	
UNIT – IV	9 Hrs
Natural Language for Communication: Phrase structure grammars, Syntactic Analysis, Augmented Grammars and semantic Interpretation, Machine Translation, Speech Recognition **Perception**: Image Formation, Early Image Processing Operations, Object Recognition by appearance, Reconstructing the 3D World, Object Recognition from Structural information, Using Vision.	
UNIT – V	9 Hrs
Robotics: Introduction, Robot Hardware, Robotic Perception, Planning to move, planning uncertain movements, Moving, Robotic software architectures, application domains **Philosophical foundations**: 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.	
Textbooks:	
Stuart J. Russell, Peter Norvig, "Artificial Intelligence A Modern Approach", 3rd Edition, Pearson Education, 2019.	
Reference Books:	
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.
Online Learning Resources:
http://peterindia.net/AILinks.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											
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				BTL	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				
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 PO7	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 PO7	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 PO7 PO8 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)
PO7 : 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 : Evaluvate(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)
PO7 : 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)
PO1:Apply(L3)
CO5 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO2:Analyze(L4)
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)
PO6:Thumb RuleApply contextual knowledge is used for society to address the security issues so correlation is medium (2)
PO7: Thumb Rule
Since ethical principles should be followed to create a robot. Therefore the correlation is medium (2)
PO8 : Thumb rule
Team work is required to create robots. Hence the correlation is medium (2)
PO11: 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 MACHINE LEARNING (AI &ML)

Course Code	Year & Sem	Data Warehousing and Mining	L	T/CLC	P	C
20APC3311	II-II		4	2	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the fundamental concepts of data mining and data warehousing.

CO2: **Analyze** the data warehouse architecture and OLAP Technology.

CO3: **Evaluate** the performance of association rule mining and classification algorithm.

CO4: **Analyze** the various clustering methods to form clusters.

CO5: **Apply** the data mining techniques to extract data.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the fundamental concepts of data mining and data warehousing			L2
CO2	Analyze	the data warehouse architecture and OLAP Technology			L4
CO3	Evaluate	The performance of association rule mining and classification algorithm			L5
CO4	Analyze	The various clustering methods		to form clusters	L4
CO5	Apply	The data mining techniques		to extract data	L3

UNIT – I	9 Hrs
Introduction: 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. **Data Preprocessing**: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.	
UNIT – II	9 Hrs
Data Warehouse and OLAP Technology for Data Mining: Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Further Development of Data Cube Technology, From Data Warehousing to Data Mining. **Data Cube Computation and Data Generalization**: Efficient Methods for Data Cube Computation, Further Development of Data Cube and OLAP Technology, Attribute-Oriented Induction.	
UNIT - III	9 Hrs
Mining Frequent Patterns, Associations and Correlations: 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, **Classification and Prediction**: 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	
UNIT – IV	9 Hrs
Cluster Analysis: 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	
UNIT – V	9 Hrs
Mining Streams, Time Series and Sequence Data: 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, **Mining Object, Spatial, Multimedia, Text and Web Data**: 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 KPujari, Second Edition, Universities Press.
2. Data Warehousing in the Real World, Sam Aanhory & Dennis Murray Pearson EdnAsia.
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=PLLspfyoOYoQcI6Nno3gPkq0h5YSe81hsc

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				BTL	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				
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 PO7	PO1: Apply(L3) PO2: Identify(L3) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO7: 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)
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: Analyze the data warehouse architecture and OLAP Technology.
Action Verb : Analyze (L4)
PO1: Apply(L3)

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

PO2: Review (L2)

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

PO4: Analyze (L4)

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

PO5: Apply(L3)

CO2 Action verb is greater than PO5 verb .Therefore the correlation is high (3)

CO3: Evaluate the performance of association rule mining and classification algorithm.

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)

PO4: Analyze (L4)

CO3 Action verb is greater than 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)

PO11: Thumb rule

In association mining we need to create association rule. Therefore the correlation is high (3)

CO4: Analyze the various clustering methods to form clusters.

Action Verb : Analyze(L4)

PO1: Apply(L3)

CO4 Action verb is greater than PO1 verb .Therefore the correlation is high (3)

PO2: Identify(L3)

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 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)

PO7: Thumb rule

Since ethical principles shall be followed in data manipulation. Therefore the correlation is medium(2)

CO5: Apply the data mining techniques to extract data.

Action Verb : Apply (L3)

PO1: Apply(L3)

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

PO2: Identify(L3)

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

PO3: Develop (L3)

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

PO4: Analyze (L4)

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

PO5: Apply(L3)

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

PO11: 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 MACHINE LEARNING (AI &ML)

Course Code	Year & Sem	Operating Systems	L	T/CLC	P	C
20APC3313	II-II		4	2	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the basic concepts of Operating Systems and its services.
CO2: **Apply** the concepts of process synchronization and CPU scheduling by drawing Gantt chart
CO3: **Analyze** the methods to handle deadlock and memory management
CO4: **Evaluate** the various disk scheduling algorithms and file system interfaces
CO5: **Understand** the issues and goals of protection various security

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the basic concepts of Operating Systems and its services			L2
CO2	Apply	the concepts of process synchronization & CPU scheduling	by drawing Gantt chart		L3
CO3	Analyze	the methods to handle deadlock and memory management			L4
CO4	Evaluate	the various disk scheduling algorithms and file system interfaces			L5
CO5	Understand	the various security issues and goals of protection			L2

UNIT - I	9 Hrs
Operating Systems Overview: Operating system functions, Operating system structure, operating systems Operations, protection and security, Computing Environments, Open- Source Operating Systems **System Structures**: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, operating system structure, operating system debugging, System Boot. **Processes:** Process concept, process Scheduling, Operations on processes, Inter process Communication, Examples of IPC systems.	
UNIT - II	10Hrs
Threads: overview, Multi-core Programming, Multithreading Models, Thread Libraries, Implicit Threading, Threading Issues. **Process Synchronization:** The critical-section problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic problems of synchronization, Monitors, Synchronization examples, Alternative approaches. **CPU Scheduling:** Scheduling-Criteria, Scheduling Algorithms, Thread Scheduling, Multiple-Processor Scheduling, Real-Time CPU Scheduling, Algorithm Evaluation.	
UNIT - III	8Hrs
Memory Management: Swapping, contiguous memory allocation, segmentation, paging, structure of the page table. **Virtual memory:** demand paging, page-replacement, Allocation of frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory **Deadlocks:** System Model, deadlock characterization, Methods of handling Deadlocks, Deadlock prevention, Detection and Avoidance, Recovery from deadlock.	
UNIT - IV	9Hrs
Mass-storage structure: Overview of Mass-storage structure, Disk structure, Disk attachment, Disk scheduling, Swap-space management, RAID structure, Stable-storage implementation. **File system Interface:** The concept of a file, Access Methods, Directory and Disk structure, File system mounting, File sharing, Protection. **File system Implementation:** File-system structure, File-system Implementation, Directory Implementation, Allocation Methods, Free-Space management.	
UNIT - V	8Hrs
I/O systems: I/O Hardware, Application I/O interface, Kernel I/O subsystem, Transforming I/O requests to Hardware operations. **Protection:** 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					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 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 PO7 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO6: Thumb rule PO7: Thumb rule PO11: Thumb rule	3 3 3 3 3 2 3 2
5	17	19%	2	CO5 : Understand	L2	PO1 PO2 PO7 PO11	PO1: Apply(L3) PO2: Review(L2) PO7: 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)

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

PO11: Thumb rule

In today's world operating system services are updating, those services needs to understand. Therefore the correlation is medium (2)

CO2: Apply the concepts of process synchronization & CPU scheduling by drawing gantt chart

Action Verb : Apply (L3)

PO1: Apply(L3)

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

PO2 Verb : Review(L2)

CO1 Action verb is greater than PO2 verb by one level. Therefore the correlation is high (3)

PO6: 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)

PO11: Thumb rule

Scheduling is the one of the daily activity done in many sectors. Therefore the correlation is High(3)

CO3: Analyze the methods to handle deadlock and memory management

Action Verb : Analyze (L4)

PO1: Apply(L3)

CO3 Action verb is greater 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)

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: Evaluate the various disk scheduling algorithms and file system interfaces.

Action Verb : Evaluate (L5)

PO1: Apply(L3)

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

PO2: Review (L2)

CO4 Action verb is greater level 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 greater than PO4 verb by one level. Therefore the correlation is high(3)

PO5: Apply(L3)

CO4 Action verb is greater than PO5 verb. Therefore the correlation is high(3)

PO6: Thumb rule

Disk scheduling and file system interfaces are applied to provide solutions for E-Commerce database access . Therefore the correlation is medium (2)

PO8: Thumb rule

Since ethical principles shall be followed in file manipulations and data storage. Therefore the correlation is high(3)

PO11: Thumb rule

File manipulation of data and storage of data is playing major role in current scenario. Therefore, the correlation is medium (2)

CO5: Understand the various security issues and goals of protection

Action Verb : Understand (L2)

PO1: Apply(L3)

CO5 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)

PO2: Review (L2)

CO5 Action verb is same asPO2 verb. Therefore, the correlation is high(3)

PO7 : Thumb rule

Ethical principles should be followed for various security issues. Therefore the correlation is high(3)

PO11: 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 MACHINE LEARNING (AI &ML)

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	**Managerial economics**

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	**Production and Cost Analysis**

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	**Business Organizations and Markets**

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	**Capital Budgeting**

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	**Financial Accounting and Analysis**

Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions-Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profitand Loss Account and Balance Sheet with simple adjustments). ***Financial Analysis*** - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

Textbooks:

1. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2013.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019

Reference Books:

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	CO: Action verb and BTL	Program Outcome(PO)	PO: Action verb and BTL	Level of correlation (0-3)
CO1	16%	understand	PO1	Apply	2
CO2	22%	understand	PO2	Analyse	1
CO3	22%	Analyse	PO1	Apply	3
CO4	16%	Evaluate	PO2	Analyse	3
CO5	22%	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: Analyse
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
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI &ML)

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 kantak, 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. FSchumacher. "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	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PSO 1	PSO 2
Universal Human Values	CO1							2				12		
	CO2							3						
	CO3						2	2						
	CO4						3	3				3		
	CO5						2	2				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	7	19.4	2	Understand	2	PO7,PO11	Thumb Rule	2,2
2	8	22.2	3	Analyze	4	PO7	Thumb Rule	3,3
3	7	19.4	2	Apply	3	PO6,PO7	Thumb Rule	2,2,2
4	8	22.2	3	Evaluate	5	PO6,,PO7,PO11	Thumb Rule	3,3,3,3
5	7	19.4	2	Apply	3	PO6,PO7,PO11	Thumb Rule	2,2,2,2

Justification Statements:

CO1: Understand the essentials of human values, self-exploration, happiness and prosperity for value added education.

Action Verb: Understand (L2)

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

CO2: Analyze the harmony in the human being as sentient 'I' and the material 'Body' in various aspects.

Action Verb: Analyze (L4)

CO2 Action Verb is Analyze of BTL 4. Using Thumb rule, L4 correlates PO6 to PO11 as high (3).

CO3: Apply the nine universal human values in relationships for harmony in the family and orderliness in the society.

Action Verb: Apply (L3)

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

CO4: Evaluate the interconnectedness of four orders of nature and holistic perception of harmony at all levels of existence.

Action Verb: Evaluate (L5)

CO4 Action Verb is Evaluate of BTL5. Using Thumb rule, L5 correlates PO6 to PO11 as high (3).

CO5: Apply the holistic understanding of harmony on professional ethics through augmenting universal human order.

Action Verb: Apply (L3)

CO5 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
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI &ML)

Course Code	Year & Sem	ARTIFICIAL INTELLIGENCE LAB	L	T/CLC	P	C
20APC3310	II-II		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
CO1	3	3									3		3
CO2	3	3		3	3						3		3
CO3	3		3	3	3						3	2	3
CO4	3	3	3	3							3		3
CO5	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	CO1: Apply	L3	PO1	PO1: Apply(L3)	3
			PO2	PO2: Review(L2)	3
2	CO2: Analyze	L4	PO1	PO1: Apply(L3)	3
			PO2	PO2: Identify (L3)	3
			PO4	PO4: Analyze (L4)	3
			PO5	PO5: Apply (L3)	3
3	CO3: Apply	L3	PO1	PO1: Apply(L3)	3
			PO3	PO3: Develop(L3)	3
			PO4	PO4: Analyze (L4)	2
			PO5	PO5: Apply (L3)	3
			PO11	PO11: Thumb rule	3
4	CO4: Analyze	L4	PO1	PO1: Apply(L3)	3
			PO2	PO2: Identify (L3)	3
			PO3	PO3: Develop(L3)	3
			PO4	PO4: Analyze (L4)	3
			PO11	PO11: Thumb rule	3
5	CO5: Apply	L3	PO1	PO1: Apply(L3)	3
			PO2	PO2: Identify (L3)	3
			PO3	PO3: Develop(L3)	3
			PO4	PO4: Analyze (L4)	2
			PO5	PO5: Apply (L3)	3

Justification Statements:

CO 1: Apply the Searching Algorithm for finding shortest path.

Action Verb: Understand (L2)

PO1 Verb: Apply (L3)

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

PO2 Verb: Review(L2)

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

CO 2: Analyze the informed and un-informed search for puzzle solving.

Action Verb: Analyze (L4)

PO1: Apply (L3)

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

PO2: idetify(L3)

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

PO4: Analyze (L4)

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

PO5: Apply (L3)

CO2 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

CO 3: Apply the Back tracking Algorithm to the N Queen problem.

Action Verb: Apply (L3)

PO1: Apply (L3)

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

PO3: Develop (L3)

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

PO4: Analyze (L4)

CO3 Action verb is Less than as PO4 verb by one level. Therefore, the correlation is high (2)

PO5: Apply (L3)

CO3 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

PO11: 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)
PO1: Apply (L3)
CO4 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: idetify(L3)
CO4 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is greater than as 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)

PO11: 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)
PO1: Apply (L3)
CO5 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2: idetify(L3)
CO5 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO5 Action verb is same 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)
PO5: Apply (L3)
CO5 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI &ML)

Course Code	Year & Sem	Data Warehousing and Mining Lab	L	T/CLC	P	C
20APC3312	II-II		0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

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 Proprocessing 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 Naive 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 generatedfor iris.arff.
9. Using Experimenter in advanced mode, demonstrate how to analyze the results from an experiment andthe 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 Integrationtool, Pentoaho 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 forany 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). Explorevisualization 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, Classifypanel, 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, TPrate, FPrate, 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)
CO1 Action verb is more than as PO1 verb. Therefore, the correlation is high (3)
PO2: Formulate (L6)
CO1 Action verb is less than PO2 verb by one level. Therefore, the correlation is moderate (2)
PO4: Analysis (L4)
CO1Action verb is more than PO4 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)
PO1: Apply (L3)
CO2 Action verb is more than as PO1 verb. Therefore, the correlation is high (3)

PO2: identify (L3)
CO2 Action verb is more than as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO2 Action verb is more than as PO3 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO2 Action verb is more than as PO5 verb. Therefore, the correlation is high (3)

CO 5: Analyze the performance of different classifiers using weka tool.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO2 Action verb is more than as PO1 verb. Therefore, the correlation is high (3)
PO2: identify (L3)
CO2 Action verb is more than as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO2 Action verb is more than as PO3 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO2 Action verb is more than as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
Weka is used to analyze different classifier present in real world the correlation is high (3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI &ML)

Course Code	Year & Sem	Operating Systems Lab	L	T/CLC	P	C
20APC3314	II-II		0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

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.**(CO1)**
2. Write programs using the following UNIX operating system calls Fork, exec, getpid, exit, wait, close, stat, opendir and readdir**(CO1)**
3. Simulate UNIX commands like cp, ls, grep, etc., **(CO1)**
4. Simulate the following CPU scheduling algorithms: a) Round Robin b) SJF c) FCFS d) Priority**(CO2)**
5. Simulate all file allocation strategies: a) Sequential b) Indexed c) Linked**(CO2)**
6. Simulate MVT and MFT**(CO2)**
7. Simulate all File Organization Techniques a) Single level directory b) Two level c) Hierarchical d) DAG**(CO2)**
8. Simulate Bankers Algorithm for Deadlock Avoidance**(CO3)**
9. Simulate Bankers Algorithm for Deadlock Prevention**(CO3)**
10. Simulate all page replacement algorithms a) FIFO b) LRU c) LFU Etc. ...**(CO4)**
11. Simulate Paging Technique of memory management**(CO4)**
12. Control the number of ports opened by the operating system with a) Semaphore b) monitors**(CO4)**
13. Simulate how parent and child processes use shared memory and address space**(CO4)**
14. Simulate sleeping barber problem**(CO4)**
15. Simulate dining philosopher's problem**(CO4)**
16. Simulate producer and consumer problem using threads (use java) **(CO4)**
17. Simulate little's formula to predict next burst time of a process for SJF scheduling algorithm. **(CO4)**
18. Develop a code to detect a cycle in wait-for graph**(CO5)**
19. Develop a code to convert virtual address to physical address**(CO5)**
20. Simulate how operating system allocates frame to process**(CO5)**
21. Simulate the prediction of deadlock in operating system when all the processes announce their resource requirement in advance. **(CO5)**

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
CO1	3				3							2	
CO2	3	3	3		3						3	2	
CO3	3	3	3		3								
CO4	2	2		3	3								
CO5	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	CO1: Understand	L2	PO5	PO1: Apply(L3) PO5: Create (L6)	3 3
2	CO2: Apply	L3	PO1 PO2 PO3 PO5	PO1: Apply(L3) PO2: Formulate (L6) PO3: Develop(L6) PO5: Create (L6) PO11:Thumb Rule	3 3 3 3 3
3	CO3: Apply	L3	PO1 PO2 PO3 PO5	PO1: Apply(L3) PO2: Formulate (L6) PO3: Develop(L6) PO5: Create (L6)	3 3 3 3
4	CO4: Analyze	L4	PO1 PO2 PO4 PO5	PO1:Apply(L3) PO2: Identify (L3) PO4: Analyze (L4) PO5: Create (L6)	2 2 3 3
5	CO5: Analyze	L4	PO1 PO5	PO1: Apply(L3) PO5: Create (L6)	2 3

Justification Statements :

CO1: Understand the basic commands in UNIX operating systems.
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO1 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO5 Verb: Create (L3)
CO1 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

CO2: Apply the concepts of CPU scheduling algorithms to solve real time problems
Action Verb: Apply (L3)
PO1 Verb: Apply (L3)
CO2 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: Formulate(L6)
CO2 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: Develop (L6)
CO2 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
PO5 Verb: Create (L6)
CO2 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

PO11 Verb: Thumb rule
Algorithms analysis is learning process to find the solution better manner the correlation is high (3)

CO3: Apply the concepts of process synchronization methods.

Action Verb: Apply(L3)

PO1 Verb: Apply (L3)

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

PO2 Verb: Formulate(L6)

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

PO3 Verb: Develop (L6)

CO3 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)

PO5 Verb: Create (L6)

CO3 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

CO4: Analyze the solutions for virtual memory and Deadlocks.

Action Verb: Analyze (L4)

PO1 Verb: Apply (L3)

CO4 Action verb is less than as PO1 verb by one level. Therefore, the correlation is medium (2)

PO2 Verb: Idetify(L3)

CO4 Action verb is less than as PO2 verb by one level. Therefore, the correlation is medium (2)

PO4 Verb: Analyze (L4)

CO4 Action verb is same as PO4 verb. Therefore, the correlation is high (3)

PO5 Verb: Create (L6)

CO4 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

CO5: Analyze various file system interfaces.

Action Verb: Analyze (L4)

PO1 Verb: Apply (L3)

CO5 Action verb is less than as PO1 verb by one level. Therefore, the correlation is medium (2)

PO5 Verb: Create (L6)

CO5 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI &ML)

Course Code	Year & Sem	Server Side Scripting	L	T/CLC	P	C
20ASC3302	II-II	(common to CSE,CIC,AIDS,AIML)	1	0	2	2

Course Outcomes:

After studying the course, student will be able to

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

Getting Up and Running: Installation Quick Start Guide with XAMPP5 - Installing and Configuring MySQL - Installing and Configuring Apache - Installing and Configuring PHP -

PHP Language Structure: The Building Blocks of PHP - Flow Control Functions in PHP - Working with Functions - Working with Arrays - Working with Objects

1. Installation of XAMPP server
2. Write PHP code to print Hello World program
3. Demonstrate 8 basic data types in PHP.
4. Demonstrate the scope of variables declared in PHP code.
5. Demonstrate Arithmetic, Comparison, Logical (or Relational), Assignment and Conditional (or ternary) Operators.
6. Demonstrate if, elseif ...else and switch statements.
7. Demonstrate for, while, do – while, and for each loop.
8. Write code to create and access numeric arrays.
9. Demonstrate the usage of associative arrays.
10. Implement Multi-dimensional arrays
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.
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.
13. Create a class called baseCalc() that stores two numbers as properties. Next, create a calculate() method that prints the numbers to the browser.
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.

UNIT – II		10 Hrs

Working with Strings, Dates, and Time - Working with Forms - Working with Cookies and User Sessions - Working with Files and Directories - Working with Images

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.
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.
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.
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.
5. Use hidden fields with the script you created in activity 1 to store and display the number of requests that the user submitted.
6. Create a script that uses session functions to track which pages in your environment the user has visited.
7. Create a new script that will list for the user all the pages he/she has visited within your environment, and when.
8. Create a form that accepts a user's first and second name. Create a script that saves this data to a file.
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.
10. Draw a New Image, shapes and lines.
11. Create a New Image with Color Fills.
12. Draw A Basic Pie Chart and 3D Pie Chart
13. Creating a New Image from an Existing Image.
14. Creating an Image from User Input.
15. Creating an Image with Custom Font and Text

UNIT – III	PHP with database connectivity	10 Hrs

Understanding the Database Design Process - Learning Basic SQL Commands - Using Transactions and Stored Procedures in MySQL - Interacting with MySQL Using PHP

Write PHP code

1. to open and close a database connection.
2. to select a database. to select a database.
3. to create a table
4. to drop a database.
5. to drop a table
6. to insert record into employee table.
7. take input using HTML Form and insert records into table.
8. to display all the records from employee table.
9. to display all the records from employee table using mysql_fetch_assoc() function.
10. to display all the records from employee table using MYSQL_NUM argument.
11. to release cursor memory at the end of SELECT statement.
12. to display 10 records per page.
13. to take user input of employee ID and update employee salary.
14. to take user input of employee ID and delete an employee record from employee table.
15. Use SELECT INTO OUTFILE query for creating table backup.

UNIT – IV		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 sendmymail.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.

UNIT – V		5 Hrs
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 PO9	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO9: 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 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3 3
			PO7	PO7: Thumb rule	3

Justification Statements:

CO1: Understand the perquisitions to connect MYSQL and Apache dynamically through PHP paradigm.

Action Verb : Understand (L2)

PO1: Apply(L3)

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

PO2: Review (L2)

CO1 Action verb is same level as PO1 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)

CO2: Analyze the working mechanism of different data media and cookies ,sessions in web browser.

Action Verb : Analyze(L4)

PO1: Apply(L3)
CO2 Action verb is greater than PO1 verb. Therefore, the correlation is high (3)
PO2: Identify (L3)
CO2 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO2 Action verb is greater than PO5 verb. Therefore, the correlation is high (3)
PO11Thumb 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)
PO1: Apply(L3)
CO3 Action verb is same PO1 verb , Therefore the correlation is high(3)
PO2: Review (L2)
CO3 Action verb is greater level by PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO3 Action verb is same as PO3 verb. Therefore the correlation high(3)
PO4: Analyze (L4)
CO4 Action verb is less than PO4 verb by one level. Therefore the correlation is medium(2)
PO9: 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)
PO1: Apply(L3)
CO4 Action verb is greater than PO1 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)
PO5: Create (L6)
CO4 Action verb is same level as PO5 verb. Therefore, the correlation is high (3)
PO11: 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)
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 as PO4 verb. Therefore the correlation is high(3)
PO5: Apply (L3)
CO5 Action verb is greater than PO5 verb. Therefore the correlation is high (3)
PO7: Thumb rule
The team should follow some ethics for evaluate and Improving the performance .Therefore the correlation is high(3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY ANDSCIENCES, TIRUPATI (AUTONOMOUS)
B. Tech - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI & ML)
(Effective for the batches admitted from 2021-22)

Semester V (Third year)

Sl.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P	C			
1	PC	20APC3315	Computer Networks & Cryptography	4	2	0	3	30	70	100
2	PC	20APC3316	Machine Learning	4	2	0	3	30	70	100
3	PC	20APC3317	Formal Languages And Automata Theory	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	20APE3301	Big Data Technologies	4	2	0	3	30	70	100
		20APE3302	Real Time Operating Systems	3	0	0				
		20APE3303	Distributed Computing	3	0	0				
		20APE3304	Ethics And Privacy In AI	3	0	0				
6	PC Lab	20APC3318	Computer Networks & Cryptography Lab	0	0	3	1.5	30	70	100
7	PC Lab	20APC3319	Machine Learning Lab	0	0	3	1.5	30	70	100
8	SC	20ASC3303	Conversational AI/ AI Chatbot	1	0	2	2	100	0	100
9	MC	20AMC9901	Biology for Engineers	3	0	0	0	30	0	30
10	CSP	20CSP3301	Evaluation of Community Service Project	0	0	0	1.5	100	0	100
			Total credits				21.5	440	490	930

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI & ML)

Course Code	Year & Sem	Computer Networks & Cryptography	L	T/CLC	P	C
20APC3315	III-I		4	2	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the basics of data communications network models by using OSI model.
CO2: Apply the Data link Layer functionalities to solve real world problems.
CO3: Analyze the various routing algorithms and protocols use network layers.
CO4: Analyze the various protocols in transport and application layers.
CO5: Understand the basic security cryptography and email security concepts.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	understand	the basics of data communications network models	by using OSI model.		L2
CO2	Apply	the Data link Layer functionalities		to solve real world problems.	L3
CO3	Analyze	the various routing algorithms and protocols	use network layers.		L4
CO4	Analyze	the various protocols in transport and application layers.			L4
CO5	understand	the basic security cryptography and email security concepts.			L2

UNIT - I

Introduction: Data Communications, Networks, Network Types, Internet History, Standards and Administration.
Network Models: Protocol Layering, TCP/IP Protocol Suite, The OSI Model Introduction to Physical Layer: Data and Signals, Transmission Impairment, Data Rate Limits, Performance.
Transmission Media: Introduction, Guided Media, Unguided Media.

UNIT - II

The Data Link Layer: 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. Media Access control: Random Access, Controlled Access, Channelization.

UNIT- III

The Network Layer: Network layer design issues, Routing algorithms, Congestion control algorithms, Quality of service, Internetworking.
The network layer in the Internet: IPV4 Addresses, IPV6, Internet Control protocol, OSPF, BGP, IP, ICMPv4, IGMP.

UNIT - IV

The Transport Layer: The Transport Service, Elements of Transport Protocols, Congestion Control, The internet transport protocols: UDP, TCP, Performance problems in computer networks, Network performance measurement.
The Application Layer: Introduction, Client-Server Programming, WWW and HTTP, FTP, e-mail, TELNET, Secure Shell, Domain Name System, SNMP.

UNIT - V	

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks.

Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques.

E-Mail Security: Pretty Good Privacy, S/MIME. **IP Security:** IP Security overview, IP Security architecture.

Textbooks:

1. Data communications and networkingl, Behrouz A. Forouzan, Mc Graw Hill Education, 5th edition, 2017.
2. Computer Networksl, Andrew S. Tanenbaum, Wetherall, Pearson, 5th edition, 2011.
3. William Stallings, "Cryptography and Network Security", 7th Edition, Pearson Education, 2016.

Reference Books:

1. Data Communication and Networks, Bhushan Trivedi, Oxford, 2016
2. Internetworking with TCP/IP – Principles, protocols, and architecture - Volume 1, Douglas E. Comer,5th edition, PHI, 2015
3. Computer Networksl, 5E, Peterson, Davie, Elsevier.
4. Introduction to Computer Networks and Cyber Securityl, Chawan- Hwa Wu, Irwin, CRC Publications.
5. Computer Networks and Internets with Internet Applicationsl, Comer.

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	
CO3	3	3		3	3	3						2	
CO4	3	3		3	3							3	2
CO5	2	1		1	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	15	23%	3	CO1 :Understand	L2	PO1 PO2	PO1: Apply(L3) PO2:Analyse(L4)	2 1
2	10	15%	2	CO2 : Apply	L3	PO1 PO2 PO6	PO1: Apply(L3) PO2: Analyse (L4) PO6:Thumb rule	3 2 2
3	15	23%	3	CO3 : Analyze	L4	PO1 PO2 PO4 PO5 PO6	PO1: Apply(L3) PO2: Analyse(L4) PO4:Analyse(L4) PO5:Apply(L3) PO6:Thumb rule	3 3 3 3 3
4	11	17%	2	CO4 :Analyze	L4	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Analyse(L4) PO4:Analyse(L4) PO5:Apply(L3)	3 3 3 3
5	15	23%	3	CO5 :understand	L2	PO1 PO2 PO4 PO5 PO6 PO7 PO8 PO11	PO1: Apply(L3) PO2: Analyse(L4) PO4:Analyse(L4) PO5:Apply(L3) PO6:Thumb rule PO7: Thumb rule PO8: Thumb rule PO11: Thumb rule	2 1 1 2 2 2 2 2
	66	100%						

Justification Statements :

CO1: Understand the basics of data communications network models by using OSI model.

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: Apply the Data link Layer functionalities to solve real world problems.

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 PO2 verb by One levels. Therefore the correlation is moderate (2)

PO6: Thumb rule

Data link Layer functionalities are useful for real time applications. Therefore the correlation is moderate (2)

CO3: Analyze the various routing algorithms and protocols use network layers.

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)

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 more than PO5 verb. Therefore the correlation is high (3)

PO6 : Thumb rule

Various routing algorithms are useful for finding distance between routers in real life. Therefore the correlation is high(3)

CO4: Analyze the various protocols in transport and application layers.

Action Verb : Analyze(L4)

PO1: Apply(L3)

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

PO2: Analyze (L4)

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

PO4: Analyze (L4)

CO4 Action verb is same level as PO4 verb. Therefore the correlation is high (3)

PO5: Apply (L3)

CO4 Action verb is more than PO5 verb by one level. Therefore the correlation is high (3)

CO5: Understand the basic security cryptography and email security concepts.

Action Verb : understand (L2)

PO1: Apply(L3)

CO5 Action verb is less than PO1 verb by one levels . Therefore the correlation is moderate (2)

PO2: Analyse (L4)

CO5 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

PO4:Analyse(L4)

CO5 Action verb is less than PO4 verb by two levels. Therefore the correlation is low (1)

PO5:Apply(L3)

CO5 Action verb is more than PO5 verb. Therefore the correlation is moderate (2)

PO6:Thumb rule

Since basic cryptography is the engineering used for society. Therefore the correlation is moderate (2)

PO7: Thumb rule

Since ethical principles should be followed to analyze the security breaches. Therefore the correlation is moderate (2)

PO8: Thumb rule

Team work is required between client and server to secure the data. Hence the correlation is moderate (2)

PO11: Thumb rule

For some of Security applications, Various Cryptographic algorithms were analyzed. Therefore the correlation is moderate (2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI & ML)

Course Code	Year & Sem	MACHINE LEARNING	L	T/CLC	P	C
20APC3316	III-I	(common to CSE,AIDS)	4	2	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Apply** the supervised learning techniques for few machine learning problems

CO2: **Evaluate** the hypotheses by comparing its learning algorithms

CO3: **Analyze** the Unsupervised learning methods using clustering methods.

CO4: **Evaluate** the machine learning algorithms using linear discrimination methods.

CO5: **Evaluate** the decision making problems by using SVM and graphical models

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Apply	The supervised learning techniques		for few machine learning problems	L3
CO2	Evaluate	The hypotheses	by comparing its learning algorithms		L5
CO3	Analyze	The Unsupervised learning methods	using clustering methods.		L4
CO4	Evaluate	The machine learning algorithms	using linear discrimination methods		L5
CO5	Evaluate	The decision making problems	by using SVM and graphical models		L5

UNIT – I	9 Hrs
What is Machine Learning?, Examples of machine learning applications, **supervised Learning:** 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. **Decision Tree Learning:** 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.	
UNIT – II	9Hrs
Evaluating Hypotheses: Motivation, Estimating hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, differences in error of two hypothesis, comparing learning algorithms. **Bayesian Learning:** 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.	
UNIT – III	9 Hrs
Dimensionality Reduction: 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. **Clustering:** 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.	
UNIT – IV	9 Hrs
Linear Discrimination: 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.	
UNIT – V	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=PL1xHD4vteKYVpaIy295pg6_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 PO7 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO3: Design (L6) PO4: Design (L6) PO5: Create(L6) PO7: 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 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop(L3) PO4: Analyze(L4) PO5: Create(L6) PO11: Thumb rule	3 3 3 3 2 3 3
5	13	19%	2	CO5: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO7 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO3: Design (L6) PO4: Design (L6) PO5: Create(L6) PO7: Thumb rule PO11: Thumb rule	3 3 2 2 2 3 3
	68	100 %						

Justification Statements:

CO1: Apply the supervised learning techniques for few machine learning problems
Action Verb : Apply (L3)
PO1 Verb : Apply(L3)
CO1 Action verb is same level of PO1 verb by one level. Therefore, the correlation is High (3)
PO2 Verb : Analyze(L4)
CO1 Action verb is less than PO2 verb by one levels. Therefore the correlation is medium (2)
PO6: Thumb rule
Some of the machine learning models will provide solutions to current societal problems. Therefore the correlation is medium (2)

CO2: Evaluate the hypotheses by comparing its learning algorithms
Action Verb : Evaluate (L5)
PO1: Apply(L3)
CO2 Action verb is greater level of PO1 verb. Therefore, the correlation is High (3)
PO2: Analyze (L4)
CO2 Action verb is greater level as PO2 verb. Therefore, the correlation is high (3)
PO3: Design (L6)
CO2 Action verb is less than PO3 verb by one level. Therefore the correlation is medium(2)
PO4: Design (L6)
CO2 Action verb is less than PO4 verb by one level. Therefore the correlation is medium(2)
PO5: Create(L6)
CO2 Action verb is less than PO5 verb by one level. Therefore the correlation is medium(2)
PO7 : Thumb rule
While creating hypothesis one need to follow the ethical principles. Therefore, the correlation is High (3)
PO11: Thumb rule
In current scenario all machine learning models are updating so one needs to follow the change. Therefore, the correlation is high (3)

CO3: Analyze the Unsupervised learning methods using clustering methods.
Action Verb : Analyze (L4)
PO1: Apply(L3)
CO3 Action verb is greater level of 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 level of 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 level of PO5 verb. Therefore, the correlation is High (3)

CO4: Evaluate the machine learning algorithms using linear discrimination methods.
Action Verb : Evaluate (L5)
PO1: Apply(L3)
CO4 Action verb is greater level of PO1 verb. Therefore, the correlation is High (3)
PO2: Analyze (L4)
CO4 Action verb is greater level as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop(L3)

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

PO4: Analyze(L4)

CO4 Action verb is same level as PO4 verb. Therefore, the correlation is high (3)

PO5: Create(L6)

CO4 Action verb is less than PO5 verb by one level. Therefore the correlation is medium(2)

PO7 : Thumb rule

some ethical principles will apply while training a model using discrimination mothods. Therefore, the correlation is High (3)

PO11: 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)

CO5: Evaluate the decision making problems by using SVM and graphical models

Action Verb : Evaluate (L5)

PO1: Apply(L3)

CO5 Action verb is greater level of PO1 verb. Therefore, the correlation is High (3)

PO2: Analyze (L4)

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

PO3: Design (L6)

CO5 Action verb is less than PO3 verb by one level. Therefore the correlation is medium(2)

PO4: Design (L6)

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

PO5: Create(L6)

CO5 Action verb is less than PO5 verb by one level. Therefore the correlation is medium(2)

PO7 : Thumb rule

While making decisions for solving real world problems one must follow the ethical principles. Therefore, the correlation is High (3)

PO11: 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 MACHINE LEARNING (AI & ML)

Course Code	Year & Sem	Formal Languages and Automata Theory (common to CSE,AIML)	L	T/CLC	P	C
20APC3317	III-I		4	2	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the Finite State Machines to recognize formal languages

CO2: **Analyze** the Regular grammar from Finite Automata by using Regular Languages.

CO3: **Apply** the normalization methods for simplification of Context Free Grammar.

CO4: **Analyze** the concept of push down automata and its applications.

CO5: **Evaluate** the Turing Machines to solve undecidability problems like PCP, MPCP.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	The Finite State Machines to recognize formal languages			L2
CO2	**Analyze**	The Regular grammar from Finite Automata	by using Regular Languages.		L4
CO3	**Apply**	The normalization methods		for simplification of Context Free Grammar.	L3
CO4	**Analyze**	the concept of push down automata and its applications.			L4
CO5	**Evaluate**	The Turing Machines		to solve undecidability problems like PCP, MPCP.	L5

UNIT – I	Introduction to Finite Automata	9 Hrs
Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages. **Finite Automata:** An Informal picture of Finite Automata, Deterministic Finite Automata (DFA), Non Deterministic Finite Automata (**NFA**), Finite Automata with Epsilon transitions (ϵ-NFA or NFA-ϵ), Finite Automata with output, Conversion of one machine to another, Minimization of Finite Automata, Myhill- Nerode Theorem.		
UNIT – II	**Regular Language**	**9Hrs**
Regular Languages: 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		
UNIT – III	**Context Free Grammars and Languages**	**9 Hrs**
Context Free Grammars and Languages: 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.		
UNIT – IV	**Push Down Automata**	**9 Hrs**
Push Down Automata (PDA): 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.		
UNIT – V	**Turing Machines and Undecidability**	**9 Hrs**
Turing Machines and Undecidability: 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

Textbooks:

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.

Reference Books:

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.

Online Learning Resources:

https://www.youtube.com/channel/UCb8HLf1c_-m0MovWMWdg_bA

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	2	1						2	
CO2	3	3	3	3	3								
CO3	3	3	3	2	3						2		
CO4	3	3	3	3	3						3	2	
CO5	3	3	3	3	3	3	3					2	2

Correlation matrix

Unit No.	CO				BTL	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				
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:	L5	PO1	PO1: Apply(L3)	3

				Evaluate		PO2 PO3 PO4 PO5 PO6 PO7	PO2: Analyze(L4) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO6:Thumb Rule PO7:Thumb Rule	3 3 3 3 3 3
	72	100 %						

Justification Statements :

CO1: Understand the Finite State Machines to recognize formal languages.
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)
PO3: Develop(L3)
CO1 Action verb is less than PO3 verb by one level. Therefore the correlation is medium(2)
PO4: Interpret (L2)
CO1 Action verb is same level as PO4 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)
PO6: 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)

CO2: Analyze the Regular grammar from Finite Automata by using Regular Languages.
Action Verb : Analyze (L4)
PO1: Apply (L3)
CO2 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO2: Analyze(L4)
CO2 Action verb is same level as 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)
PO4: Analyze(L4)
CO2 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
PO5: Apply(L3)
CO2 Action verb is greater than PO5 verb. Therefore the correlation is high (3)

CO3: Apply the normalization methods for simplification of Context Free Grammar.
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)
PO3: Develop(L3)
CO2 Action verb is greater than 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 greater than PO5 verb. Therefore the correlation is high (3)
PO11: Thumb rule
Normalization methods are used to reduce the productions in grammar. Therefore the correlation is medium(2)

CO4: Analyze the concept of push down automata and its applications.
Action Verb: Analyze(L4)
PO1: Apply (L3)
CO4 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO2: Analyze(L4)

CO4 Action verb is same level 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 level 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)

PO11: Thumb rule

Learning of push down automata is required for recognition of strings, tokens, patterns. Therefore the correlation is high (3)

CO5: Evaluate the Turing Machines to solve undecidability problems like PCP, MPCP.

Action Verb : Evaluate (L5)

PO1: Apply (L3)

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

PO2: Analyze (L4)

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

PO5: Apply(L3)

CO5 Action verb is greater than PO5 verb. Therefore, the correlation is high (3)

PO6: 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)

PO7: Thumb rule

Since ethical principles should be followed to solve undecidabilty problems by using Turing machines. Therefore the correlation is high (3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI & ML)

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 byA.AldoFaisal,Cheng Soon Ong, and Marc Peter Deisenroth
2. Dr.B.SGrewal,HigherEngineeringMathematics,45thEdition,KhannaPublishers.
3. Operations Research, S.D.Sharma

Reference Books:

1. Operations Research, An Introduction, Hamdy A.Taha, Pearson publishers.
2. A ProbabilisticTheoryofPatternRecognitionbyLucDevroye,.LaszloGyorfi,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).

CO4: Analyze the theory of multivariate distributions and Bayesian Inference.

Action Verb: Analyze **(L4)**

PO2 Verb: Analyze (L4)

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

CO5: Analyze the constrained and unconstrained optimization techniques in machine learning and data science.

Action Verb: Analyze **(L4)**

PO2 Verb: Analyze (L4)

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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI & ML)

Course Code	Year & Sem	Optimization Techniques	L	T/CLC	P	C
20AOE0303	III-I		3	0	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: Apply the knowledge of vector design for optimizing the problems involved with single and multiple variables

CO2: Apply the mathematical procedure for solving the LPP and transportation models

CO3: Understand the unconstrained optimization techniques to solve models related to nonlinear programming

CO4: Understand the constrained optimization techniques to solve models related to nonlinear programming

CO5: Apply the decision making abilities in optimizing the dynamic programming models

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Apply	the knowledge of vector design for optimizing the problems involved with single and multiple variables		in industry	L3
CO2	Apply	the mathematical procedure for solving the LPP and transportation models		in logistic related fields	L3
CO3	Understand	the unconstrained optimization techniques to solve models related to nonlinear programming		in industry	L2
CO4	Understand	the constrained optimization techniques to solve models related to nonlinear programming		in industries	L2
CO5	Apply	the decision making abilities in optimizing the dynamic programming models		in industrial management	L3

UNIT – I

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.

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.

UNIT – II

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.

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.

UNIT – III

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.		
UNIT – IV		
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.		
UNIT – V		
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.		
Textbooks:		
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		
Reference Books:		
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.		
Online Learning Resources:		
https://www.youtubc.com/watch?v=gw_ZEUjl9KM&list=PLYihddLF-CgZGDFVwB1v699kvl4FMcAr-		

Co po Mapping

Course Title	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
Optimization techniques 20AOE0303	CO1	3		3									2	2
	CO2	3		3		3							2	2
	CO3	2		2		2							2	2
	CO4	2	2										2	2
	CO5	3	3			3							2	2

Correlation matrix

CO	CO		Program Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO5)	Level of Correlation
	Verb	BTL			
1	CO1: Apply	L3	PO1	Apply (L3)	3
			PO3	Develop (L3)	3
			PSO1	Thumb Rule	2
			PSO2	Thumb Rule	2
2	CO2: Apply	L3	PO1	Apply (L3)	3
			PO3	Develop (L3)	3
			PO5	Apply (L3)	3
			PSO1	Thumb Rule	2
			PSO2	Thumb Rule	2
3	CO3: Understand	L2	PO1	Apply (L3)	2
			PO3	Develop (L3)	2
			PO5	Apply (L3)	2
			PSO1	Thumb Rule	2
			PSO2	Thumb Rule	2

4	**CO4: Understand**	L2	PO1 PO2 PSO1 PSO2	Apply (L3) Identify (L3) Thumb Rule Thumb Rule	2 2 3 2
5	**CO5: Apply**	L3	PO1 PO2 PO5 PSO1 PSO2	Apply (L3) Identify (L3) Apply (L3) Thumb Rule Thumb Rule	3 3 3 2 2

Justification Statements:

CO1: Apply the knowledge of vector design for optimizing the problems involved with single and multiple variables

Action Verb: Apply (L3)

PO1 Verb: **Apply (L3)**

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

PO3 Verb: **Develop (L3)**

CO1: Action verb is same level as PO3 verb. Therefore, the correlation is high (3).

CO2: Apply the mathematical procedure for solving the LPP and transportation models.

Action Verb: Apply (L3)

PO1 Verb: **Apply (L3)**

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

PO3 Verb: **Develop (L3)**

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

PO5 Verb: **Apply (L3)**

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

CO3: Understand the unconstrained optimization techniques to solve models related to nonlinear programming .

Action Verb: Understand (L2)

PO1 Verb: **Apply (L3)**

CO2: Action verb is lower level as PO1 verb. Therefore, the correlation is low (2).

PO3 Verb: **Develop (L3)**

CO2: Action verb is lower level as PO3 verb. Therefore, the correlation is low (2).

PO5 Verb: **Apply (L3)**

CO2: Action verb is lower level as PO5 verb. Therefore, the correlation is low (2).

CO4: Understand the constrained optimization techniques to solve models related to nonlinear programming .

Action Verb: Understand (L2)

PO1 Verb: **Apply (L3)**

CO1 Action verb is lower level as PO1 verb. Therefore, the correlation is low (2).

PO2 Verb: **Identify (L3)**

CO1: Action verb is lower level as PO2 verb. Therefore, the correlation is low (2).

CO5: Apply the decision making abilities in optimizing the dynamic programming models.

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: **Identify (L3)**

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

PO5 Verb: **Apply (L3)**

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

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI & ML)

Course Code	Year & Sem		L	T/CLC	P	C
20AOE0552	III-I	**Internet of Things**	3	0	0	3

Course Outcomes:

After studying the course, student will be able to

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	the Vision of IoT from the Global Context		M2M	L2
CO2	Understand	the concept of Market Perspective in M2M & IoT		Global Value Chains	L2
CO3	Understand	the M2M and IoT Fundamentals		Devices, Networks & Gateways.	L2
CO4	Analyze	the Architectures in IoT	Networks		L4
CO5	Apply	the Real World Design Constraints and Industrial Automation			L3

UNIT – I	9 Hrs
M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics.	
UNIT – II	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.	
UNIT – III	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	
UNIT – IV	9 Hrs
IoT Architecture-State of the Art - Introduction, State of the art.	
UNIT – V	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	
Textbooks:	
1 Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014. (ISBN-13:978-0124076846)	
Reference Books:	

1. Vijay Madisetti 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)

Mapping of course outcomes with program outcomes

Course Title	Cos	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
Internet of Things	CO1		3											
	CO2		3											
	CO3	3	3											
	CO4	2			3									
	CO5	3	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)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	10	16	2	Understand	L2	PO2	Review (L2)	3
2	10	16	2	Understand	L2	PO1	Identify (L2)	3
3	15	23	2	Understand	L2	PO1 PO2	Apply (L3) Identify (L2)	3 3
4	14	22	3	Analyze	L4	PO1, PO4	Apply (L3) Analyze (L3)	2 3
5	14	22	3	Apply	L3	PO1 PO2	Apply (L3) Identify (L2)	3 2

Justification Statements:

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).

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Course Code	Year & Sem	BIG DATA TECHNOLOGIES	L	T/CLC	P	C
20APE3301	III-I		4	2	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the fundamental Concepts and modern technology of big data.
CO2: Apply the different technologies and frame works for handling big data.
CO3: Analyze the huge data using map reduce and Hbase technologies.
CO4: Evaluate the map reduce application using testing and debugging.
CO5: Analyze the data base application various using Hive and NoSQL.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the fundamental elements and modern technology of big data			L2
CO2	Apply	the Different technologies and frame works for		for handling big data	L3
CO3	Analyze	the Huge data	using map reduce and Hbase technologies		L4
CO4	Evaluate	the Map reduce application	using testing and debugging		L5
CO5	Analyze	the Data base application various	using Hive and NoSQL		L4

UNIT – I	
Getting an Overview of Big Data: 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	
UNIT - II	
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.	
UNIT- III	
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 he Concept of Map Reduce Framework, Developing Simple Map Reduce Application, Points to Consider while Designing Map Reduce.	
UNIT - IV	
Customizing Map Reduce Execution and Implementing Map Reduce Program Controllong 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)

PO2 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)

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 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)

PO1: Apply (L3)

CO3 Action verb 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)

PO4: Analysis (L4)

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

PO11: 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)

PO1: Apply(L3)

CO4 Action verb is more than PO1 verb. Therefore, the correlation is high (3)

PO2: Identify (L3)

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

PO4: Analysis (L4)

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

PO11: 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)

PO1: Apply (L3)

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

PO2: Identity (L3)

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

PO4: Analysis (L4)

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

PO11: Thumb rule

For use to create data base application using Hive and NoSQL technologies to handling big data. Therefore, the correlation is high (3)

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI & ML)

Course Code	Year & Sem	REAL TIME OPERATING SYSTEMS	L	T/CLC	P	C
20APE3302	III-I		3	0	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the real time scheduling problems by using various approaches.

CO2: **Apply** the clock-driven scheduling approach for making decisions.

CO3: **Analyze** the Priority-Driven Scheduling algorithms for implementing periodic Tasks.

CO4: **Analyze** the Scheduling Aperiodic and Sporadic Jobs in Priority Driven Systems.

CO5: **Evaluate** the various priority protocols and Scheduling algorithms.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the real time scheduling problems	by using various approaches		L2
CO2	Apply	the clock-driven scheduling approach		for making decisions	L3
CO3	Analyze	the Priority-Driven Scheduling algorithms		for implementing periodic Tasks	L4
CO4	Analyze	the Scheduling Aperiodic and Sporadic Jobs		in Priority Driven Systems	L4
CO5	Evaluate	the various priority protocols and Scheduling algorithms			L5

UNIT – I	9 Hrs
Typical Real time Applications: Digital control, High-level control, Signal processing, other Real-time Applications. **Hard versus Soft Real-Time Systems:** Jobs and processors, Release time, deadlines and Timing constraints, Hard and soft timing constraints, Hard Real time systems, Soft Real-time Systems. **A Reference Model of Real Time Systems:** Processors and resources, Temporal parameters of Real time workload, periodic task model, precedence constraints and data dependency, Functional parameter, Resource Parameters of Jobs and Parameters of Resources, Scheduling Hierarchy. **Commonly used Approaches to real time Scheduling**: Clock-Driven Approach, Weighted Round-Robin Approach, Priority driven Approach, Dynamic vs Static Systems, Effective release time and deadlines, Optimality of the EDF and LST algorithms, Nonoptimality of the EDF and LST algorithms, Challenges in validating timing constraints in priority driven System, Off line vs On line scheduling, summary.	
UNIT – II	9Hrs
Clock-Driven Scheduling: Notations and Assumptions, static, Timer-Driven scheduler, General Structure of the Cyclic Scheduler, Improving the average response time of Aperiodic Jobs, Scheduling sporadic Jobs, Practical considerations and generalizations, Algorithm for generating Static Schedules, Pros and cons of Clock-driven scheduling, summary.	
UNIT – III	9 Hrs
Priority-Driven Scheduling of periodic Tasks : Static Assumption, Fixed-priority vs Dynamic-priority Algorithms, Maximum Schedulable Utilization, Optimality of the RM and DM Algorithms, A Schedulability test for Fixed-priority tasks with Short Response time, A Schedulability test for Fixed-priority tasks with arbitrary Response time, Sufficient Schedulability conditions for the RM and DM Algorithms, summary.	
UNIT – IV	9 Hrs
Scheduling Aperiodic and Sporadic Jobs in Priority Driven Systems: Assumptions and approaches, Diferrable servers, Sporadic Servers, Constant utilization, total bandwidth and weighted	

fair –Queueing servers, Slack stealing in Dead-line Driven System, Stack stealing in Fixed-priority systems, Scheduling of sporadic jobs, Real-time performance for jobs with soft timing constraints, A two-level scheme for Integrated scheduling.

UNIT – V 9 Hrs

Resources and Resource access control: Assumptions on Resources and their usage, Effects of Resource contention and resource access control, Non Preemptive critical section, Basic Priority inheritance protocol, Basic Priority ceiling protocol, Stack
–based, Priority ceiling protocol, Use of priority ceiling protocol in Dynamic priority systems, pre-emption ceiling protocol, Controlling accesses to Multiple unit Resources, Controlling concurrent accesses to data objects.

Multiprocessor Scheduling, Resource access control, and Synchronization: Model of Multiprocessor and Distributed Systems, Task assignment, Multiprocessor Priority ceiling protocol, Elements of Scheduling Algorithms for End-to-End Periodic Tasks, Schedulability of Fixed-priority End-to-End periodic Tasks, End to End tasks in heterogeneous Systems, Predictability and validation of Dynamic Multiprocessor Systems, Summary.

Textbooks:

1. "Real-Time Systems" by Jane W.S Liu, Pearson Edition, 2006.

Reference Books:

1. Real-Time Systems: Scheduling, Analysis, and Verification, Cheng, A. M. K.: Wiley, 2002.
2. Z.: Scheduling in Real-Time Systems, by Cottet, F., Delacroix, J., Kaiser, C., Mammeri John Wiley & Sons, 2002.
3. Real-Time Systems, C. M., Shin, K. G. McGraw-Hill, Krishna 1997.

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	3	3
CO3	3	3	3	3	3							2	2
CO4	3	3		3	3								2
CO5	3	3	3	3	3								

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	PO1: Apply(L3) PO2: Review(L2)	2 3
2	CO2: Apply	L3	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	3 3 2
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: Analyze	L4	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3
5	CO5: Evaluate	L5	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

Justification Statements :

CO1: Understand the real time scheduling problems by using various approaches.
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 clock-driven scheduling approach for making decisions.
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 greater than PO2 verb. Therefore, the correlation is high(3)
PO11: Thumb rule
The clock-driven scheduling approach is useful for making decisions in real time applications.Therefore the correlation is medium (2)

CO3: Analyze the Priority-Driven Scheduling algorithms for implementing periodic Tasks.
Action Verb : Analyze (L4)
PO1: Apply(L3)
CO3 Action verb is greater level of PO1 verb. Therefore, the correlation is High (3)
PO2: Review (L2)
CO3 Action verb is greater 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 greater than 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)

CO4: Analyze the Scheduling Aperiodic and Sporadic Jobs in Priority Driven Systems.
Action Verb : Analyze (L4)
PO1: Apply(L3)
CO4 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO2: Review(L2)
CO4 Action verb is greater than PO2 verb. Therefore the correlation is high(3)
PO4: Analyze (L4)
CO4 Action verb is same level 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)

CO5: Evaluate the various priority protocols and Scheduling algorithms.
Action Verb : Evaluate (L5)
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 greater than PO4 verb. Therefore the correlation is high(3)
PO5: Apply(L3)
CO5 Action verb is greater than PO5 verb. Therefore the correlation is high (3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI & ML)

Course Code	Year & Sem	Distributed Computing	L	T/CLC	P	C
20APE3303	III-I		3	0	0	3

Course Outcomes:

After Studying the Course, student will be able to

CO1: Understand the concept of Distributed Systems to perform Distributed Computations.

CO2: Analyze the various distributed algorithms to Perform synchronization and state consistency problems.

CO3: Analyze the resource sharing techniques in distributed systems

CO4: Apply the working model of consensus and reliability of distributed systems.

CO5: Understand the Cloud computing concepts for cloud services.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the concept of Distributed Components	to perform Distributed Computations.		L2
CO2	Analyze	the various distributed algorithms	to Perform synchronization and state consistency problems.		L4
CO3	Analyze	the resource sharing techniques in distributed systems			L4
CO4	Apply	the working model of consensus and reliability of distributed systems			L3
CO5	Understand	the Cloud computing concepts	for cloud services		L2

UNIT – I	INTRODUCTION	
Introduction: Definition-Relation to Computer System Components – Motivation – Message - Passing Systems versus Shared Memory Systems – Primitives for Distributed Communication – Synchronous versus Asynchronous Executions – Design Issues and Challenges; A Model of Distributed Computations: A Distributed Program – A Model of Distributed Executions – Models of Communication Networks – Global State of a Distributed System.		

UNIT – II	LOGICAL TIME AND GLOBAL STATE	
Logical Time: Physical Clock Synchronization: NTP – A Framework for a System of Logical Clocks – Scalar Time – Vector Time; Message Ordering and Group Communication: Message Ordering Paradigms – Asynchronous Execution with Synchronous Communication – Synchronous Program Order on Asynchronous System – Group Communication – Causal Order – Total Order; Global State and Snapshot Recording Algorithms: Introduction – System Model and Definitions – Snapshot Algorithms for FIFO Channels.		

UNIT – III	DISTRIBUTED MUTEX AND DEADLOCK	
Distributed Mutual exclusion Algorithms: Introduction – Preliminaries – Lamport's algorithm – Ricart- Agrawala's Algorithm — Token-Based Algorithms – Suzuki-Kasami's Broadcast Algorithm; Deadlock Detection in Distributed Systems: Introduction – System Model – Preliminaries – Models of Deadlocks – Chandy-Misra-Haas Algorithm for the AND model and OR Model.		

UNIT – IV	CONSENSUS AND RECOVERY	
Consensus and Agreement Algorithms: Problem Definition – Overview of Results – Agreement in a Failure-Free System(Synchronous and Asynchronous) – Agreement in Synchronous Systems with Failures; Checkpointing and Rollback Recovery: Introduction – Background and Definitions – Issues in Failure Recovery – Checkpoint-based Recovery – Coordinated Checkpointing Algorithm -- Algorithm for Asynchronous Checkpointing and Recovery		

UNIT – V	CLOUD COMPUTING	

Definition of Cloud Computing – Characteristics of Cloud – Cloud Deployment Models – Cloud Service Models – Driving Factors and Challenges of Cloud – Virtualization – Load Balancing – Scalability and Elasticity – Replication – Monitoring – Cloud Services and Platforms: Compute Services – Storage Services – Application Services

Textbooks:

1. Kshemkalyani Ajay D, Mukesh Singhal, "Distributed Computing: Principles, Algorithms and Systems", Cambridge Press, 2011.

2. Mukesh Singhal, Niranjan G Shivaratri, "Advanced Concepts in Operating systems", McGraw Hill Publishers, 2001.

Reference Books:

1. George Coulouris, Jean Dollimore, Time Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.
2. Pradeep I. Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
3. Tanenbaum A S, Van Steen M, "Distributed Systems: Principles and Paradigms", Pearson Education, 2007.
4. Liu M L, "Distributed Computing: Principles and Applications", Pearson Education, 2004.
5. Nancy A Lynch, "Distributed Algorithms", Morgan Kaufman Publishers, 2003.
6. Arshdeep Bagga, Vijay Madisetti, " Cloud Computing: A Hands-On Approach", Universities Press, 2014.

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: Analyze	L4	PO1 PO2 PO3 PO5 PO11	PO1: Apply(L3) PO2:Identify(L3) PO3:Develop() PO5:Apply(L3) PO11:Thumb Rule	3 3 3 3 3
4	CO4: Apply	L3	PO1 PO2 PO5 PO11	PO1: Analyze (L4) PO2:Identify(L3) PO5:Apply(L3) PO11: Thumb Rule	2 3 3 2
5	CO5: understand	L2	PO1 PO2 PO11	PO1: Analyze (L4) PO2:Identify(L3) PO11: Thumb Rule	1 2 2

Justification Statements:

CO1: Understand the concept of Distributed Systems to perform Distributed Computations.

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 Distributed Systems are used to perform the Distributed Computations Therefore correlation is moderate (2).

CO2: Analyze the various distributed algorithms to Perform synchronization and state consistency problems.

Action Verb: Analyze (L4)

PO1: Apply(L3)

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

PO2:Identify(L3)

CO2 Action Verb is more than PO2 verb; Therefore correlation is high (3).

PO3:Develop(L3)

CO2 Action Verb is more than PO3 verb; Therefore correlation is high (3).

PO5:Apply(L3)

CO2 Action Verb is more than PO5 verb; Therefore correlation is high (3).

PO11:Thumb Rule

Here various distributed algorithms are used to perform different distributed tasks . Therefore correlation is high (3).

CO3: Analyze the resource sharing techniques in distributed systems

Action Verb: Analyze (L4)

PO1: Apply(L3)

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

PO2:Identify(L3)

CO3 Action Verb is more than PO2 verb; Therefore correlation is high (3).

PO3:Develop(L3)

CO3 Action Verb is more than PO3 verb; Therefore correlation is high (3).

PO5:Apply(L3)

CO3 Action Verb is more than PO5 verb; Therefore correlation is high (3).

PO11:Thumb Rule

Here various resource sharing techniques in distributed systems . Therefore correlation is high (3).

CO4: Apply the working model of consensus and reliability of distributed systems.

Action Verb: Apply (L3)

PO1: Analyze (L4)

CO4 Action Verb is less than PO1 Verb by one level. Therefor correlation is Moderate(2)

PO2:Identify(L3)

CO4 Action Verb is same as PO2Verb. Therefor correlation is high(3)

PO5:Apply(L3)

CO4 Action Verb is same as PO5 Verb. Therefor correlation is high(3)

PO11: Thumb Rule

Here, working model of consensus and reliability of distributed systems is used real world. Therefore correlation is Moderate(2)

CO5: Understand the Cloud computing concepts for cloud services.

Action Verb: Understand (L2)

PO1: Analyze (L4)

CO5 Action Verb is less than PO1 verb by two levels. Therefore correlation is Low(1)

PO2:Identify(L3)

CO5 Action Verb is less than PO2 verb by one level. Therefore correlation is moderate(2)

PO11: Thumb Rule

Here we discussd cloud computing concepts to understand the cloud services, Therefore correlation is moderate(2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI & ML)

Course Code	Year & Sem	ETHICS AND PRIVACY IN AI	L	T/CLC	P	C
20APE3304	III-I		3	0	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the ethical issues in the development of AI agents.

CO2: **Analyze** the ethical consideration of AI to replace the work of humans.

CO3: **Apply** the sociocultural factors in AI to develop code of ethics.

CO4: **Analyze** the code to control pitfall in the ethics of AI.

CO5: **Understand** the privacy aspects of ICT to Perform Data Mining.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the ethical issues in the development		of AI agents	L2
CO2	Analyse	the ethical consideration of AI		to replace the work of humans	L4
CO3	Apply	the sociocultural factors in AI		to develop codes of ethics	L3
CO4	Analyse	the code to control pitfil		in the ethics of AI	L4
CO5	Understand	The privacy aspects of information and common technologies		to Perform Data Mining.	L2

UNIT – I	Introduction, What Do We Need to Understand About Ethics?	

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(orWhat) 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? Moral Agents, Moral Motivation, AI, Codes of Ethics and the Law

UNIT – II	Does AI Raise Any Distinctive Ethical Questions? Codes of Professional Ethics	

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

UNIT – III		

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.

UNIT – IV	**Some Characteristic Pitfalls in Considering the Ethics of AI, and What to Do About Them, Some Suggestions for How to Proceed**	

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

UNIT – V	**An Introduction to Privacy Aspects of Informationand Communication Technologies, Data Mining in Large Databases**	

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.

Textbooks:

1. Paula Boddington," Towards a Code of Ethics for Artificial Intelligence", Springer.
2. AgustiSolanas& Antoni Martínez-Ballesté "Advances in Artificial Intelligence for Privacy Protection and Security" World Scientific

Reference Books:

1. "Oxford Handbook of Ethics of AI", Markus D. Dubber frank pasqualesunit Das, oxford university press.

Online Learning Resources:

1. Coursera: Ethics of Artificial Intelligence
2. Coursera: Artificial Intelligence Privacy and Convenience

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	2	2					
CO2	3		3			3	3	3					
CO3	3		2				3	2	2				
CO4	3		3				3	3	3	3	3		
CO5	2		1	1				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	CO1: Understand	L2	PO1 PO2 PO6 PO7 PO8	PO1: Apply(L3) PO2: Analysis(L4) PO6: Apply(L3) PO7: Apply(L3) PO8: Thumb Rule	2 1 2 2 2
2	CO2: Analyse	L4	PO1 PO3 PO6 PO7 PO8	PO1: Apply(L3) PO3: Analysis(L4) PO6: Apply(L3) PO7: Apply(L3) PO8: Thumb Rule	3 3 3 3 3
3	CO3: Apply	L3	PO1 PO3 PO6 PO7 PO8 PO9 PO10	PO1: Apply(L3) PO3: Analysis(L4) PO6: Apply(L3) PO7: Apply(L3) PO8: Thumb Rule PO9: Thumb Rule PO10: Thumb Rule	3 2 3 3 2 2 2

4	CO4: Analyse	L4	PO1 PO3 PO6 PO7 PO8 PO9 PO10 PO11	PO1: Apply(L3) PO3: Analysis(L4) PO6: Apply(L3) PO7: Apply(L3) PO8: Thumb Rule PO9: Thumb Rule PO10: Thumb Rule PO11: Thumb Rule	3 3 3 3 3 3 3 3
5	CO5: Understand	L2	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 1 1 2 2 2 2

Justification Statements:

CO1: **Understand** the ethical issues in the development of AI agents.
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: Analysis (L4)
CO1 Action verb is less than PO2 verb by two level. Therefore, the correlation is low (1)
PO6: Apply (L3)
CO1 Action verb is less than PO6 verb by one level. Therefore, the correlation is moderate (2)
PO7: Apply (L3)
CO1 Action verb is less than PO8 verb by one level. Therefore, the correlation is moderate (2)
PO8: Thumb Rule
CO1 Using Moral Motivation, therefore the correlation is moderate (2)

CO2: **Analyze** the ethical consideration of AI to replace the work of humans.
Action Verb: Analyze (L4)

PO1: Apply (L3)
CO2 Action verb is more than PO1 verb. Therefore, the correlation is high (3)
PO3: Analysis(L4)
CO2 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO6: Apply (L3)
CO2 Action verb is more than PO6 verb. Therefore, the correlation is high (3)
PO7: Apply (L3)
CO2 Action verb is more than PO8 verb. Therefore, the correlation is high (3)
PO8: Thumbrule
CO2 Using Developing Technology, therefore the correlation is high (3)

CO3: **Apply** the sociocultural factors in AI to develop code of ethics.
Action Verb: Apply (L3)

PO1: Apply (L3)
CO3 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO3: Analysis(L4)
CO3 Action verb is less than PO3 verb by one level. Therefore, the correlation is moderate (2)
PO6: Apply(L3)
CO3 Action verb is same as PO6 verb. Therefore, the correlation is high (3)
PO7: Apply(L3)
CO3 Action verb is same as PO8 verb. Therefore, the correlation is high (3)
PO8: Thumbrule
CO3 Developing Codes of Ethics, therefore the correlation is moderate (2)
PO9: Thumbrule
CO3 Developing Codes of Ethics, therefore the correlation is moderate (2)
PO10: Thumbrule
CO3 Developing Codes of Ethics, therefore the correlation is moderate (2)
CO4: **Analyze** the code to control pitfall in the ethics of AI.
Action Verb: Analyze(L4)

PO1: Apply (L3)
CO4 Action verb is more than PO1 verb. Therefore, the correlation is high (3)
PO3: Analyze(L4)
CO4 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO6: Apply(L3)
CO3 Action verb is more than PO6 verb. Therefore, the correlation is high (3)
PO7: Apply(L3)
CO3 Action verb is more than PO8 verb. Therefore, the correlation is high (3)
PO8: Thumbrule
CO4 Building Ethics into AI , therefore the correlation is high (3)
PO9: Thumbrule
CO4 Using Enhancing Human Agency, therefore the correlation is high (3)
PO10: Thumbrule
CO4 Thinking About Ethical Issues in Developing and Implementing Codes of Ethics, therefore the correlation is high (3)
PO11: Thumbrule
CO4 Asilomar AI Principles, therefore the correlation is high (3)

CO5: **Understand** the privacy aspects of ICT to Perform Data Mining.
Action Verb: Understand (L2)

PO1: Apply (L3)
CO5 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)
PO3: Analysis(L4)
CO5 Action verb is less than PO3 verb by two levels. Therefore, the correlation is low (1)
PO4: Analysis(L4)
CO5 Action verb is less than PO4 verb by two levels. Therefore, the correlation is low (1)
PO8: Thumbrule
CO5 Data-collecting institutions and data users, therefore the correlation is moderate (2)
PO9: Thumbrule
CO5 Data-collecting institutions and data users, therefore the correlation is moderate (2)
PO10: Thumbrule
CO5 Strategies for controlling privacy, therefore the correlation is moderate (2)
PO11: Thumbrule
CO5 Measures of the utility of published data sets and outputs , therefore the correlation is moderate (2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI & ML)

Course Code	Year & Sem	Computer Networks & Cryptography Lab	L	T/CLC	P	C
20APC3318	III-I		0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO 1: Apply the different techniques to perform error detection/error correction.

CO 2: Analyze the data link layer protocol to provide reliable services.

CO 3: Analyze the network layer protocol to provide best path for data transmission.

CO 4: Apply the congestion control algorithm to deal with congestion problems.

CO 5: Apply the different cipher techniques to deal with security.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Apply**	the different techniques		to perform error detection/error correction	L3
CO2	**Analyze**	the data link layer protocol		to provide reliable services	L4
CO3	**Analyze**	the network layer protocol		to provide best path for data transmission	L4
CO4	**Apply**	the congestion control algorithm		to deal with congestion problems	L3
CO5	**Apply**	the different cipher techniques		to deal with security	L2

List of Experiments:

1. Implementation of Error Detection / Error Correction Techniques(CO1)
2. Implementation of Stop and Wait Protocol and sliding window(CO1)
3. Implementation and study of Goback-N and selective repeat protocols(CO1)
4. Implementation of High Level Data Link Control(CO2)
5. Write a socket Program for Echo/Ping/Talk commands.(CO2)
6. To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols. (CO2)
7. Implementation of Link state routing algorithm (CO3)
8. Implement the data link layer framing methods such as character, character- stuffing and bitstuffing.(CO3)
9. Write a program to compute CRC code for the polynomials CRC-12, CRC-16 and CRC CCIP(CO3)
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.(CO4)
11. Implement Dijsktra's algorithm to compute the shortest path through a network(CO4)

12. Take an example subnet of hosts and obtain a broadcast tree for the subnet.(CO4)
13. Implement distance vector routing algorithm for obtaining routing tables at each node.(CO4)
14. Write a program for congestion control using Leaky bucket algorithm.(CO5)
15. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should XOR each character in this string with 0 and displays the result.(CO5)
16. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should AND or and XOR each character in this string with 127 and display the result.(CO5)
17. Write a Java program to perform encryption and decryption using the following algorithms(CO5)
a. Ceaser cipher b. Substitution cipher c. Hill Cipher

References:

1. Shivendra S.Panwar, Shiwen Mao, Jeong-dong Ryoo, and Yihan Li, —TCP/IP Essentials A Lab-Based 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.
5. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition

Online Learning Resources/Virtual Labs:

https://onlinecourses.nptel.ac.in/noc21_cs16/preview

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						2	2	
CO2	3	3	3		3							2	
CO3	2	2	2		2							2	
CO4	3	2	3		3						2	2	2
CO5	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: 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	PO1: Apply(L3) PO2: Identify (L3)	3 3
			PO3 PO5	PO3: Develop(L3) PO5: Apply (L3)	3 3
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 2

Justification Statements:

CO1: Apply the different techniques to perform error detection/error correction.
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)

CO2: Analyze the data link layer protocol to provide reliable services.
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)
CO2 Action verb is more than PO5 verb. Therefore, the correlation is high (3)

CO3: Analyze the network layer protocol to provide best path for data transmission.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO3 Action verb is more than PO1 verb. Therefore, the correlation is high (3)
PO2: identify (L3)
CO3 Action verb is more than PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO3 Action verb is more than PO3 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO3 Action verb is more than PO5 verb. Therefore, the correlation is high (3)

CO4: Apply the congestion control algorithm to deal with congestion problems.
Action Verb: Apply (L3)
PO1: Apply (L3)
CO4 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO4 Action verb is less than as PO2 verb. Therefore, the correlation is moderate (2)
PO3: Develop (L3)

CO4 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO4 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
Congestion control techniques are used to solve congestion problems the correlation is moderate (2)

CO5: Apply the different cipher techniques to deal with security.

Action Verb: Apply (L3)
PO1 Verb: Apply (L3)
CO5 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: Review (L2)
CO5 Action verb is greater as PO2 verb. Therefore, the correlation is moderate (2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI & ML)

Course Code	Year & Sem	Machine Learning Lab	L	T/CLC	P	C
20APC3319	III-I		0	0	3	1.5

Course Outcomes:

After studying the course, student will be 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2		3									
CO2	3	2	3		3						2		
CO3	3	3	1		3							1	
CO4	3	3									3		
CO5	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 2 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	PO1: Apply(L3) PO2: Review (L2) PO3: Design(L6) PO4: Apply(L3)	3 3 1 3
4	CO4: Analyze	L4	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review (L2) PO11: Thumb rule	3 3 3
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 procedures for various learning's to machine learning algorithms.
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 level. 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 Python programs for various Learning algorithms using Pandas and Matplotlib.
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 different data sets to the Machine Learning algorithm.
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3)
CO3 Action verb is more than PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: Review (L2)
CO3 Action verb is more than PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: Design(L6)
CO3 Action verb is less than PO3 verb by two levels. Therefore, the correlation is low (1)
PO4 Verb: Apply (L3)
CO3 Action verb is more than PO4 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)
PO1 Verb: Apply (L3)
CO4Action verb is more than PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: Review (L2)
CO4 Action verb is more than PO2 verb. Therefore, the correlation is high (3)
PO11: 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)
PO1: Apply (L3)
CO5 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO5 Action verb is less than as PO2 verb by one level. Therefore, the correlation is moderate (2)
PO3: Develop (L3)
CO5 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO5 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO11: 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 MACHINE LEARNING (AI & ML)

Course Code	Year & Sem	Conversational AI / AI Chatbot	L	T/CLC	P	C
20ASC3303	III-I		1	0	2	2

Course Outcomes:
After studying the course, student will be able to

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 workBy 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 PO9 PO10	PO1: Apply(L3) PO2: Identify(L3) PO3: Select(L1) PO4: Analyze(L4) PO9: Thumb Rule PO10: 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 PO9 PO10 PO11	PO1: Apply(L3) PO2:Idenify(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)

PO2: Identify(L3)
CO2 Action verb is lesser than as PO2 verb. Therefore, the correlation is moderate (2)
PO3: Select(L1)
CO2 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze(L4)
CO2 Action verb is lesser than as PO4 verb. Therefore, the correlation is moderate (2)
PO5: Apply(L3)
CO2 Action verb is lesser than as PO5 verb. Therefore, the correlation is moderate (2)

CO 3: Apply the chatbot methods for different training and testing assistance.
Action Verb: Apply(L3)
PO1 Verb: Apply (L3)
CO3 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2: Identify(L3)
CO3 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
PO3: Select(L1)
CO3 Action verb is more than as PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze(L4)
CO3 Action verb is less than as PO4 verb by one level . Therefore, the correlation is moderate (2)
PO9: Thumbrule
CO3 Creating chatbot, therefore the correlation is moderate (2)
PO10: Thumbrule
CO3 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)
PO1 Verb: Apply (L3)
CO4 Action verb is more than as PO1 verb. Therefore, the correlation is high (3)
PO2: Identify(L3)
CO4 Action verb is more than as PO2 verb. Therefore, the correlation is high (3)
PO3: Select(L1)
CO4 Action verb is more than as PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze(L4)
CO4 Action verb is more than as PO4 verb. Therefore, the correlation is high(3)
PO10: Thumbrule
CO4 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)
PO1: Apply (L3)
CO5 Action verb is more than as PO1 verb. Therefore, the correlation is high (3)
PO2: Identify(L3)
CO5 Action verb is more than as PO2 verb. Therefore, the correlation is high (3)
PO3: Select(L1)
CO5 Action verb is more than as PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze(L4)
CO5 Action verb is more than as PO4 verb. Therefore, the correlation is high (3)
PO5: Apply(L3)
CO5 Action verb is more than as PO5 verb. Therefore, the correlation is high (3)

PO9: Thumbrule
CO5 Using dialog flow in Chatbots,therefore the correlation is high (3)
PO10: Thumbrule
CO5 Using Chatbot to manage projects in multi-disciplinary environments as a member or leader in a team, therefore the correlation is high (3)
PO11: Thumbrule
CO5 Using Chatbot, 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 MACHINE LEARNING (AI & ML)

Course Code	Year & Sem		L	T/CLC	P	C
20AMC9901	III-I	**BIOLOGY FOR ENGINEERS**	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, 5th 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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1						2							
2						2							
3						2							
4						2							
5						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	PO6:	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	PO6:	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 as moderate (2).

CO3: Understand the functioning of physiology in respiratory system and digestive system
Action Verb: Understand (L2)
CO3 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO4: Understand DNA technology in living organisms.
Action Verb: Understand (L2)
CO4 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).
CO5: Apply the biological principles in different technologies for the production of medicines and pharmaceuticals.
Action Verb: Apply (L3)
CO5 Action Verb is of BTL 3. Using Thumb rule, L2 correlates PO6 as moderate (2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)

B. Tech - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI&ML)

Semester VI (Third year)

Sl.	Category	Course Code	Course Title	Hours per week				CIE	SEE	TOTAL
				L	T/CLC	P				
1	PC	20APC3320	Deep Learning Techniques	4	2	0	3	30	70	100
2	PC	20APC3321	Speech and Language Processing	4	2	0	3	30	70	100
3	PC	20APC3322	Big Data Analytics	4	2	0	3	30	70	100
4	PE – 2/ MOOCS-II	20APE3305	Robotic Process Automation	4	2	0	3	30	70	100
		20APE3306	Automation of Model Building							
		20APE3307	Computer Vision							
		20MOC3302	Object –oriented system development using UML, java and Patterns							
5	PC Lab	20APC3323	Deep Learning Techniques Lab	0	0	3	1.5	30	70	100
6	PC Lab	20APC3324	Speech and Language Processing Lab	0	0	3		30	70	100
7	PC Lab	20APC3325	Big Data Analytics Lab	0	0	3		30	70	100
8	SC	20ASA0502	Soft Skills	1	0	2		100	0	100
9	MC	20AMC9904	Professional Ethics and Human Values	2	0	0		30	0	30
			Total credits					**340**	**490**	**830**
Industrial/Research Internship (Mandatory) 2 Months during summer vacation										

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI & ML)

Course Code	Year & Sem		L	T/CLC	P	C
20APC3320	III-II	**Deep Learning Techniques**	4	2	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the basic concepts of maths and statistics used for machine learning.
CO2: **Understand** the foundations of neural networks and deep learning
CO3: **Analyze** the common architecture principles of deep networks.
CO4: **Apply** the deep learning research models on linear factor models and auto encoders
CO5: **Evaluate** the deep generating models for deep learning applications

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	basic concepts of maths and statistics used		for machine learning.	L2
CO2	Understand	the foundations of neural networks and deep learning			L2
CO3	Analyse	the common architecture principles of deep networks.			L4
CO4	Apply	the deep learning research models		on linear factor models and auto encoders	L3
CO5	Evaluate	The deep generating models		for deep learning applications	L5

UNIT – I	**A Review of Machine Learning**	**9 Hrs**
A Review of Machine Learning: 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		
UNIT – II	**Foundations of Neural Networks and Deep Learning**	**9Hrs**
Foundations of Neural Networks and Deep Learning : Neural Networks: Biological Neuron, Perceptron, Multi Layer Perceptron, **Training Neural Networks:** Back-propagation, Activation Functions, Loss Function, Hyper-parameters.		
UNIT – III	**Fundamentals of Deep Learning**	**9 Hrs**
Fundamentals of Deep Learning: Definition of Deep Learning, Common Architecture Principles of Deep Networks, Building Blocks of Deep Learning. **Architectures of Deep Learning**: Unsupervised Pre trained Networks, Convolution Neural Networks (CNN's), Recurrent Neural Networks, and Recursive Neural Networks		
UNIT – IV	**Deep Learning Research**	**9 Hrs**
Deep Learning Research: **Linear factor models:** Probabilistic PCA And Factor Analysis, Independent Component Analysis, Sparse Coding, Manifold Interpretation of PCA, **Auto Encoders:** Regularized Autoencoders, Representational Power, Layer Size and Depth, Denoising Autoencoders, Applications of Autoencoders.		
UNIT – V	**Deep Generating Models**	**9 Hrs**
Deep Generating Models: Boltzmann Machines, Restricted Boltzmann Machines, Deep Belief Networks, Deep Boltzmann Machines, Convolution Boltzmann Machines, Backpropagation throug h Random Operations, Directed Generative Nets, Generating Static Networks. **Applications:** Large Scale Deep Learning, Image Recognition, Speech Recognition, Natural Language Processing, Other Applications.		
Textbooks:		
1. Deep Learning A practitioner's approach- josh Patterson and Adam Gibson, OREILLY. 2. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.		

Reference Books:
1. Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt. Ltd, 2009.
2. Matrix Computations, Golub, G.,H., and Van Loan,C.,F, JHU Press,2013.
3. Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-Hill Education, 2004.
4. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.

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	3	
CO2	2	1				2					2		
CO3	3	3	1	1	1	2					2		
CO4	3	2									2		
CO5	3	3	3	3	3						2		

Correlation matrix

Unit No.	CO				BTL	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				
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)

PO11: 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)

CO3: Analyse the common architecture principles of deep networks.

Action Verb : Analyse (L4)

PO1: Apply(L3)

CO3 Action verb is greater level of 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: Design (L6)

CO3 Action verb is less than PO3 verb by two level. Therefore the correlation is Low(1)

PO4: Design (L6)

CO3 Action verb is less than PO4 verb by two level. Therefore the correlation is Low(1)

PO5: Create(L6)

CO3 Action verb is less than PO5 verb by two level. Therefore the correlation is Low(1)

PO6 : Thumb rule

New versions of architecture principles of deep networks were applied to address the societal needs. Therefore, the correlation is medium (2)

PO11: 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)

CO4: Apply the deep learning research models on linear factor models and auto encoders.

Action Verb : Apply (L3)

PO1: Apply(L3)

CO4 Action verb is same level of PO1 verb. Therefore the correlation is High (3)

PO2: Analyze(L4)

CO4 Action verb is less than PO2 verb by one level. Therefore the correlation is Medium (2)

PO11: Thumb rule

New research models are derived to address issues present in data set. Therefore the correlation is medium (2)

CO5: Evaluate deep generating models for deep learning applications.

Action Verb : Evaluate(L5)

PO1: Apply(L3)

CO5 Action verb is greater than PO1 verb by three level. Therefore the correlation is High (3)

PO2: Analyze (L4)

CO5 Action verb is greater than two level as PO2 verb. Therefore the correlation is High (3)

PO3: Develop(L3)

CO5 Action verb is greater than two level as PO3 verb. Therefore the correlation is High (3)

PO4: Design (L6)

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

PO5: Create(L6)

CO5 Action verb is less than PO5 verb by one level. Therefore the correlation is moderate(2)

PO11: 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 MACHINE LEARNING (AI & ML)

Course Code	Year & Sem	Speech and Language Processing	L	T/CLC	P	C
20APC3321	III-II	AIML	4	2	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the basic concepts of NLP to build language models

CO2: Apply the parsing techniques to syntactic structure of sentences in natural language

CO3: Analyze the grammars and mechanisms of augmented transition network for NLP

CO4: Apply the language models and semantic interpretation to NLP

CO5: Analyze the machine translation, MLIR approaches to improve system performance

CO	Action Verb	Knowledge Statement Condition	Criteria	Blooms level
CO1	Understand	the basic concepts of NLP.	to build language models	L2
CO2	Apply	the parsing techniques	to study syntactic structure of sentences in natural language	L3
CO3	Analyze	the grammars and mechanisms	augmented transition network for NLP	L4
CO4	Apply	the language models and semantic interpretation	to generate compelling 2D transitions between images	L3
CO5	Analyze	the machine translation and MLIR approaches	to improve system performance	L4

UNIT - I	Introduction to Natural language	
Introduction to Natural language: 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		
UNIT - II	**Grammars and Parsing**	
Grammars and Parsing: 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, Bayees Rule, Shannon game, Entropy and Cross Entropy.		
UNIT - III	**Grammars for Natural Language**	
Grammars for Natural Language: 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.		
UNIT - IV	**Semantic Interpretation**	
Semantic Interpretation: 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.		
UNIT - V	**Machine Translation Survey**	
Machine Translation Survey: 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.		
Textbooks:		

1. Jurafsky D, Martin J H, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, 2nd edition, Pearson Education, 2013.
2. James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.
3. Multilingual Natural Language Processing Applications : From Theory To PracticeDaniel M.Bikel and Imed Zitouni, Pearson Publications.
4. Natural Language Processing, A paninian perspective, Akshar Bharathi,Vineet chaitanya,Prentice –Hall of India.

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								3	2
CO2	3	3		2	3						2	3	2
CO3	3	3		3	3						3		3
CO4	3	3	3								2	2	
CO5	3	3		3		3					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)
	Co's Action verb	BTL			
1	CO1:Understand	L2	PO1 PO2 PO4	PO1: Apply(L3) PO2: Review(L2) PO4: Interpret(L2)	2 3 3
2	CO2 : 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	CO3 : 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	CO4 : Apply	L3	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Identify(L3) PO3: Develop(L3) PO11: Thumb rule	3 3 3 2
5	CO5 :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 :

CO1: Understand the basic concepts of NLP to build language models

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 : Review(L2)

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

PO4: Interpret(L2)

CO1 Action verb is same as PO4 verb. Therefore the correlation is high(3)

CO2: Apply the parsing techniques to syntactic structure of sentences in natural language
Action Action Verb : Apply(L3)
PO1: Apply(L3)
CO2 Action verb is same as PO1 verb .Therefore the correlation is high (3)
PO2: Identify(L3)
CO2 Action verb is same 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: Apply(L3)
CO2 Action verb is same as PO5 verb .Therefore the correlation is high (3)
PO11: Thumb rule
The Parsing techniques to syntactic structure in natural language applications to learn continuously. Therefore the correlation is moderate(2)

CO3: Analyze the grammars and mechanisms of augmented transition network for NLP
Action Verb : Analyze (L4)
PO1: Apply(L3)
CO3 Action verb is more than PO1 verb. Therefore the correlation is high (3)
PO2: Identify(L3)
CO3 Action verb is more than PO2 verb. 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 more than PO5 verb. Therefore the correlation is high (3)
PO11 : Thumb rule
The grammar and mechanisms of augmented grammar for NLP. Therefore the correlation is high (3)

CO4: Apply the language models and semantic interpretation to NLP
Action Verb : Apply(L3)
PO1: Apply(L3)
CO4 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Identify(L3)
CO4 Action verb is same level as 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)
PO11: Thumb rule
For developing language models and semantic interpretation to NLP to learn continuously. Therefore the correlation is moderate (2)

CO5: Analyze the machine translation , MLIR approaches to improve system performance
Action Verb : Analyze (L4)
PO1: Apply(L3)
CO4 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO2: Identify(L3)
CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO5 Action verb is same as PO4 verb. Therefore the correlation is high (3)
PO6: Thumb rule
Information retrieval methods are used in many real time applications. Therefore the correlation is high (3)
PO11 : 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 MACHINE LEARNING (AI & ML)

Course Code	Year & Sem	Big Data Analytics	L	T/CLC	P	C
20APC3322	III-II		4	2	0	3

Course Outcomes:

After studying the course, student will be 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	Blooms level
CO1	Understand	the concepts and challenges of hadoop in big data			L2
CO2	Evaluate	the Exiting 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

UNIT - I

Introduction to Big Data : 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.

UNIT - II

HDFS : The Design of HDFS, HDFS Concepts, The Command-Line Interface, Hadoop File systems, The Java Interface, Data flow.
MapReduce: Developing a MapReduce application, The Configuration API, Setting up the Development Environment, Running Locally on Test Data, Running on a Cluster

UNIT- III

How MapReduce Works : Anatomy of a MapReduce, Job Run, Failures, Shuffle and Sort, Task Execution. MapReduce Types and Formats:MapReduce Types, Input formats, output formats.

UNIT - IV

Hadoop Environment: Setting up a Hadoop Cluster, Cluster specification, Cluster Setup and Installation, Hadoop Configuration, Security.
Pig: Installing and Running Pig, an Example, Comparison with Databases, Pig Latin, User- Defined Functions, Data Processing Operators.

UNIT - V

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, Spingers, 2007. 3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos,Uderstanding 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:

CO1: Understand the concepts and challenges of hadoop in 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)
PO2 Verb: Identify (L3)
CO1 Action verb is less than PO2 verb by one level. Therefore, the correlation is moderate(2)

CO2: Evaluate the existing modern technologies related to big data Analytics
Action Verb: Evaluate (L5)
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)
PO4: Analyze (L4)
CO2 Action verb is more than PO4 verb. Therefore, the correlation is high (3)
PO5: Select (L3)
CO2 Action verb is more than PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
For use some different technologies to handling big data. Therefore, the correlation is high (3)

CO3: Analyze the different formats to perform operations on big data Analytics
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)
PO4: Analysis (L4)
CO3 Action verb is same level as PO4 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
For use map reduce and H base technologies to handling big data. Therefore, the correlation is high (3)

CO4: Apply the large scale analytics tools to solve open big data problem.
Action Verb: Apply(L3)
PO1: Apply(L3)
CO4 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2: Identify (L3)
CO4 Action verb is same as PO2 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)
PO11: Thumb rule
For use map reduce applications to test and debug big data. Therefore, the correlation is moderate(2)

CO5: Analyze the big data applications using modern tools Hive and spark.

Action Verb: Analyze (L4)

PO1: Apply (L3)
CO5 Action verb is more than PO1 verb. Therefore, the correlation is high (3)
PO2: Identity (L3)
CO5 Action verb is more than PO2 verb. Therefore, the correlation is high (3)
PO4: Analysis (L4)
CO5 Action verb same as PO4 verb. Therefore, the correlation is high (3)

PO11: 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 MACHINE LEARNING (AI & ML)

Course Code	Year & Sem		L	T/CLC	P	C
20APE3305	III-II	**Automation of Model Building**	4	2	0	3

Course Outcomes:

After Studying the Course, student will be able to

CO1: Understand the advanced knowledge in Automation Engineering

CO2: Apply the advanced techniques to solve Automation problems

CO3: Apply the various principles for effective Automation system management

CO4: Analyse the Hyper parameter optimization techniques

CO5: Create the Data Science projects.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the advanced knowledge in Automation Engineering			L2
CO2	Apply	advanced techniques to solve		Automation problems	L3
CO3	Apply	various principles for effective		Automation system management	L3
CO4	Analyse	Hyper parameter optimization techniques			L4
CO5	Create	Data Science projects			L6

UNIT – I
Introduction to Auto ML: Scope of machine learning, what is AutoML? Why use AutoML and how does it help? When do you automate ML? What will you learn? Core components of AutoML system, Building prototype subsystems for each component. Putting it all together as end & end AutoML System Overview of AutoML libraries.
UNIT – II
Introduction to Machine Learning Using Python: Technical requirements, Machine learning, Linear regression, What is linear regression? important evaluation metrics regression algorithms, Logistic regression, Important evaluation metrics, classification algorithms, Decision trees, Support Vector Machines, k-Nearest Neighbours, Ensemble methods, Comparing the results of classifiers, Cross validation: Clustering.
UNIT – III
Data Preprocessing: Technical requirements, Data transformation, Numerical data transformation, Categorical data transformation, Text Preprocessing, Feature selection, Feature generation. Automated Algorithm Selection: Technical requirements, Computational complexity, Differences in training and scoring time, Linearity versus non-linearity, Necessary feature transformations, supervised ML, Unsupervised AutoML
UNIT – IV
Hyperparameter Optimization: Technical requirements, Hyperparameters, Warm start, Bayesianbased hyperparameter tuning, An example system Creating AutoML Pipelines: Technical requirements, An introduction to machine learning pipelines, A simple pipeline, Function Transformer, A complex pipeline.
UNIT – V
Dive into Deep Learning: Technical requirements, Overview of neural networks, Neuron, Activation functions, A feed-forward neural network using Keras: Autoencoders, Convolutional Neural Networks. Critical Aspects of ML and Data Science Projects: Machine learning as a search, Trade-offs in machine learning, Engagement model for a typical data science project, The phases of an engagement model.

Textbooks:
1. Sibanjan Das, UmitMertCakmak "Hands-On Automated Machine Learning" Packt Publishing, 2018.
Reference Books:
1. EthernAlpaydin, "Introduction to Machine Learning", MIT Press,2004. 2. Stephen Marsland, "Machine Learning -An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,2014.

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	2			3						2		2
CO3	3	2			3						2		2
CO4	2	3		3							3		2
CO5	3	3		3	3						3		2

Correlation matrix

Unit No.	CO				BTL	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				
1	19	22%	3	CO1: Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Identify(L3) PO11: Thumb rule	2 2 2
2	17	20%	2	CO2: Apply	L3	PO1 PO2 PO5 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO5: Apply(L3) PO11: Thumb rule	3 2 3 2
3	17	20%	2	CO3: Apply	L3	PO1 PO2 PO5 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO5: Apply (L3) PO11: Thumb rule	3 2 3 2
4	18	20%	2	CO4: Analyse	L4	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO4: Analysis (L4) PO11: Thumb rule	3 3 3 3
5	16	18%	2	CO5: Create	L6	PO1 PO2 PO4 PO5 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO4: Analysis (L4) PO5: Create (L6) PO11: Thumb rule	3 3 3 3 3
	87	100 %						

Justification Statements:

CO1: Understand the advanced knowledge in Automation Engineering

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 PO1 verb by one level. Therefore, the correlation is moderate (2)
PO11: Thumb rule
For advanced knowledge in Automation Engineering various applications are used. Therefore, the correlation is moderate (2)

CO2: Apply data science tools 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)
PO5: Apply (L3)
CO2 Action verb is same level as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
For to solve Automation problems advanced techniques are applied. Therefore, the correlation is moderate (2)

CO3: Apply various principles for effective Automation system management
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)
PO5: Apply (L3)
CO3 Action verb is same level as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
For to solve Automation problems advanced techniques are applied. Therefore, the correlation is moderate (2)
CO4: Analyse Hyper parameter optimization techniques
Action Verb: Analyse (L4)

PO1: Apply (L3)
CO4 Action verb is more than PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2: Analyze (L4)
CO4 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO4: Analysis (L4)
CO4 Action verb is same level as PO4 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
For some Healthcare and Bioinformatics applications data science concepts are used. Therefore, the correlation is high (3)

CO5: Create Data Science projects
Action Verb: Create (L6)

PO1: Apply (L3)
CO5 Action verb is more than PO1 verb by two levels. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO5 Action verb is more than PO2 verb by two levels. Therefore, the correlation is high (3)
PO4: Analysis (L4)
CO5 Action verb is more than PO4 verb by two levels. Therefore, the correlation is high (3)
PO5: Create (L6)
CO5 Action verb is same level as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
For Create Data Science projects. Therefore, the correlation is high (3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI & ML)

Course Code	Year & Sem		L	T/CLC	P	C
20APE3306	III-II	**Computer Vision**	3	0	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the differences between bitmap and vector graphics in common digital image formats

CO2: **Apply** the image enhancement techniques to improve the visual quality of digital images.

CO3: **Analyze** the various noise models for removing interfering signals at specific frequencies

CO4: **Apply** the image morphing techniques to generate compelling 2D transitions between images.

CO5: **Analyze** the Feature Extraction techniques to extract relevant features from raw data

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the differences between bitmap and vector graphics		in common digital image formats	L2
CO2	**Apply**	the image enhancement techniques		to improve the visual quality of digital images	L3
CO3	**Analyze**	the various noise models		for removing interfering signals at specific frequencies	L4
CO4	**Apply**	the image morphing techniques		to generate compelling 2D transitions between images.	L3
CO5	**Analyze**	the Feature Extraction techniques		to extract relevant features from raw data	L4

UNIT – I	**Digital image fundamentals**	**9 Hrs**

Digital image fundamentals

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.

UNIT – II	**Image Enhancement (spatial domain)**	**9Hrs**

Image Enhancement (spatial domain)

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.

Image Enhancement (frequency domain)

Basics of filtering in frequency domain, Image smoothing using lowpass frequency domain filters, Image sharpening using highpass filters.

UNIT – III	**Image restoration**	**9 Hrs**

Image restoration

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.

Wavelet and Multiresolution processing

Matrix-based transform, Walsh-Hadamard Transform, Slant transform, Haar transform.

UNIT – IV	**Image compression**	**9 Hrs**

Image compression

Lossy and lossless compression schemes: Huffman coding, Run-length coding, Arithmetic coding, Block transform coding, JPEG.

Image Morphology: Fundamental operations, Morphological Algorithms.

Image segmentation: Point, Line and Edge detection, Canny edge detection, Hough Transform, Edge linking, Thresholding, Region-based segmentation, Pixel-based segmentation.

UNIT – V	Feature Extraction	9 Hrs

Feature Extraction

Boundary preprocessing, Boundary feature descriptor, Region feature descriptor, Principal components as feature descriptor, Whole image feature.

Video Processing: Video Formats, Video Enhancement and Restoration, Video Segmentation.

Textbooks:

1. Digital Image Processing, R. C. Gonzalez and R. E. woods, Pearson Education.
2. Handbook of Image and Video Processing, AL Bovik, Academic Press.

Reference Books:

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	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						2		
CO4	3	3	3	3	3		2						
CO5	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 PO7	PO1: Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO4: Interpret (L2) PO5: Apply(L3) PO7: 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)
PO1 Verb:Apply(L3)
CO1 Action verb is greater 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 image enhancement techniques to improve the visual quality of digital images
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 grater than PO2 verb. Therefore the correlation is high (3)
PO4: Interpret (L2)
CO2 Action verb is greater than PO4 verb. Therefore the correlation is high (3)
PO5: Apply(L1)
CO2 Action verb is same as PO5 verb. Therefore the correlation is high(3)

CO3: Analyze the various noise models for removing interfering signals at specific frequencies
Action Verb : Analyze(L4)
PO1: Apply(L3)
CO3 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO2: Review (L2)
CO3 Action verb is less than as PO2 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 same as PO5 verb. Therefore the correlation is high (3)
PO11: Thumb rule
In computer vision the noise models are to remove the interfering signals. Therefore the correlation is medium (2)
CO4: Apply the image morphing techniques to generate compelling 2D transitions between images
Action Verb : Apply (L3)
PO1: Apply(L3)
CO4 Action verb is same as PO1 verb. 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: interpret (L2)
CO4 Action verb is greater than PO4 verb. Therefore the correlation is high (3)
PO5: Apply(L3)
CO4 Action verb is same as PO5 verb. Therefore the correlation is high(3)
PO7: 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)
CO5: Analyze the Feature Extraction techniques to extract relavent features from raw data

Action Verb : Analyze (L4)

PO1: Apply(L3)

CO4 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 as 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)

PO5: Apply(L3)

CO5 Action verb is greater than as PO5 verb. Therefore the correlation is high (3)

PO11: 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 MACHINE LEARNING (AI & ML)

Course Code	Year & Sem	Robotic process Automation	L	T/CLC	P	C
20APE3304	III-II		3	0	0	3

Course Outcomes:

CO1: **understand** the benefits of RPA and various platforms available on the Market.
CO2: **Analyze** the Process methodologies and Planning for Robotic process Automation.
CO3: **Apply** the RPA Knowledge to implement different types of data table automation.
CO4: **Analyze** the Deployment of the Robot to establish robot connections.
CO5: **Evaluate** the Features of RPA to Perform Process Mining and Tasks.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	understand	the benefits of RPA and various platforms available on the Market.			L2
CO2	Analyze	the Process methodologies and Planning		for Robotic process Automation	L4
CO3	Apply	the RPA Knowledge		to implement different types of data table automation.	L3
CO4	Analyze	the Deployment of the Robot		to establish robot connections.	L4
CO5	Evaluate	the Features of RPA		to Perform Process Mining and Tasks.	L5

UNIT - I	**RPA Foundations& RPA Skills**	
What Is RPA? Flavors of RPA History of RPA, The Benefits of RPA, The Downsides of RPA, RPA Compared to BPO, BPM, and BPA, Consumer Willingness for Automation, The Workforce of the Future. RPA Skills: On-Premise Vs. the Cloud, Web Technology, Programming Languages and Low Code, OCR (Optical Character Recognition),Databases, APIs (Application Programming Interfaces), AI (Artificial Intelligence), Cognitive Automation, Agile, Scrum, Kanban, and Waterfall, DevOps, Flowcharts		
UNIT - II	**Process Methodologies & Planning**	
Lean, Six Sigma, How to Implement Six Sigma, Six Sigma Roles and Levels, Lean Six Sigma, Finding the Right Balance, Applying Lean and Six Sigma to RPA. Planning: The Preliminaries, Use a Consulting Firm? RPA Consulting: Some Case Studies, What to Automate? ROI for RPA, RPA Use Cases, The Plan		
UNIT - III	**RPA Vendor Evaluation & Center of Excellence (CoE)**	
Be Realistic, Check Out Third Parties, Minimum Capabilities, Who Is the User?, Funding, Ecosystem, Costs, Training and Education, Support, Best-of-Breed vs. End-to-End, Thought Leadership and Vision, Industry Expertise, Security, Monitoring, and Deployment, What Type of RPA?, The Design, Next-Generation Technologies Center of Excellence (CoE): What Is the CoE? Why Have a CoE? Forming the Team, Business Analyst, Developer, RPA Solution Architect, RPA Supervisor, What Should a CoE Do? Communication, Change Management, CoE Case Study: Intuit		
UNIT - IV	**Bot Development, Deployment and Monitoring & Data Preparation**	
Preliminaries, Installation of UiPath, Getting Started, Activities, Flowcharts and Sequences, Log Message, Variables, Loops and Conditionals, For Each Loop, Do While Loop and While Loop, IF/THEN/ELSE Conditionals, Switch, Debug, Common UiPath Functions, The UiPath Orchestrator, Best Practices for Bot Development Deployment and Monitoring: Testing, Going into Production, Monitoring, Security, Scaling Data Preparation: Types of Data, Big Data, The Issues with Big Data, The Data Process, Types of Algorithms, The Perils of the Moonshot, Bias		
UNIT - V	**Open Source RPA, Process Mining & Future of RPA**	
What Is Open Source Software?, The Business Model of Open Source?, The Pros and Cons of Open Source Software, Open RPA, UI. Vision, Robot Framework, Robocorp, Orchestra, TagUI Process Mining: Old Way Vs. Process Mining, Backgrounder on Process Mining, How Process Mining Works, Celonis, ProM, Signavio, Fluxicon, ABBYY, The Future of Process Mining Future of RPA: Consolidation and IPOs, Microsoft, Attended Automation, Vertical-Specific Companies, Hype Factor, Software-as-a-Service (SaaS) and Open Source, Chathots, Artificial Intelligence, Privacy and Ethics.		
Textbooks:		
1. Tom Taulli, "The Robotic Process Automation Handbook", Apress, 2020		

Reference Books:
1. Alok Mani Tripathi, "Learning Robotic Process Automation", March 2018 2. Robotic process and Cognitive Automation by, Mary C Lacity& Leslie P Willcocks, 2018.
Online Learning Resources:
1. https://www.uipath.com/rpa/robotic-process-automation 2. https://www.academy.uipath.com

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	2	
CO3	3		3		3						2	2	2
CO4	3		3		3						3		3
CO5	3		3		2				3		3	1	1

Correlation Matrix

Unit No.	CO		Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Co's Action verb	BTL			
1	CO1 :Understand	L2	PO1 PO2	PO1: Apply(L3) PO3: Develop (L3)	2 2
2	CO2 :Analyze	L4	PO1 PO3 PO5 PO11	PO1: Apply(L3) PO3: Develop (L3) PO5:Apply(L3) PO11:Thumb Rule	3 3 3 3
3	CO3 : Apply	L3	PO1 PO3 PO5 PO11	PO1: Apply(L3) PO3: Develop (L3) PO5:Apply(L3) PO11:Thumb Rule	3 3 3 2
4	CO4 :Analyze	L4	PO1 PO3 PO5 PO9 PO11	PO1: Apply(L3) PO3: Develop (L3) PO5: Create(L6) PO9: Thumb Rule PO11: Thumb Rule	3 3 1 3 3
5	CO5 :evaluate	L5	PO1 PO3 PO5 PO9 PO11	PO1: Apply(L3) PO3: Develop (L3) PO5: Create(L6) PO9: Thumb Rule PO11: Thumb Rule	3 3 2 3 3

Justification Statements:

CO1: **understand** the benefits of RPA and various platforms available on the Market.
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)
PO3 Verb : **Develop (L3)**
CO1 Action verb is less than PO2 verb by one levels. Therefore the correlation is moderate (2)

CO2: **Analyze** the Process methodologies and Planning for Robotic process Automation.
Action Verb: Analyze (L4)

PO1: Apply (L3)

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

PO3: Develop (L3)

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

PO5: Apply(L3)

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

PO12: Thumb Rule

Process Methodologies and Planning for RPA is important to update the data Processing. Therefore the Correlation is High (3)

CO3: **Apply** the RPA Knowledge to implement different types of data table automation.

Action Verb : Apply (L3)

PO1: Apply (L3)

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

PO3: Develop (L3)

CO2 Action verb is same as PO2 verb. Therefore the correlation is High (3)

PO5: Apply**(L3)**

CO2 Action verb is same as PO2 verb. Therefore the correlation is High (3)

PO12: Thumb Rule

RPA Knowledge is used to implement the data tables. Therefore the Correlation is moderate (2)

CO4: **Analyze** the Deployment of the Robot to establish robot connections.

Action Verb : Analyze (L4)

PO1: Apply(L3)

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

PO3: Develop (L3)

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

PO5: Create(L6)

CO4 Action verb is less than PO5 verb by two level. Therefore the correlation is low (1)

PO9: Thumb Rule

The Deployment of the Robot and Robot connection is important. Therefore the correlation is high (3)

PO12: Thumb Rule

Robotic connection establistion is very important Therefore the correlation is high (3)

CO5: **Evaluate** the Features of RPA to Perform Process Mining and Tasks.

Action Verb : Evaluate(L5)

PO1: Apply(L3)

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

PO3: Develop (L3)

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

PO5: Create(L6)

CO4 Action verb is less than PO5 verb by one level. Therefore the correlation is moderate (2)

PO9: Thumb Rule

The Process Mining in the data played very important role . Therefore the correlation is high (3)

PO12: Thumb Rule

Robotic Features very important in RPA Therefore the correlation is High (3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI & ML)

Course Code	Year & Sem	Deep Learning Techniques LAB	L	T/CLC	P	C
20APC3323	III-II		0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO 1: Evaluate the procedures for the principles using deep learning.

CO 2: Analyze the Deep learning algorithms using learning tasks in various domains.

CO 3: Apply the Convolutional Neural Networks algorithms to solve real-world problems.

CO 4: Evaluate the Auto encoder algorithms for any real-world data.

CO 5: Apply the Generative Adversial Networks for generation using unsupervised tasks.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Evaluate	the procedures for the principles	using deep learning		L5
CO2	Analyze	the Deep learning algorithms are more appropriate for	using different types of using learning tasks in various domains.		L4
CO3	Apply	the Convolutional Neural Networks algorithms		to solve real-world problems.	L3
CO4	Evaluate	the Auto encoder algorithms		for any real-world data	L5
CO5	Apply	the Generative Adversial Networks for generation	using unsupervised tasks		L3

List of Experiments:

1. Installing Keras and packages in Keras. (CO1)
2. Setting up the Spyder IDE Environment and Executing a Python Program. (CO1)
3. Installing, Tensorflow and Pytorch libraries and making use of them. (CO1)
4. Train the model to add two numbers and report the result. (CO1)
5. Train the model to multiply two matrices and report the result using keras. (CO1)
6. Train the model to print the prime numbers using Keras. Recurrent Neural Network
7. Recurrent Neural Network (CO2)

a. Numpy implement of a simple recurrent neural network

b. Create a recurrent layer in keras

c. Prepare IMDB data for movie review classification problem.

d. Train the model with embedding and simple RNN layers.

e. Plot the Results

8. Consider temperature-forecast as one the example for recurrent neural network and implement the following. (CO2)

a. Inspect the data of the weather dataset

b. Parsing the data

c. Plotting the temperature time series

d. Plotting the first 10 days of the temperature time series

9. Train a sentiment analysis model on IMDB dataset, use RNN layers with LSTM/GRU notes. Convolutional Neural Networks (CO3)

10. Convolutional Neural Networks (CO3)
a. Preparing the IMDB data
b. Train and evaluate a simple 1D convent on IMDB Data
c. Train and evaluate a simple 1D convent on temperature prediction data
11. Applying the Convolution Neural Network on computer vision problems. (CO4)
12. Image classification on MNIST dataset (CNN model with Fully connected layer). Long short-term memory network (CO4)
13. Long short-term memory network (CO5)
a. Implement LSTM using LSTM layer in keras
b. Train and evaluate using reversed sequences for IMDB data
c. Train and evaluate a bidirectional LSTM for IMDB data
14. Develop a traditional LSTM for sequence classification problem. Autoencoders (CO5)
15. Applying the Autoencoder algorithms for encoding the real-world data. Generative Adversial Networks (CO5)
16. Applying Generative Adversial Networks for image generation and unsupervised tasks. (CO5)

PROJECTS:
1) Write a program for Multilabel Movie Poster Classification.
2) Write a program for Predicting Bike-Sharing patterns

Textbooks:
1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press
2. Deep Learning A practitioner's approach- josh Patterson and Adam Gibson, OREILLY
3. The Elements of statistical learning by T.Hastie,R Tibshirani, and J.Friedman, Spinger.
4.Probabilistic Graphical Models. Koller, and N. friedman, Mit Press

Reference Books:
1.Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.
2.Yegnanarayana,B., Artificial Neural Networks PHI Learning Pvt.Ltd,2009.
3.Golub, G.H., and Van Loan, C.F., Matrix Computations, JHU press,2013.
4.Satish Kumar, neural Networks: A Classroom Approach,TataMcGraw Hill Education, 2004. References: Ian Goodfellow, YoshuaBengio, Aaraon Courville, "Deep Learning (Adaptive Computation and Machine Learning series)", MIT Press, 2016.

Online Learning Resources/Virtual Labs/ Extensive Reading:
1) Introduction to Deep Learning Course | Introduction to Deep Learning Course (rses- dlcourse.github.io)
2) Deep Learning | Introduction to Long Short Term Memory – GeeksforGeeks
3) http://www.deeplearning.net/
4) https://www.deeplearningbook.org
5) https://developers.google.com/machinelearning/crash-course/ml-intro
6) www.cs.toronto.edu/~fritz/absps/imagenet.pdf
7) http://nerualnetworksandeeplearning.com

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									
CO2	3	3	1	3								1	
CO3	3	2	3		3						2	1	
CO4	3	2		3							3		
CO5	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: Analyze (L4)	3 2 3
2	CO2: Analyze	L4	PO1 PO2 PO3 PO4	PO1: Apply(L3) PO2: Review (L2) PO3: Design(L6) PO4: Apply(L3)	3 3 1 3
3	CO3: 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
4	CO4: Evaluate	L5	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Formulate (L6) PO4: Analysis (L4) PO11: Thumb rule	3 2 3 3
5	CO5: 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 procedures for the principles using deep learning.
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 level. 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: Analyze the Deep learning algorithms using learning tasks in various domains.
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3)
CO2 Action verb is more than PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: Review (L2)
CO2 Action verb is more than PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: Design(L6)
CO2 Action verb is less than PO3 verb by two levels. Therefore, the correlation is low (1)
PO4 Verb: Apply (L3)
CO2 Action verb is more than PO4 verb. Therefore, the correlation is high (3)

CO 3: Apply the Convolutional Neural Networks algorithms to solve real-world problems.
Action Verb: Apply (L3)
PO1: Apply (L3)
CO3Action verb is same as PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)
CO3 Action verb is less than as PO2 verb by one level. 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
Using orange to visualize real world solutions the correlation is moderate (2)

CO 4: Evaluate the Auto encoder algorithms for any real-world data.
Action Verb: Evaluate (L5)
PO1: Apply (L3)
CO4 Action verb is more than PO1 verb. Therefore, the correlation is high (3)
PO2: Formulate (L6)
CO4 Action verb is less than PO2 verb by one levels. Therefore, the correlation is moderate (2)
PO4: Analysis (L4)
CO4 Action verb is more than 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 high (3)

CO 5: Apply the Generative Adversial Networks for generation using unsupervised tasks.
Action Verb: Apply (L3)
PO1: Apply (L3)
CO5 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO5 Action verb is less than as PO2 verb by one level. Therefore, the correlation is moderate(2)
PO3: Develop (L3)
CO5 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO5 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)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI & ML)

Course Code	Year & Sem	Speech Language Processing Lab	L	T/CLC	P	C
20APC3324	III-II	AIML	0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO 1: Evaluate the semantics and pragmatics of English language for text processing.

CO 2: Analyze the CORPUS linguistics based on digestive approach using Text Corpus method.

CO 3: Apply the Pre-processing NLP Techniques to generate POS Tagging's.

CO 4: Apply the language Modelling and Statistical Machine translation to Perform POS Tagging's.

CO 5: Analyse the NLP Techniques to perform text alignment and Text Patterns.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Evaluate	the semantics and pragmatics of English language		for text processing	L5
CO2	Analyze	the CORPUS linguistics based on digestive approach	using Text Corpus method		L4
CO3	Apply	the Pre-processing NLP Techniques.		to generate POS Tagging's	L3
CO4	Apply	the suitable language Modelling and Statistical Machine translation		to Perform POS Tagging's	L3
CO5	Anlyze	the NLP Techniques		to Perform text alignment and Text Patterns	L4

List of Experiments:

1. Word Analysis (CO1)
2. Word Generation (CO1)
3. Morphology (CO2)
4. N-Grams(CO2)
5. N-Grams Smoothing(CO3)
6. POS Tagging: Hidden Markov Model (CO3)
7. POS Tagging: Viterbi Decoding (CO4)
8. Building POS Tagger (CO4)
9. Chunking (CO5)
10. Building Chunker (CO5)

Refer: https://nlp-iiith.vlabs.ac.in/List%20of%20experiments.html

References:

1. Jurafsky D, Martin J H, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, 2nd edition,
2. James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.
3. Natural Language Processing, A paninian perspective, Akshar Bharathi, Vineet Chaitanya, Prentice –Hall of India. Online Learning Resources/Virtual Labs: 1. Natural Language Processing in TensorFlow | Coursera

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										
CO2	3	3	3		3						3	2	
CO3	3	2	3		3						2	2	2
CO4	3	3	3		3						2	2	2
CO5	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: Evaluate	L5	PO1 PO2 PO3	PO1: Apply(L3) PO2: Formulate(L6) PO3:Design(L6)	3 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: Analyze (L4) PO3: Develop(L3) PO5: Apply (L3) PO11: Thumb rule	3 2 3 3 2
4	CO4: 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
5	CO5: Analyze	L4	PO1 PO2 PO3 PO5	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO5: Apply (L3)	3 3 3 3

Justification Statements :

CO 1: Evaluate the semantics and pragmatics of English language for text processing. **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: Review(L2)

CO1 Action verb is same as PO2 verb. Therefore, the correlation is high (2)

PO3:Develop(L3)

CO1 Action verb is less than PO3 verb by one level. Therefore, the correlation is moderate (2)

CO 2: Analyze the CORPUS linguistics based on digestive approach using Text Corpus method.

Action Verb: Analyze (L4)

PO1: Apply (L3)

CO2 Action verb is more than as PO1 verb. Therefore, the correlation is high (3)
PO2: idetify(L3)
CO2 Action verb is more than as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO2 Action verb is more than as PO3 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO2 Action verb is more than as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
Text Corpus method is used for to solve the text based problems the correlation is high (3)

CO 3: Apply the Pre-processing NLP Techniques to generate POS Tagging's.
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 by one level. 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
NLP Techniques are used to generate solution for POS tagging's the correlation is moderate (2)

CO 4: Apply the language Modelling and Statistical Machine translation to Perform POS Tagging's.
Action Verb: Apply (L3) PO1:
Apply (L3)
CO4 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2: idetify(L3)
CO4 Action verb is same as 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)
PO5: Apply (L3)
CO4 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
language Modelling and Statistical Machine translation to Perform POS Tagging's the correlation is moderate (2)

CO 5: Analyse the NLP Techniques to perform text alignment and Text Patterns.
Action Verb: Analyze (L4) PO1:
Analyze (L4)
CO5 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2: idetify(L3)
CO5 Action verb is more than PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO5 Action verb is more than PO3 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO5 Action verb is more than PO5 verb. Therefore, the correlation is high (3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI

(AUTONOMOUS)

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI & ML)

Course Code	Year & Sem	Big Data Analytics Lab (Common to : AIDS, AIML)	L	T/CLC	P	C
20APC3325	III-II		0	0	3	1.5

Course Outcomes:

After studying the course, student will be 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 4: Apply the different data storages tools using Hive and Hadoop

CO 5: Apply the different data processing tools using Hive and pig, Spark

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

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)

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)

UserId	TrackId	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 eachyear and find in which year maximum number of books were published usingthe following data. (CO4)

Title	Author	Published year	Author country	Language	No of pages
12. Develop a MapReduce program to analyze Titanic ship data and to find the average age of the people (both male					

Column 1 :Passengerl d 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

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	PSO1	PSO2
CO1	3	1		3									
CO2	3	2	3		3						2		
CO3	3	3	1		2							1	
CO4	3	2	3		3						2		
CO5	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)
PO1 Verb: Apply (L3)
CO3 Action verb is more than PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: Review (L2)
CO3 Action verb is more than PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: Design(L6)
CO3 Action verb is less than PO3 verb by two level. Therefore, the correlation is low (1)
PO4 Verb: Apply (L3)
CO3 Action verb is less than PO4 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)
PO1: Apply (L3)
CO4 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO4 Action verb is less than PO2 verb by one level. Therefore, the correlation is moderate (2)
PO3: Develop (L3)
CO4 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO4 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 5: Apply the different data processing tools using Hive and pig, Spark
Action Verb: Apply (L3)
PO1: Apply (L3)
CO5 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO5 Action verb is less than PO2 verb by one level. Therefore, the correlation is moderate (2)
PO3: Develop (L3)
CO5 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO5 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)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI & ML)

Course Code	Year & Sem		L	T/CLC	P	C
20ASA0502	III-II	SOFT SKILLS LAB	1	0	2	2

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the importance of verbal and non-verbal skills
CO2: Apply the interpersonal and intrapersonal skills
CO3: Apply the grammatical structures to formulate sentences and correct word forms.
CO4: Understand the trust among people and develop employability skills
CO5: 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.it.iitb.ac.in/~vijaya/ssrvm/worksheetscd/getWorksheets.com/Language%20Arts/syn_ant.pdf
Basics of Communication (Definition , Types of communication).
Web links: 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
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://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.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-Leasership-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

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=Pflg-67smf4
https://www.youtube.com/watch?v=-IXjbph22Fk

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=KIoD19uoxt8

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 5th 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 3rd 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**

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 PO6to 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

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)

CO4 Action Verb Understand is of BTL 3. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

CO5: Evaluate the skills needed for approaching different types of interviews.
Action Verb: Evaluate (L5)

CO5 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 MACHINE LEARNING (AI & ML)

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

CO1: Understand the sustained happiness through identifying the essentials of human values and skills.

CO2: Understand the importance of Values and Ethics in their personal lives and professional careers.

CO3: Understand the rights and responsibilities as an employee, team member and a global citizen.

CO4: Understand the importance of trust, mutually satisfying human behavior and enriching interaction with nature.

CO5: Understand appropriate technologies and management patterns to create harmony in professional and personal life.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Understand**	The sustained happiness	through identifying the essentials of human values and skills		L2
2	**Understand**	the importance of Values and Ethics		in their personal lives and professional careers.	L2
3	**Understand**	the rights and responsibilities	as an employee, team member and a global citizen.		L2
4	**Understand**	the importance of trust, mutually satisfying human behavior and enriching interaction with nature.			L2
5	**Understand**	appropriate technologies and management patterns		to create harmony in professional and personal life.	L2

UNIT - I	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.	
UNIT - II	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!	
UNIT - III	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.	
UNIT - IV	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.	
UNIT - V	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.	
Textbooks:	
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.	
Reference Books:	
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 PritchaMichael J Rabins, 4e , Cengage learning, 2015. 4. Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008.	
Online Learning Resources:	
https://www.youtube.com/watch?v=9LSEBK03CiY&list=PLysZquKdjuWSv87TaE7pByn5TE_e46O2C	

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	2		
4						2	2	2	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)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	8	27	2	Understand	L2	PO11	Thumb Rule	2
2	8	26	2	Understand	L2	PO7, PO8	Thumb Rule Thumb Rule	2 2
3	4	13	2	Understand	L2	PO6,	Thumb Rue	2
						PO8, PO9	Thumb Rule Thumb Rule	2

4	**5**	17	**2**	**Understand**	**L2**	PO6, PO7, PO8, PO9	Thumb Rule Thumb Rule Thumb Rule Thumb Rule	2 2
5	**5**	17	**2**	**Understand**	**L2**	PO7, PO11	Thumb Rule Thumb Rule	1 2

CO1: Understand sustained happiness through identifying the essentials of human values and skills.
Action Verb: Understand (L2)
CO1 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

CO2: Understand the importance of Values and Ethics in their personal lives and professional careers.
Action Verb: Understand (L2)
CO2 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

CO3: Understand the rights and responsibilities as an employee, team member and a global citizen.
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 importance of trust, mutually satisfying human behavior and enriching interaction with nature.
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 appropriate technologies and management patterns to create harmony in professional and personal life.
Action Verb: Understand (L2)
CO5 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).
CO5 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 MACHINE LEARNING

(Effective for the batches admitted from 2021-22)

Semester VII (Fourth year)

Sl.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P	C			
1	PE - 3	20APE3308	Advanced ML	4	2	0	3	30	70	100
		20APE3309	Recommender Systems	3	0	0				
		20APE3310	Reinforcement Learning in AI	3	0	0				
		20APE3311	Machine Learning for Unstructured Data	3	0	0				
2	PE – 4	20APE3312	Optimizing Techniques in AI	3	0	0	3	30	70	100
		20APE3313	AI for Image Analysis	3	0	0				
		20APE3314	Intelligent Information Retrieval System	3	0	0				
		20APE3315	Generative AI	4	2	0				
3	PE – 5 CBCC/ MOOCS -III	20APE3316	Data Analytics	4	2	0	3	30	70	100
		20APE3317	Software Project Management							
		20APE3318	Linux Environment System							
		20MOC3303	1. Data Analytics with Python 2. Software Testing.							
4	JOE/OE-2	20AOE3301	Information Retrieval Techniques	3	0	0	3	30	70	100
		20AOE3302	Soft Computing	3	0	0				
		20AOE3303	Principles of Data science	4	2	0				
5	OE - 3	20APE0415	Digital Image Processing	3	0	0	3	30	70	100
		20AOE3004	Embedded Systems	3	0	0				
		20AOE3601	Enabling Technologies for data science and analytics :IOT	3	0	0				
		20APE0415	Wireless Communications	4	2	0				
6	HE	20AOE0302	Management Science	4	2	0	3	30	70	100
		20AOE9901	English for Research Paper Writing	3	0	0				
		20AHSMB02	Entrepreneurship Development	3	0	0				
7	SC	20ASC3305	Exploratory Data Analysis with R	1	0	2	2	100	0	100
8	INTERNSHIP	20APR3301	Evaluation of Industry Internship(III-II Summer Internship)	0	0	0	3	100	0	100
			Total credits				**23**	**380**	**420**	**800**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI&ML)

Course Code	Year & Sem		L	T/CLC	P	C
20APE3308	IV-I	**ADVANCED ML**	4	2	0	3

Course Outcomes:

After studying the course, students will be able to

CO1: Understand the basic concepts of text mining techniques suitable for a given problem.

CO2: Analyze the different clustering algorithms and Categorization techniques.

CO3: Apply Preprocessing applications using Probabilistic models.

CO4: Apply visualization techniques to enhance browsing, query refinement of textual data in network structures

CO5: Analyze the text mining applications.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the basic concepts of text mining techniques suitable	for a given problem.		L2
CO2	**Analyze**	the different clustering algorithms and categorization techniques.			L4
CO3	**Apply**	Prepossessing applications		using probabilistic models.	L3
CO4	**Apply**	visualization techniques		to enhance browsing, query refinement of textual data in network structures	L3
CO5	**Analyze**	the text mining applications.			L4

UNIT - I	**UNSTRUCTURED MACHINE LEARNING**	9 Hrs
Unsupervised Machine Learning & Deep Belief Principal component analysis, Introducing K-means clustering, and self-organizing maps. Deep Belief Networks: Neural networks – a primer, composition of a neural network, network topologies, Restricted Boltzmann Machine, Introducing the RBM, Applications of the RBM, Further applications of the RBM, Deep belief Networks-Training a DBN, Applying the DBN, Validating the DBN		
UNIT - II	**STACKED DENOISING AUTOENCODERS**	14 Hrs
Stacked DE noising Auto encoders & Convolutional Neural Auto encoders, Introducing the autoencoder, Topology, Training, DE noising autoencoders, Apply in grad, Stacked DE noising A uto encoders, Applying the SdA, Assessing SdA performance Convolutional Neural Networks: Introduction to CNN, Understanding the convent topology, understanding convent layers and pooling layers, training a convent, Applying a CNN		
UNIT - III	**SEMI-SUPERVISED LEARNING**	9 Hrs
Semi-Supervised Learning Introduction, understanding semi-supervised learning, Semi-supervised algorithms in action, Self training, implementing self-training, Finessing your -training implementation, Contrastive Pessimistic Likelihood Estimation Text Feature Engineering: Introduction.		
UNIT - IV	**FEATURE ENGINEERING**	12 Hrs
Feature Engineering, creating a feature set, Engineering features for ML applications, using rescaling techniques to improve the learnability of features, creating effective derived variables, reinterpreting non-numeric features, using feature selection techniques, Performing feature selection, Feature engineering in practice, Acquiring data via RESTful APIs, Testing the performance of our model, Twitter, Deriving and selecting variables using feature engineering techniques		
UNIT - V	**ENSEMBLE METHODS**	15 Hrs

Ensemble Methods & Additional Python Machine Learning Tools, Introducing ensembles, understanding averaging ensembles, using bagging algorithms, using random forests, applying boosting methods, Using XG Boost, Using stacking ensembles, Applying ensembles in practice, Using models in dynamic applications, Understanding model robustness, Identifying modeling risk factors, Strategies to managing model robustness Additional Python Machine Learning Tools: Alternative development tools, Introduction to Lasagna, getting to know Lasagna, Introduction to Tensor flow, knowing when to use these libraries
Textbooks:
John Hearty, Advanced Machine Learning with Python, Packt Publishing Ltd, 2016.
Reference Books:
1. T.M. Mitchell, "Machine Learning with python", McGraw-Hill,1997 2. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019. Online Learning Resources:www.packtpub.com
Online Resources:
https://www.quora.com/What-are-the-best-resources-to-learn-AI-and-ML

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		2		3									
CO3	3				3	1					2		
CO4	3				3	1					2		
CO5		3		3									

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			3	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2:Review(L2)	2 1
2			2	CO2: Analyse	L4	PO1 PO2 PO3	PO2: Review(L2) PO4:Analyze(L4)	2 3
3			2	CO3: Apply	L3	PO1 PO5 PO6 PO11	PO1: Apply(L3) PO5: Apply(L3) PO6: Thumb rule PO11: Thumb rule	3 3 1 2
4			2	CO4 : Apply	L3	PO1 PO5 PO6 PO11	PO1: Apply(L3) PO5:Apply (L3) PO6:Thumb rule PO11:Understand(L2)	3 3 1 2
5			3	CO5 :Analyse	L4	PO2 PO4	PO2: Apply(L3) PO4: Design (L6)	3 3

Justification Statements:

CO1: Understand the basic concepts of text mining techniques suitable for a given problem.

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: Analyse (L4)

CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

CO2: Analyze the different clustering algorithms and Categorization techniques.

Action Verb: Analyse (L4)

PO2: Analyse (L4)

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

PO4: Design (L6)

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

CO3: Apply Preprossessing applications using Probabilistic models.

Action Verb : Analyse (L4)

PO1: Apply(L3)

CO4 Action verb is less than PO1 verb by two levels. 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

Apply reasoning informed by the contextual knowledge to assess probabilistic models. Therefore the correlation is low (1)

PO11: Thumb rule

Demonstrate knowledge and understanding of the pre-processing principles. Therefore the correlation is moderate (2).

CO4: Apply visualization techniques to enhance browsing, query refinement of textual data in network structures.

Action Verb: Apply (L3)

PO1: Apply(L3)

CO4 Action verb is less than PO1 verb by two levels. 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

Apply reasoning informed by the contextual knowledge to enhance network structures. Therefore the correlation is low (1)

PO11: Thumb rule

Demonstrate knowledge and understanding of the visualization techniques. Therefore the correlation is moderate (2).

CO5: Analyze the text mining applications.

Action Verb: Analyze (L5)

PO2: Apply (L3)

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

PO4: Design (L6)

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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI&ML)

Course Code	Year & Sem	Recommender systems	L	T/CLC	P	C
20APE3309	IV-I		3	0	0	3

Course Outcomes:

After studying the course, students will be able to

CO1: Understand the basic concepts of recommender systems.

CO2: Apply the mathematical optimization techniques pertain to recommender systems.

CO3: Evaluating the performance of recommender systems using Content-based recommendation.

CO4: Analyse the simple recommender system using Collaborative Filtering for hybridization design

CO5: understanding the advanced topics and current applications of recommender systems in real time applications

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	**Understand** the basic concepts of recommender systems.			L2
CO2	Apply	The mathematical optimization techniques		to recommender systems.	L3
CO3	Evaluate	the performance of recommender systems	using Content-based recommendation.		L5
CO4	Analyze	the simple recommender system	using Collaborative Filtering	For hybridization design	L4
CO5	Understand	**understanding** the advanced topics and current applications of recommender systems in real time applications			L2

UNIT - I	**Introduction to Recommender system functions**	9 Hrs
Recommender system functions, Linear Algebra notation: Matrix addition, Multiplication, transposition, and inverses; covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.		
UNIT - II	**Collaborative Filtering**	9Hrs
User-based nearest neighbour recommendation, Item-based nearest neighbour recommendation, Model based and pre-processing based approaches, Attacks on collaborative recommender systems		
UNIT - III	**Content-based recommendation:**	9 Hrs
High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, Discovering features of documents, Obtaining item features from tags, Representing item profiles, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.		
UNIT - IV	**Knowledge based recommendation**	9 Hrs
Knowledge representation and reasoning, Constraint based recommenders, Case based recommenders. Hybrid approaches: Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta-level, Limitations of hybridization strategies. Evaluating Recommender System: Introduction, General properties of evaluation research, Evaluation designs, Evaluation on historical datasets, Error metrics, Decision-Support metrics, User-Centered metrics.		
UNIT - V	**Recommender Systems and communities**	9 Hrs
Communities, collaboration and recommender systems in personalized web search, Social tagging recommender systems, Trust and recommendations, Group recommender systems.		
Textbooks:		
1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press(2011).		
Reference Books:		

1. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer(2011), 1st ed.
2. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer (2013)
Online Resources:
https://www.researchgate.net/publication/294286311_Recommender_Systems_Introduction_and_Challenges

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	3	2
CO2	3	3	2								3	3	2
CO3	3	3	3	3	2						2	2	3
CO4	3	3	2								3	3	2
CO5	3	3	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				CO1: Understand	L2	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO11: Thumb rule	3 3 2 3
2				CO2: Apply	L3	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO11: Thumb rule	3 3 2 3
3				CO3: 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 2 2
4				CO4: Analyze	L4	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO11: Thumb rule	3 3 2 3
5				CO5: Understand	L2	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO11: Thumb rule	3 3 2 2

Justification Statements :

CO1:. Understand the basic concepts of recommender systems

Action Verb : Understand (L2)

PO1 Verb : Apply(L3)

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

PO2 Verb : Review(L2)
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high(3).
PO3 Verb : Develop(L3)
CO1 Action verb is less than PO3 verb by one level. Therefore the correlation is Moderate(2)
PO11: Thumb rule
Understanding the basic concepts of recommender systems is continuous activity. Therefore the correlation is high (3)

CO2: Apply the mathematical optimization techniques pertain to recommender systems.

Action Verb : Apply(L3)
PO1: Apply(L3)
CO2 Action verb is greater than PO1 verb. Therefore, the correlation is high (3)
PO2: Review(L2)
CO2 Action verb is same level as PO2 . Therefore, the correlation is high (3)
PO3: Develop(L3)
CO2 Action verb is less than PO3 verb by one level. Therefore, the correlation is moderate (2)
PO11: Thumb rule
Mathematical optimization techniques are needed to develop recommender systems . Therefore the correlation is high(3)

CO3:Evaluating the performance of recommender systems using Content-based recommendation.
Action Verb : Evaluate (L5)
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 level as 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 same level as PO4 verb. Therefore the correlation is high(3)
PO5: Apply(L3)
CO3 Action verb is less than PO5 verb by one level. Therefore the correlation is moderate(2)
PO11: Thumb rule
For evaluation of recommender systems various Classification algorithms are used. Therefore, the correlation is moderate (2)
CO4: Analyse the simple recommender system using Collaborative Filtering for hybridization design
Action Verb : Analyze (L4)
PO1: Apply(L3)
CO4 Action verb is greater than PO1 verb. 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 less than PO3 verb by one level. Therefore the correlation is moderate (2)
PO11: Thumb rule
the simple recommender system using Collaborative Filtering for hybridization design. Therefore the correlation is high(3)
CO5: understanding the advanced topics and current applications of recommended systems in real time applications
Action Verb : Understand (L2)
PO1: understand(L2)
CO5 Action verb is same 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)
CO5 Action verb is less than PO3 verb by one level. Therefore the correlation is moderate (2)
PO11: Thumb rule
For getting the real time applications advanced topics in recommended systems are used .Therefore the correlation is moderate(2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI&ML)

Course Code	Year & Sem	Reinforcement learning in AI	L	T/CLC	P	C
20APE3310	IV-I		3	0	0	3

Course Outcomes:

After studying the course, students will be able to

CO1: Understand the history and fundamentals of Reinforcement Learning research
CO2: Apply the various Tabular Solution Methods to Markov Reward Process Problems.
CO3: Apply the various Iterative Solution methods to Markov Decision Process Problems
CO4: Apply the Comprehend Functions using approximation methods to Machine Learning.
CO5: Understand the Model-based reinforcement learning is based on Policy Gradients.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the history and fundamentals of Reinforcement Learning research			L2
CO2	Apply	The various Tabular Solution Methods		To Markov Reward Process Problems	L3
CO3	Apply	The various Iterative Solution methods to Markov Decision Process Problems		To Markov Decision Process Problems	L3
CO4	Apply	the Comprehend Functions	using approximation methods	to Machine Learning.	L4
CO5	Understand	The Model-based reinforcement learning is based on Policy Gradients.			L2

UNIT - I	Introduction	9 Hrs
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		
UNIT - II	Markov Decision Process	9Hrs
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.		
UNIT - III	Monte Carlo Methods for Model Free Prediction and Control	9 Hrs
Monte Carlo Methods for Model Free Prediction and Control 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. TD Methods Incremental Monte Carlo Methods for Model Free Prediction, Overview TD(0), TD(1) and TD(λ), kstep estimators, unified view of DP, MC and TD evaluation methods, TD Control methods - SARSA, Q-Learning and their variants.		
UNIT - IV	Function Approximation Methods	9 Hrs
Getting started with the function approximation methods, Revisiting risk minimization, gradient descent from Machine Learning, Gradient MC and Semi-gradient TD(0) algorithms, Eligibility trace for function approximation, After states, Control with function approximation, Least squares, Experience replay in deep Q-Networks.		
UNIT - V	**ENSEMBLE METHODS**	9 Hrs
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, actor-critic methods		
Textbooks:		
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		

Reference Books:
1. Murphy, Kevin P. Machine learning: a probabilistic perspective. MIT press, 2012
Online Resources:
1. https://www.freecodecamp.org/news/a-brief-introduction-to-reinforcement-learning 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	3	3	3								3	3	2
CO2	3	2	2								2	3	3
CO3	3	3	3								3	2	2
CO4	3	3	2	2							3	3	2
CO5	3	3									2	2	2

Correlation matrix

Unit No.	CO				BTL	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				
1			3	CO1: Understand	L2	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO11: Thumb rule	3 3 3 3
2			2	CO2: Apply	L3	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO11: Thumb rule	3 2 2 2
3			3	CO3: Apply	L3	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO11: Thumb rule	3 3 3 3 3
4			3	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 2 2 3
5			3	CO1: Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	3 3 2

Justification Statements :

CO1:. Understand the history and fundamentals of Reinforcement Learning research
Action Verb : Understand (L2)
PO1 Verb : Apply(L3)
CO1 Action verb is same level as PO1 verb. Therefore, the correlation is high (3).
PO2 Verb : Review(L2)
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3).
PO3 Verb : Develop(L3)
CO1 Action verb is greater than PO3 verb. Therefore the correlation is high (3)
PO11: Thumb rule
The fundamentals of Reinforcement Learning is continuous activity. Therefore the correlation is high (3)

CO2: Apply the various Tabular Solution Methods to Markov Reward Process Problems.
Action Verb : Apply(L3)
PO1: Apply(L3)
CO2 Action verb is greater than 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 moderate (2)
PO3: Develop(L3)
CO2 Action verb is less than PO3 verb by one level. Therefore, the correlation is moderate (2)
PO11: Thumb rule
various Tabular Solution Methods are used to solve Markov Reward Process Problems. Therefore the correlation is high(2)

CO3: Apply the various Iterative Solution methods to Markov Decision Process Problems
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 level as 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)
PO11: Thumb rule
various Iterative Solution methods are used to solve Markov Decision Process Problems Therefore, the correlation is high (3)

CO4: Apply the Comprehend Functions using approximation methods to Machine Learning.
Action Verb : Apply (L3)
PO1: Apply(L3)
CO4 Action verb is greater than PO1 verb. 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 less than PO3 verb by one level. Therefore the correlation is moderate (2)
PO4: Analyze (L4)
CO4 Action verb is less than PO4 verb by one level. Therefore the correlation is moderate (2)
PO11: Thumb rule
Comprehend Function approximation methods to Machine Learning must be needed Therefore the correlation is high(3)

CO5: Understand the Model-based reinforcement learning based on Policy Gradients.
Action Verb : Understand (L2)
PO1: Apply(L3)
CO5 Action verb is same 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)
PO11: Thumb rule
The outcome of Model-based reinforcement learning is Policy Gradients .Therefore the correlation is moderate(2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI&ML)

Year: IV Semester: I Branch of Study: AI & ML

COURSE CODE	COURSE TITLE	L	T/CLC	P	CREDITS
20APE3311	Machine Learning for Unstructured Data (AIML)	3	0	0	0

Course Outcomes (CO):

After completion of the course, students will be able to

CO1: **Understand** the basic concepts of text mining techniques suitable for a given problem.

CO2: **Analyze** the different clustering algorithms and Categorization techniques.
CO3: **Apply** Preprocessing applications using Probabilistic models.

CO4: **Apply** visualization techniques to enhance browsing, query refinement of textual data in network structures
CO5: **Analyze** the text mining applications.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO 1	**Understand**	the basic concepts of text mining techniques suitable	for a given problem.		L2
CO 2	**Analyze**	the different clustering algorithms and categorization techniques.			L4
CO 3	**Apply**	Preprocessing applications		using probabilistic models.	L3
CO 4	**Apply**	visualization techniques		to enhance browsing, query refinement of textual data in network structures	L3
CO 5	**Analyze**	the text mining applications.			L4

UNIT - I Text Mining Core Text Mining Operations

Introduction to Text Mining: Defining Text Mining, General Architecture of Text Mining Systems, Core Text Mining Operations, Using Background Knowledge for Text Mining, Text Mining Query Languages, Task-Oriented Approaches, Further Reading

UNIT - II Categorization & Clustering

Introduction to Categorization: Applications of Text Categorization, Definition of the Problem, Document Representation, Knowledge Engineering Approach to TC, Machine Learning Approach to TC, Using Unlabelled Data to Improve Classification, Evaluation of Text Classifiers, Citations and Notes, Introduction to Clustering: Clustering Tasks in Text Analysis, The General Clustering Problem, Clustering Algorithms, Clustering of Textual Data, Citations and Notes

UNIT III Information Extraction & Probabilistic Models for Information Extraction

Introduction to Information Extraction: Introduction to Information Extraction, Historical Evolution of IE: The Message Understanding Conferences and Tipster, IE Examples, Architecture of IE Systems, Anaphora Resolution, Inductive Algorithms for IE, Structural IE, Introduction to Probabilistic Models for Information Extraction: Hidden Markov Models, Stochastic Context-Free Grammars, Maximal Entropy Modelling, Maximal Entropy Markov Models, Conditional Random Fields Introduction to Preprocessing Applications Using Probabilistic and Hybrid Approaches: Applications of HMM to Textual Analysis, Using MEMM for Information Extraction, Applications of CRFs to Textual Analysis, TEG: Using SCFG Rules for Hybrid Statistical– Knowledge-Based IE, Bootstrapping

UNIT - IV Presentation-Layer Considerations for Browsing and Query Refinement &Visualization Approaches

Introduction to Presentation-Layer Considerations for Browsing and Query Refinement: Browsing, Accessing Constraints and Simple Specification Filtersat the Presentation Layer, Accessing the Underlying Query Language, Citations and Notes Introduction to Visualization Approaches: Introduction, Architectural Considerations, Common Visualization Approaches for Text Mining, Visualization Techniques in Link Analysis, RealWorld Example: The Document Explorer System

UNIT - V Link Analysis & Text Mining Applications

Introduction to Link Analysis: Preliminaries, Automatic Layout of Networks, Paths and Cycles in Graphs, Centrality, Partitioning of Networks, Pattern Matching in Networks, Software Packages for Link Analysis Introduction to Text Mining Applications: General Considerations, Corporate Finance: Mining Industry Literature for Business Intelligence, A "Horizontal" Text Mining Application: Patent Analysis Solution Leveraging a Commercial Text Analytics Platform, Life Sciences Research: Mining Biological Pathway Information with Gene Ways.

Textbooks:

1. The Text Mining Hand Book, by Ronen Feldman, James Sanger, 2006

Reference Books:

1. Machine learning by Anuradha Srinivasa Raghavan,2019 Online Learning Resources:
2. ANN on Unstructured Data | Artificial Neural Network on Unstructured Data (analyticsvidhya.com)
3. Machine learning and unstructured data - Operationalizing Machine Learning Models Courser

Mapping of course outcomes with program outcomes

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

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

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 PO4	PO2 :Analyse (L4) PO4: Design (L6)	2 3
3	12	16	2	CO3 : Apply	L3	PO1 PO5 PO6 PO10	PO1: Apply(L3) PO5: Apply (L3) PO6: Thumb rule PO10: Thumb rule	3 3 1 2
4	13	18	2	CO4 : Apply	L3	PO1 PO5 PO6 PO10	PO1: Apply(L3) PO5:Apply (L3) PO6:Thumb rule PO10: Thumb rule	3 3 1 2
5	15	21	3	CO5 :Analyse	L4	PO2 PO4	PO2: Apply(L3) PO4: Design (L6)	3 3
	73	100 %						

Justification Statements:

CO1: Understand the basic concepts of text mining techniques suitable for a given problem.

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:Analyse (L4)

CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

CO2: Analyze the different clustering algorithms and Categorization techniques.

Action Verb: Analyse (L4)

PO2: Analyse (L4)

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

PO4: Design (L6)

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

CO3: Apply Preprocessing applications using Probabilistic models.

Action Verb : Analyse (L4)

PO1: Apply(L3)

CO4 Action verb is less than PO1 verb by two levels. 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

Apply reasoning informed by the contextual knowledge to assess probabilistic models. Therefore the correlation is low (1)

PO10: Thumb rule

Demonstrate knowledge and understanding of the pre-processing principles. Therefore the correlation is moderate (2).

CO4: Apply visualization techniques to enhance browsing, query refinement of textual data in network structures.

Action Verb: Apply (L3)
PO1: Apply(L3)
CO4 Action verb is less than PO1 verb by two levels. 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
Apply reasoning informed by the contextual knowledge to enhance network structures. Therefore the correlation is low (1)
PO10: Thumb rule
Demonstrate knowledge and understanding of the visualization techniques. Therefore the correlation is moderate (2).

CO5: Analyze the text mining applications.

Action Verb: Analyze (L5)
PO2: Apply (L3)
CO5 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO4: Design (L6)
CO5 Action verb is same level as PO4 verb. Therefore the correlation is high (3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI&ML)

Year: IV **Semester: I** **Branch of Study: AI & ML**

Course Code	Year & Sem		L	T/CLC	P	C
20APE3312	IV-I	Optimizing Techniques in AI	3	0	0	3

Course Outcomes:

After studying the course, students will be able to

CO1: Understand the key concepts and applications of various optimization techniques.

CO2: Apply the simplex multiples using graphical methods for two dimensional linear programming problems.

CO3: Apply the random search methods using Unrestricted search for non-linear programming problems.

CO4: Analyse the objective functions and constraints to solve real-life optimization problems.

CO5: understand the uncertainty under decision-making and self-training implementation.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the key concepts and applications of various optimization techniques.			L2
CO2	Apply	the simplex multiples	using graphical methods	For two dimensional linear programming problems	L3
CO3	Apply	The random search methods	using Unrestricted search	for non-linear programming problems	L3
CO4	Analyse	the objective functions and constraints		to solve real-life optimization problems	L4
CO5	understand	The uncertainty under decision-making and self-training implementation.			L2

UNIT – I	Optimization Problems	9 Hrs

Unsupervised Machine Learning & Deep Belief Principal component analysis, Introducing K-means clustering, and self-organizing maps. Deep Belief Networks: Neural networks – a primer, composition of a neural network, network topologies, Restricted Boltzmann Machine, Introducing the RBM, Applications of the RBM, Further applications of the RBM, Deep belief Networks-Training a DBN, Applying the DBN, Validating the DBN

UNIT – II	Graphical methods for linear programming	9Hrs

Graphical method for two dimensional problems, central problems of Linear Programming Definitions – Simples – Algorithm – Phase I and II of simplex Method – Revised Simplex Method. Simplex Multipliers, Dual and Primal Dual Simplex Method Sensitivity Analysis Transportation problem and its solution – Assignment problem and its solution – Assignment problem and its solution by Hungarian method Karmakar's method statement, Conversion of the Linear Programming problem into the required form

UNIT – III	NONLINEAR PROGRAMMING	9 Hrs

NONLINEAR PROGRAMMING (ONE DIMENSIONAL MINIMIZATION: Introduction Unrestricted search – Exhaustive search – interval halving method – Fibonacci method. NONLINEAR PROGRAMMING: Introduction– Random search method – Un variate method Pattern search methods Hooke and Jeeves method, simplex method Gradient of a function – steepest descent method – Conjugate gradient method NONLINEAR PROGRAMMING – (CONSTRAINED OPTIMIZATION): Introduction – Characteristics of the problem – Random search method – Conjugate gradient method

UNIT – IV	DYNAMIC PROGRAMMING	9 Hrs

DYNAMIC PROGRAMMING: Introduction, multistage decision processes, Principles of optimality Computation procedures.

UNIT – V	DECISION MAKING	9 Hrs

information Decisions under uncertainty, certainty and risk – Decision trees – Expected Value of

perfect information and imperfect information, supervised algorithms, Semi-supervised algorithms, Self-training, implementing self-training implementation, Contrastive Pessimistic Likelihood Estimation
Textbooks:
1. Kalynamoy Deb, "Optimization for Engineering Design, Algorithms and Examples", Prentice Hall, 2004. 2. Hamdy A Taha, "Operations Research – An introduction", Pearson Education, 2002.
Reference Books:
1. Hillier / Lieberman, "Introduction to Operations Research", Tata McGraw Hill Publishing company Ltd, 2002.
Online Resources:
https://www.quora.com/induction to operational research

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	2	2
CO2	3	3	3								3	2	3
CO3	3	3	2	3	2						2	2	3
CO4	3	3									2	2	2
CO5	2	3	2	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			3	CO1: Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	3 3 2
2			3	CO2: Apply	L3	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO11: Thumb rule	3 3 3 3
3			2	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 2 3 2 2
4			3	CO4: Analyse	L4	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	3 3 2
5			3	CO4: Understand	L4	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO11: Thumb rule	2 3 2 3 3

Justification Statements :
CO1: Understand the key concepts and applications of various optimization techniques.
Action Verb : Understand (L2)
PO1 Verb : Apply(L3)

CO1 Action verb is same level as 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).
PO11: Thumb rule
The fundamentals of key concepts and applications in various optimization techniques. is needed. Therefore the correlation is high (2)

CO2: Apply the simplex multiples using graphical methods for two dimensional linear programming problems
Action Verb : Apply(L3)
PO1: Apply(L3)
CO2 Action verb is greater than PO1 verb. 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 less than PO3 verb by level . Therefore, the correlation is high (3)
PO11: Thumb rule
To solve linear programming problems simplex multipliers are used. Therefore the correlation is moderate(2)

CO3: Apply the random search methods using Unrestricted search for non-linear programming problems.
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 level as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO3 Action verb is less than PO3 verb by one level. Therefore the correlation is moderate (2)
PO4: Analyze (L4)
CO3 Action verb is greater than PO4 verb. Therefore the correlation is high (3)
PO5: Apply(L3)
CO3 Action verb is less than PO5 verb by one level. Therefore the correlation is moderate (2)
PO11: Thumb rule
To solve non-linear programming problems random search methods are used. Therefore, the correlation is moderate (2)

CO4: Analyse the objective functions and constraints to solve real-life optimization problems.
Action Verb : Analyse(L4)
PO1: Apply(L3)
CO4 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO2: Review(L2)
CO4 Action verb is greater than PO2 verb. Therefore the correlation is high(3)
PO11: Thumb rule
the objective functions and constraints are used to solve real-life optimization problems. Therefore the correlation is moderate (2)
CO5: understand the uncertainty under decision-making and self-training implementation.
Action Verb : understand(L2)
PO1: Apply(L3)
CO5 Action verb is less than PO1 verb by one level. Therefore the correlation is moderate(2)
PO2: Review (L2)
CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO5 Action verb is less than PO3 verb by one level. Therefore the correlation is moderate (2)
PO4: Analyze (L4)
CO5 Action verb is same as PO4 verb. Therefore the correlation is high (3)
PO11: Thumb rule
Uncertainty problems are solved under decision-making and self-training implementation. Therefore the correlation is high(3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI&ML)

Year: IV **Semester: I** **Branch of Study: AIML**

Course Code	Year & Sem		L	T/CLC	P	C
20APE3313	IV-I	**AI For IMAGE ANALYSIS**	3	0	0	3

Course Outcomes:

After Studying the Course, student will be able to

CO1: Understand the concepts of image formation to perform 3-D Images Operations.
CO2: Understand the image Processing Methods, colors spaces to perform Advanced Images.
CO3: Analyze the python concepts scikit image using transformation techniques.
CO4: Apply the Open CV for Advanced image Processing.
CO5: Apply the machine learning and real time use cases for image processing.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the concepts of image formation		to Perform 3-D Images Operations	L2
CO2	**Understand**	the image Processing Methods, colors spaces		to perform Advanced Images.	L2
CO3	**Analysis**	the python concepts scikit image	using transformation techniques		L4
CO4	**Apply**	the Open CV		for Advanced image Processing	L3
CO5	**Apply**	the machine learning and real time use cases		for image processing.	L3

UNIT – I	**Image Formation& 3-D Imaging**

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

UNIT – II	**Image Processing**

Introduction to Image Processing: Images, Pixels, Image Resolution, PPI and DPI, Bitmap Images, Lossless Compression, Lossy Compression, Image File Formats, **Color Spaces:** RGB, XYZ, HSV/HSL, LAB, LCH, YPbPr, YUV, YIQ,

Advanced Image Concepts: Bezire Curve, Ellipsoid, Gamma Correction, Structural Similarity Index, Deconvolution, Homography, Convolution

UNIT – III	**Basics of Python and Scikit Image**

Basics of Python:

Variables and Data Types, Data Structures, Control Flow Statements, Conditional Statements, Functions.

Scikit Image:

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.

UNIT – IV	**Advanced Image Processing Using Open CV**

Blending Two Images, Changing Contrast and Brightness, Adding Text to Images,

Smoothing Images: Median Filter, Gaussian Filter, Bilateral Filter. Changing the Shape of Images, Effecting Image Thresholding, Calculating Gradients, Performing Histogram Equalization

UNIT – V	**Image Processing Using Machine Learning & Real-Time Use Cases**

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 **Introduction to Real-Time Use Cases**: Finding Palm Lines, Detecting Faces, Recognizing Faces, Tracking Movements, Detecting Lanes
Textbooks:
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1						2					
CO2	2	1						2					
CO3	3		3		1			3	3	3			
CO4	3		2					3	2	2	2		
CO5	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	CO1: Understand	L2	PO1 PO2 PO8	PO1: Apply(L3) PO2: Analysis(L4) PO8: Thumb Rule	2 1 2
2	CO2: Understand	L2	PO1 PO3 PO8	PO1: Apply(L3) PO3: Analysis(L4) PO8: Thumb Rule	2 1 2
3	CO3: 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	CO4: 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	CO5: 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:

CO1: Understand the concepts of image formation to perform 3-D Images Operations.
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: Analyze(L4)
CO1 Action verb is less than PO2 verb by two levels. Therefore, the correlation is low (1)
PO8: Thumb Rule
CO1 Using 3-D Imaging, therefore the correlation is moderate (2)
CO2: Understand the image Processing Methods, colors spaces to perform Advanced Images.
Action Verb: understand (L2)
PO1: Apply (L3)
CO2 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2: Analyze(L4)
CO2 Action verb is less than PO2 verb by two level. Therefore, the correlation is low (1)
PO8: Thumb rule

CO2 Using Color Spaces like RGB,XYZ, therefore the correlation is moderate (2)
CO3: Analyze the python concepts scikit image using transformation techniques.
Action Verb: Analyze(L4)
PO1: Apply (L3)
CO3 Action verb is more than PO1 verb. Therefore, the correlation is high (3)
PO3: Analysis(L4)
CO3 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO5: Create(L6)
CO3 Action verb is less than as PO5 verb by two levels. Therefore, the correlation is low (1)
PO8: Thumb rule
CO3 Scikit Image: Uploading and Viewing an Image, Getting Image Resolution, Looking at Pixel Values, Converting Color Space, therefore the correlation is high (3)
PO9: Thumb rule
CO3 Scikit Image creating, therefore the correlation is high (3)
PO10: Thumb rule
CO3 Designing Scikit Image using python Programming, therefore the correlation is high (3)
CO4: Apply the Open CV for Advanced image Processing.
Action Verb: Apply(L3)
PO1: Apply (L3)
CO4 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO3: Analysis(L4)
CO4 Action verb is less than PO3 verb by one level. Therefore, the correlation is moderate (2)
PO8: Thumb rule
CO4 Using Smoothing techniques Blending Two Images, therefore the correlation is moderate (2)
PO9: Thumb rule
CO4 Using Smoothing techniques, therefore the correlation is moderate (2)
PO10: Thumb rule
CO4 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)
PO11: Thumb rule
CO4 Using Performing Histogram Equalization Techniques, Median Filter, Gaussian Filter, therefore the correlation is moderate (2)
CO5: Apply the machine learning and real time use cases for image processing.
Action Verb: Apply(L3)
PO1: Apply (L3)
CO5 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO3: Analyze(L4)
CO5 Action verb is less than PO3 verb by one level. Therefore, the correlation is moderate (2)
PO4: Analysis(L4)
CO5 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderatev(2)
PO8: Thumb rule
CO5 Classification Using CNNs, therefore the correlation is moderate (2)
PO9: Thumb rule
CO5 Creating HTML and CSS programs, therefore the correlation is moderate (2)
PO10: Thumbrule
CO5 Using Image Classification Using Machine Learning Approaches, therefore the correlation is moderate (2)
PO11: Thumbrule
CO5 Using Real-Time Use Cases, therefore the correlation is moderate (2)

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI&ML)

Year: IV **Semester: I** **Branch of Study: AI & ML**

Course Code	Year & Sem		L	T/CLC	P	C
20APE3314	IV-I	**Intelligent information retrieval system**	3	0	0	3

Course Outcomes:

After studying the course, students will be able to

CO1: Understand the fundamentals of the Boolean Model, Vector Space Model, and Probabilistic Model.

CO2: Apply the Indexing process using retrieval utilities and Cataloguing Indexing for file structures.

CO3: Understand the cross-language information retrieval with Automatic Indexing.

CO4: Apply the clustering for searching Information Visualization.

CO5: Apply the Text Search Algorithms, Multimedia Information Retrieval, and Information System for searching

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The fundamentals of the Boolean Model, Vector Space Model, and Probabilistic Model.			L2
CO2	Analyze	The Indexing process	Using retrieval utilities and Cataloguing Indexing	for file structures	L4
CO3	Understand	the cross-language information retrieval with Automatic Indexing.			L2
CO4	Apply	the clustering		for searching Information Visualization	L3
CO5	Apply	the Text Search Algorithms, Multimedia Information Retrieval techniques for searching		for searching	L3

UNIT - I	Introduction to Information Retrieval Systems	9 Hrs

Definition of Information Retrieval System ,Objectives of Information Retrieval Systems, FunctionalOverview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses.

Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities

UNIT - II	Cataloguing and Indexing	9Hrs

History and objectives of Indexing, Indexing Process, Automatic Indexing, and Information extraction.

Data structure:

Introduction to Data Structure, Stemming Algorithms, Inverted File Structure, N-Gram DataStructures PAT Data Structure, Signature File Structure, Hypertext and XML Data Structures,

Hidden Markov Models.

UNIT - III	Automatic Indexing	9 Hrs

Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, HypertextLinkages.

Document and Term Clustering:

Introduction to Clustering, Thesaurus Generation, Manual Clustering Automatic Term Clustering, Complete Term Relation Method, Clustering Using Existing Clusters, One Pass Assignments, Item Clustering, hierarchy of Clusters.

UNIT - IV	Automatic Indexing and Information visualization	9 Hrs

Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the INTERNET and Hypertext, Clustering.

Information visualization:

Introduction to Information Visualization, Cognition and Perception, Information Visualization Technologies.

UNIT - V	Text Search Algorithms, Multimedia Information Retrieval, Information	9 Hrs

	System Evaluation	

Text Search Algorithms:

Introduction to Text Search techniques, software Text Search algorithms, a n d Hardware Text Search Systems.

Multimedia Information Retrieval:

Spoken Language Audio Retrieval, Non-Speech Audio Retrieval, Graph retrieval, Imagery Retrieval,Video Retrieval.

Information System Evaluation:

Introduction to Information System Evaluation, Measures Used in System Evaluation, Measurement Example- TREC results

Textbooks:

Information Storage and Retrieval Systems: Theory and Implementation by Gerald J. Kowalski, Mark T. Maybury, Springer, 2013.

Reference Books:

1. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.
2. Modern Information Retrieval by Yates Pearson Education. 3. Information Storage & Retrieval by Robert Korfhage – John Wiley & Sons.

Online Resources:

https://www.quora.com/What-are-the-best-resources-to-learn-Intelligent -inf-retrieval system

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3								3	3	2
CO2	3	2	2								3	3	2
CO3	3	3		3							2	2	3
CO4	3	3		3							2	3	2
CO5	2	3	2	2	3						2	2	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			3	CO1: Understand	L2	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO11: Thumb rule	3 3 2 3
2			3	CO2: Analyse	L4	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO11: Thumb rule	3 2 2 3
3			3	CO3: Understand	L2	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Review(L2) PO4: Analyze (L4) PO11: Thumb rule	3 3 3 2
4			3	CO4: Apply	L3	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Review(L2) PO4: Analyze (L4) PO11: Thumb rule	3 3 3 2
5			2	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	2 3 2 2 3 2

Justification Statements :

CO1:. Understand the fundamentals of the Boolean Model, Vector Space Model, and Probabilistic Model.
Action Verb : Understand (L2)
PO1 Verb : Apply(L3)
CO1 Action verb is same level as PO1 verb. Therefore, the correlation is high(3).
PO2 Verb : Review(L2)
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high(3).
PO3 Verb : Develop(L3)
CO1 Action verb is less than PO3 verb by one level. Therefore the correlation is Moderate(2)
PO11: Thumb rule
The fundamentals of the Boolean Model, Vector Space Model, and Probabilistic Model is continuously needed. Therefore the correlation is high (3)

CO2: Apply the Indexing process using retrieval utilities and Cataloguing Indexing for file structures.
Action Verb : Apply (L3)
PO1: Apply(L3)
CO2 Action verb is greater than 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 moderate (2)
PO3: Develop(L3)
CO2 Action verb is less than PO3 verb by one level. Therefore, the correlation is moderate (2)
PO11: Thumb rule
retrieval utilities and Cataloguing and Indexing are used for algorithms. Therefore the correlation is high(3)

CO3: Understand the cross-language information retrieval with Automatic Indexing.
Action Verb : understand (L2)
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 level as PO2 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is greater than PO4 verb. Therefore the correlation is high(3)
PO11: Thumb rule
on the implementation of cross-language information retrieval, automatic indexing is used. Therefore, the correlation is moderate (2)

CO4: Apply the clustering for searching Information Visualization Technologies.
Action Verb : Apply (L4)
PO1: Apply(L3)
CO4 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO2: Review(L2)
CO4 Action verb is greater than PO2 verb. Therefore the correlation is high(3)
PO4: Analyze (L4)
CO3 Action verb is greater than PO4 verb. Therefore the correlation is high(3)
PO11: Thumb rule
In Intelligent information retrieval system searching is possible through clustering. Therefore the correlation is high(3)

CO5: Apply the Text Search Algorithms, Multimedia Information Retrieval, and Information System for searching
Action Verb : Apply(L3)
PO1: Apply(L3)

CO5 Action verb is same 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)

CO5 Action verb is less than PO3 verb by one level. Therefore the correlation is moderate (2).

PO4: Analyze (L4)

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

PO5: Apply(L3)

CO5 Action verb is greater than PO5 verb. Therefore the correlation is high (3).

PO11: Thumb rule

The efficiency of Intelligent information retrieval system is obtained through text search algorithms and multimedia information retrieval system . Therefore the correlation is moderate(2).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI&ML)

Year: IV **Semester: I** **Branch of Study: AI & ML**

COURSE CODE	COURSE TITLE	L	T/CLC	P	CREDITS
20APE3315	GENERATIVE AI	4	2	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the basic concepts of artificial intelligence and intelligent agents

CO2: **Analyze** the generative text and chat bot applications.

CO3: **Apply** the generative image concepts to perform image sourcing and generation.

CO4: **Apply** the different generative video tools to perform video making.

CO5: **Analyze** the GAN and LLM Architectures for language models.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The basics concepts of artificial intelligence and intelligent agents			L2
CO2	Analyze	the different Artificial Intelligence applications.			L4
CO3	Apply	the generative image concepts		to perform image sourcing and generation.	L3
CO4	Apply	the different generative video tools		to perform video making.	L3
CO5	Analyze	the GAN and LLM Architectures		for language models.	L4

UNIT - 1: **12Hrs**

Introduction to AI, Definition, Foundations & History of AI, Intelligent agent & it's types, Good behavior, AI tools for processing

UNIT - 2: **12Hrs**

Generative text , Introduction to AI chatbots, Popular AI chatbots, ChatGPT & use cases of ChatGPT for various users

UNIT - 3: **12Hrs**

Introduction to Image sourcing & image generation, Role of AI in image generation, popular AI tools for image generation, mid-journey for image generation, working of mid-journey

UNIT - 4: **15Hrs**

Generative videos, AI tools in video making, Popular AI video makers, Benefits of AI video makers, Introduction to syntheria, features & working syntheria

UNIT - 5: **12Hrs**

Transformers & LLM, GAN Architecture , use cases & various models for NLP,

Security : Security , Ethics – Privacy and security , Privacy – **P**reserving , Generative models , Impact of generative AI on society , Accountability & responsibility .

Text Books:

1. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville.
2. "Generative Deep Learning" by David Foster.

Reference Books:

1. Research papers from conferences like NeurIPS, ICML, and CVPR.
2. Online tutorials and documentation from TensorFlow, PyTorch, etc.
3. Blogs and articles from reputable sources like OpenAI and Distill.

Mapping of course outcomes with program outcomes

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

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

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				CO1 :Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2				CO2 :Analyze	L4	PO1 PO3 PO5 PO9 PO11	PO1: Apply(L3) PO3: Develop (L3) PO5:Apply(L3) PO9:Thumb rule PO11:Thumb rule	2 2 2 3 3
3				CO3 : Apply	L3	PO1 PO3 PO5 PO9 PO11	PO1: Apply(L3) PO3: Develop (L3) PO5:Apply(L3) PO9:Thumb rule PO11:Thumb rule	3 3 3 2 2
4				CO4 :Apply	L3	PO1 PO3 PO5 PO11	PO1: Apply(L3) PO3: Develop (L3) PO5:Apply(L3) PO11:Thumb rule	3 3 3 2
5				CO5 :Analyze	L4	PO1 PO3 PO5 PO9 PO11	PO1: Apply(L3) PO3: Develop (L3) PO5:Apply(L3) PO9:Thumb rule PO11:Thumb rule	2 2 2 3 3

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 moderate (2)

PO2 : **Review(L2)**

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

CO2: Analyze various practical use cases of ChatGPT, using its applications in customer support and more.

Action Verb : Analyze (L4)

PO1: Apply(L3)

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

PO3: Develop (L3)

CO2 Action verb is less than as PO3 verb by one level. Therefore the correlation is moderate (2)

PO5:Apply(L3)

CO2 Action verb is less than as PO5 verb by one level. Therefore the correlation is moderate (2)

PO9:Thumb rule

For communicating system through the text and chat bot applications therefore the correlation is High(3)

PO11:Thumb rule

For some of text and chat bot applications are used to communicate the system. There for the correlation is High(3)

CO3: Apply the generative image concepts to perform image sourcing and generation.
Action Verb : Apply (L3)

PO1: Apply(L3)

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

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)

PO9:Thumb rule

For communicating system through the text and chat bot applications therefore the correlation is moderate(2)

PO11:Thumb rule

The Generative image concepts to perform image sourcing and generating images this concepts are used for life long learning. Therefore the correlation is moderate(2)

CO4: Apply the different generative video tools to perform video making.
Action Verb : Apply (L3)

PO1: Apply(L3)

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

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

The Generative video tools are used for making videos to learning life long learning . Therefore the correlation is moderate(2)

CO5: Analyze the GAN and LLM Architectures for language models.
Action Verb : Analyze(L4)

PO1: Apply(L3)

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

PO3: Develop (L3)

CO2 Action verb is less than as PO3 verb by one level. Therefore the correlation is moderate (2)

PO5:Apply(L3)

CO2 Action verb is less than as PO3 verb by one level. Therefore the correlation is moderate (2)

PO9:Thumb rule

For communicating system through the text and chat bot applications therefore the correlation is High(3)

PO11:Thumb rule

The GAN and LLM architecture concepts are life long learning concepts for understanding the language models. Therefore the correlation is High(3)

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Year: IV **Semester: I** **Branch of Study: AIML**

Course Code	Year & Sem		L	T/CLC	P	C
20APE3316	IV-I	DATA ANALYTICS	4	2	0	3

Course Outcomes:

After Studying the Course, student will be able to

CO1: **Understand** the basic concepts of R programming to perform statistical analysis.

CO2: **Analyze** the Data Analytics by using Machine Learning algorithms like regression, multiple linear regression for estimation.

CO3: **Apply** the linear model framework for Data Analytics using regression, linear models.

CO4: **Evaluate** the simulation methods, optimization methods, forecasting analysis and survival analysis by using case studies.

CO5: **Apply** the various analytics for real time applications.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the basic concepts of R programming		to perform statistical analysis.	L2
CO2	Analyze	the Data Analytics	By using Machine Learning algorithms like regression, multiple linear regression.	For estimation	L4
CO3	Apply	the linear model framework	By using regression, linear models	for Data Analytics	L3
CO4	Evaluate	the simulation methods, optimization methods, forecasting analysis and survival analysis	By using case studies		L5
CO5	Apply	The various analytics		for real time applications.	L3

UNIT – I	An overview of R	10 Hrs

An overview of R, 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

UNIT – II	Basic concepts of estimation	9 Hrs

Basic concepts of estimation, 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.

UNIT – III	Exploiting the linear model framework	9 Hrs

Exploiting the linear model framework: 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.

UNIT – IV	Simulation	8 Hrs

Simulation - 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

UNIT – V	Applications	9 Hrs
Applications: Retail Analytics, Marketing Analytics, Financial Analytics, Social Media and Web Analytics, Healthcare Analytics		
Textbooks:		
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, https://doi.org/10.1007/978-3-319-68837-4		
Reference Books:		
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
CO1	2	1											
CO2	3	3				3					3		
CO3	3	2				2						2	
CO4	3	3	2	2	2		3					2	
CO5	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	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 PO7	PO1: Apply(L3) PO2: Analyze(L4) PO3: Design (L6) PO4: Design (L6) PO5: Create(L6) PO7: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:

CO1: Understand the basic concepts of R programming

Action Verb: Understand (L2)

PO1: Apply (L3)

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

PO2: Analyze (L4)

CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

CO2: Analyze the Data Analytics by using Machine Learning algorithms like regression, multiple linear regression for estimation.

Action Verb: Analyze (L4)

PO1: Apply (L3)

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

PO2: Analyze (L4)

CO2 Action verb is same as PO2 verb . Therefore the correlation is high(3)

PO6: Thumb rule

By using estimation concepts, the programmers are able to solve engineering problems using machine learning algorithms. Therefore the correlation is high(3)

PO11: Thumb rule

Data Analytics estimation concepts are used for solving complex problems. Therefore the correlation is high(3)

CO3: Apply the linear model framework for Data Analytics using regression, linear models.

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)

PO11: Thumb rule

Linear models are used to create framework for generating hypotheses Therefore the correlation is moderate (2)

CO4: Evaluate the simulation methods, optimization methods, forecasting analysis and survival analysis by using case studies.

Action Verb : Evaluate(L5)

PO1: Apply(L3)

CO4 Action verb is greater than PO1 verb. Therefore the correlation is high (3)

PO2: Analyze (L4)

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

PO3: Design (L6)

CO4 Action verb is less than PO3 verb by one level. Therefore the correlation is moderate (2)

PO4: Design (L6)

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

PO5: Create(L6)

CO4 Action verb is less than PO5 verb by one level. Therefore the correlation is moderate (2)

PO7: Thumb rule

Since ethical principles shall be followed in performing simulation, optimization and analysis. Therefore the correlation is high(3)

CO5: Apply the various analytics for real time applications.

Action Verb: Apply (L3)

PO1: Apply (L3)

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

PO2: Analyze (L4)

CO5 Action verb is less than PO2 verb by one level. Therefore the correlation is moderate (2)

PO11: Thumb rule

For real time applications, Data Analytics concepts are used. Therefore the correlation is moderate (2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI&ML)

Year: IV **Semester: I** **Branch of Study: AIML**

Course Code	Year & Sem	SOFTWARE PROJECT MANAGEMENT	L	T/CLC	P	C
20APE3317	IV-I		3	0	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

UNIT – I	Conventional Software Management	9 Hrs
Conventional Software Management: The waterfall model, conventional software Management performance. Evolution of Software Economics: Software Economics, pragmatic software cost estimation		
UNIT – II	**Improving Software Economics**	9 Hrs
Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections. **The old way and the new:** The principles of conventional software engineering, principles of modern software management, transitioning to an iterative process		
UNIT – III	**Life cycle phases**	9 Hrs
Life cycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases. **Artifacts of the process:** The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts. Model based software architectures: A Management perspective and technical perspective.		
UNIT – IV	**Work Flows of the process**	9 Hrs
Work Flows of the process: Software process workflows, Inter Trans workflows. Checkpoints of the Process: Major Mile Stones, Minor Milestones, Periodic status assessments. **Iterative Process Planning:** Work breakdown structures, planning guidelines, cost and schedule estimating, Interaction planning process, Pragmatic planning. **Project Organizations and Responsibilities:** Line-of-Business Organizations, Project Organizations, evolution of Organizations. Process Automation: Automation Building Blocks, The Project Environment		
UNIT – V	**Project Control and Process instrumentation**	9 Hrs
Project Control and Process instrumentation: The server care Metrics, Management indicators, quality indicators, life cycle expectations pragmatic Software Metrics, Metrics automation. **Tailoring the Process:** Process discriminates, Example. Future Software Project Management: Modern Project Profiles Next generation Software economics, modern Process transitions. **Case Study:** The Command Center Processing and Display System-Replacement (CCPDS-R)		

Textbooks:

1. Software Project Management, Walker Royce, Pearson Education.
2. Software Project Management, Bob Hughes & Mike Cotterell, fourth edition,Tata Mc- Graw Hill

Reference Books:

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 Managent, 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 PO8 PO10	PO1: Apply(L3) PO2: Analyze (L4) PO3:Apply(L3) PO8: Thumb rule PO10: Thumb rule	3 3 3 3 3
3	CO3 : Analyze	L4	PO1 PO2 PO8 PO10	PO1: Apply(L3) PO2: Identify (L3) PO8: Thumb rule PO10: Thumb rule	3 3 3 3
4	CO4 : Analyze	L4	PO1 PO2 PO4 PO8 PO10	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze (L4) PO8: Thumb rule PO10: Thumb rule	3 3 3 3 3
5	CO5 : Apply	L3	PO1 PO2 PO4 PO10	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze (L4) PO10: 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)
PO8: Thumb rule
To evaluate the economics for improving software project quality, teamwork and individual performance is required. Therefore the correlation is high(3)
PO10: 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).
CO3: Analyze the phases and process of software project management life cycle

Action Verb : Analyze (L4)

PO1: Apply(L3)
CO3 Action verb is more than PO1 verb. Therefore the correlation is high (3)
PO2: Identify (L3)
CO3 Action verb is more than PO2 verb. Therefore the correlation is high (3)
PO8: 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)
PO10: 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)

CO4: Analyze process workflows and responsibilities

Action Verb : Analyze(L4)

PO1: Apply(L3)
CO4 Action verb is more than PO1 verb. Therefore the correlation is high (3)
PO2: Identify (L3)
CO4 Action verb is more than PO2 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO4 Action verb is same as PO4 verb. Therefore the correlation is high (3)
PO8: Thumb rule
To analyze process workflows and responsibilities, teamwork and individual performance is required. Therefore the correlation is high(3).
PO10: Thumb rule
To analyze process workflows and responsibilities, knowledge on projects and management principles are required. Therefore the correlation is high(3).

CO5: Apply process control and instrumentation for CCPDS-R

Action Verb : Apply (L3)

PO1: Apply(L3)
CO5 Action verb is same as PO1 verb. Therefore the correlation is high (3)
PO2: Identify (L3)
CO5 Action verb is same as PO2 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)
PO10: 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).

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Year: IV **Semester: I** **Branch of Study: AIML**

Course Code	Year & Sem		L	T/CLC	P	C
20APE3318	IV-I	**Linux Environment System**	3	0	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

UNIT – I	INTRODUCTION TO LINUX OPERATING SYSTEM	9 Hrs

INTRODUCTION TO LINUX OPERATING SYSTEM: 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.

UNIT – II	INSTALLING LINUX AS A SERVER	9 Hrs

INSTALLING LINUX AS A SERVER : 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;).

INSTALLING LINUX IN A SERVER CONFIGUARTION : Before Installation; Hardware; Server Design ;Dual-Booting Issues; Modes of Installation; Installing Fedora Linux; Creating a Boot Disk; Starting the Installation; **GNOME AND KDE:** The History of X Windows; The Downside; Enter GNOME; About GNOME ; Starting X Windows and GNOME; GNOME Basics; The GNOME Configuration Tool.

UNIT – III	INSTALLING SOFTWARE	9 Hrs

INSTALLING SOFTWARE : 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. MANAGING USERS: Home Directories ;Passwords; Shells; Stratup 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.

UNIT – IV	THE COMMAND LINE	9Hrs

THE COMMAND LINE : 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.

UNIT – V	FILE SYSTEMS	9 Hrs

FILE SYSTEMS: The Makeup File Systems; Managing File Systems; Adding and Partitioning a Disk; Network File S ystems; Quota Management; CORE SYSTEM SERVICES: The init Service; The inetd and xinetd Processess; 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 8th 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 8th 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 :

CO1: Understand the introductory concepts of LINUX operating 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)
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high(3)

CO2: Analyze the procedure to install LINUX operating system.
Action Verb : Analyze (L4)
PO1: Apply(L3)
CO2 Action verb is greater than PO1 verb. Therefore, the correlation is high (3)
PO2: Review(L2)
CO2 Action verb is greater than PO2 verb. Therefore, the correlation is high(3)
PO11: Thumb rule
Installations of operating systems are a continuous activity. Therefore the correlation is medium (2)

CO3: Apply the procedure to configure various privileges for the user and system.
Action Verb : Apply (L3)
PO1: Apply(L3)
CO3 Action verb is same level as of PO1 verb. Therefore, the correlation is High (3)
PO2: Review (L2)
CO3 Action verb is greater level as PO2 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is medium(2)
PO5: Apply(L3)
CO3 Action verb is same level as PO5 verb. Therefore the correlation is high(3)

CO4: Analyze the various commands through console window.
Action Verb : Analyze (L4)
PO1: Apply(L3)
CO4 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO2: Review(L2)
CO4 Action verb is greater than PO2 verb. Therefore the correlation is high(3)
PO11: Thumb rule
Various commands using console window useful in future enhancements. Therefore the correlation is medium(2)

CO5: Evaluate the file system services in real time applications.
Action Verb : Evaluate (L5)
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 greater than PO4 verb. Therefore the correlation is high(3)
PO5: Apply(L3)
CO5 Action verb is greater than PO5 verb. Therefore the correlation is high (3)
PO11: 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 MACHINE LEARNING (AI&ML)

Year: IV **Semester: I** **Branch of Study: AIML**

Course Code	Year & Sem		L	T/CLC	P	C
20AOE3301	IV-I	**Information Retrieval Techniques**	3	0	0	3

Course Outcomes:

After Studying the Course, student will be able to

CO1: Understand the information retrieval search engine framework and explore its capabilities.
CO2: Understand different models to acquire knowledge and pre-processing of web page.
CO3: Analyze appropriate methods of classification or clustering.
CO4: Design the web retrieval using search engines.
CO5: Analyze different techniques of recommender system.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	Utilize the information of retrieval models		Search Engine Framework	L2
CO2	Understand	document vector space and probabilistic models		Web Page	L2
CO3	Analyze	Various supervised and un supervised learning methods		Machine Learning Algorithms	L4
CO4	Design	Operate on various search engine systems	Search Engines		L4
CO5	Analyze	To understand search engine functionality	Data Models		L4

UNIT – I	**Information Retrieval**	**9 Hrs**
Information Retrieval – 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.		
UNIT - II	**MODELING AND RETRIEVAL EVALUATION**	**9Hrs**
MODELING AND RETRIEVAL EVALUATION : 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.		
UNIT - III	**TEXT CLASSIFICATION AND CLUSTERING**	**9 Hrs**
TEXT CLASSIFICATION AND CLUSTERING: 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.		
UNIT - IV	**WEB RETRIEVAL AND WEB CRAWLING**	**9 Hrs**
WEB RETRIEVAL AND WEB CRAWLING: 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.		
UNIT – V	**RECOMMENDER SYSTEM**	**9 Hrs**
RECOMMENDER SYSTEM : 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.		
Textbooks:		

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 PO8	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze(L4) PO8: 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 PO7 PO11	PO2: Formulate(L6) PO3: Design (L6) PO4: Analyze(L4) PO6: Thumb rule PO7: 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)

CO3: Analyze appropriate methods of classification or clustering. Action Verb : Analyze (L4)

PO1: Apply(L3)

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

PO2: Identify (L3)

CO3 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)

PO4: Analyze (L4)

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

PO5: Create(L6)

CO3 Action verb is less than PO5 verb by two levels. Therefore the correlation is low (1)

PO8 : Thumb rule

Finding solution to real world problems. Hence the correlation is low (1)

CO4: Design the web retrieval using search engines.

Action Verb: Design (L6)

PO1 Verb : Apply(L3)

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

PO3: Design (L6)

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

PO4: Interpret (L5)

CO4 Action verb is greater than PO4 verb by one level. Therefore the correlation is high(3)

CO5: Analyze different techniques of recommender system.

Action Verb : Analyze (L4)

PO2: Formulate (L6)

CO5 Action verb is less than two levels as PO2 verb. Therefore the correlation is low(1)

PO3: Design (L6)

CO5 Action verb is less than two levels as PO2 verb. Therefore the correlation is low(1)

PO4: Analyze (L4)

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

PO6 : Thumb rule

Since ethical principles should be followed to create a recommender systems and services to users. Therefore the correlation is low(1)

PO7 : Thumb rule

Team work is required between recommender system users and providers. Hence the correlation is low (1)

PO11: Thumb rule

For some of real world applications we use recommender systems to provide services. Therefore the correlation is low (1)

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI&ML)

Year: IV **Semester: I** **Branch of Study: AIML**

Course Code	Year & Sem		L	T/CLC	P	C
20AOE3302	IV-I	**Soft Computing**	3	0	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the paradigms of soft computing techniques to make intelligent Systems
CO2: **Understand** the common algorithms to discover hidden patterns or data groupings without the need for human intervention
CO3: **Apply** the encoding techniques (binary, real-valued, permutation) for representing solutions in genetic algorithms
CO4: **Apply** the fuzzy logic concepts to model and solve real-world problems characterized by uncertainty or ambiguity.
CO5: **Evaluate** the impact of parameter tuning and optimization strategies on the effectiveness of hybrid models.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	soft computing techniques		Design intelligent Systems	**L2**
CO2	**Understand**	common algorithms	discover hidden patterns or data groupings	without the need for human intervention	**L2**
CO3	**Apply**	encoding techniques		representing solutions in genetic algorithms	**L3**
CO4	**Apply**	fuzzy logic concepts		to model and solve real-world problems characterized by uncertainty or ambiguity.	**L3**
CO5	**Evaluate**	impact of parameter tuning and optimization strategies		the effectiveness of hybrid models.	**L5**

UNIT – I	**INTRODUCTIONTO SOFT COMPUTING AND SUPERVISED LEARNING NETWORKS**	**9 Hrs**

Introduction to Soft Computing: Neural networks, Application scope of neural networks, Fuzzy logic, Genetic algorithm, Hybrid systems, Softcomputing.
Artificial Neural Networks: Fundamentals, Basic Models, Terminologies, Linear Separability, Hebb network.
Supervised Learning Networks: Perceptron Networks- Theory, Perceptron learning rule, Architecture, Flowchart for training process, Perceptron training algorithm for single and multiple output classes, Perceptron network testing algorithm; Back-Propagation Network - Theory, Architecture, Flow chart for training process, Training algorithm, Learning factors of back-propagation network, Testing algorithm for back-propagation network.

UNIT – II	**UNSUPERVISED LEARNING NETWORKS**	**9Hrs**

Fixed weight competitive nets – Maxnet, Mexican Hat Net, Hamming network; Kohonenself-organizing feature maps – Theory, Architecture, Flowchart, Training algorithm; Learning vector quantization – Theory, Architecture, Flowchart, Training algorithm, Variants; Counter propagation networks – Theory, Full counter propagation Net, Forward-only counter propagation Net; Adaptive resonance theory network – Fundamental architecture, Fundamental operating principle, Fundamental algorithm.

UNIT – III	**GENETIC ALGORITHMS**	**9 Hrs**

Genetic algorithms- Biological background, Traditional optimization and search techniques, Genetic algorithm and search space, Genetic algorithms vs. traditional algorithms, Basic terminologies in genetic algorithm, Simple GA, General genetic algorithm, Operators in genetic algorithm, Stopping condition for genetic algorithm flow, Constraints in genetic algorithm, Problem solving using genetic algorithm, Adaptive genetic algorithms, Hybrid genetic algorithms, Advantages and limitations of genetic algorithm, Applications of genetic algorithm.

UNIT – IV	**FUZZY LOGIC**	**9 Hrs**

Introduction to fuzzy logic, Classical sets, Fuzzy sets, Membership function – Features, Fuzzification, Methods of membership value assignments; Fuzzy arithmetic and measures–Fuzzy arithmetic, Extension principle, Fuzzy measures, Measures of fuzziness, Fuzzy integrals; Fuzzy rule base and approximation reasoning -Truth values and tables in fuzzy logic, Fuzzy propositions, Formation of rules, Compound rules, Aggregation of fuzzy rules, Fuzzy reasoning, Fuzzy inference systems, Overview of fuzzy expert system; Fuzzy decision making, Fuzzy logic control systems.		
UNIT – V	**HYBRID SOFT COMPUTING TECHNIQUES AND APPLICATIONS**	**9 Hrs**
Hybrid Soft Computing Techniques: Genetic neuro hybrid systems, Genetic fuzzy hybrid and fuzzy genetic hybrid systems. **Applications of Soft Computing:** Optimization of traveling salesman problem using genetic algorithm approach, Genetic algorithm-based internet search technique, Soft computing-based hybrid fuzzy controllers, Soft computing-based rocket engine control		
Textbooks:		
1. S. N. Sivanandam and S. N. Deepa, Principles of Soft Computing, Wiley, 3rd Edition, 2019.		
Reference Books:		
1. S. Rajasekaran and G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms:Synthesis and Applications, PHI Learning Private Ltd, 2011. 2. Udit Chakraborty, Samir Roy, Soft Computing: Neuro-Fuzzy and Genetic Algorithms, Pearson, 2013. 3. Saroj Kaushik, Sunita Tewari, Soft Computing: Fundamentals, Techniques and Applications, McGraw Hill, 2018.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	3											
CO2	2	3		3	3						2		
CO3	3	3		3	3						2		
CO4	3	3	3	3	3		2						
CO5	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 : Understand	L2	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO4:Interpret(L2) PO5:Apply(L3)	2 3 3 2
3	CO3 : Apply	L3	PO1 PO2 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review (L2) PO4: Interpret (L2) PO5: Apply(L3) PO11: Thumb rule	3 3 3 3 2
4	CO4 : Apply	L3	PO1 PO2 PO3 PO4 PO5 PO7	PO1: Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO4: Interpret (L2) PO5: Apply(L3) PO7: Thumb rule	3 3 3 3 3 2
5	CO5 : Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply (L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze(L3) PO5:Apply(L3) PO11:Thumb Rule	3 3 3 3 3 2

Justification Statements :

CO1: Understand the paradigms of soft computing techniques to create/Design intelligent Systems
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 : Review(L2)
CO1 Action verb is same level as PO2 verb . Therefore the correlation is high(3)

CO2: Understand the common algorithms to discover hidden patterns or data groupings without the need for human intervention
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: Review (L2)
CO2 Action verb is grater than PO2 verb. Therefore the correlation is high (3)
PO4: Interpret (L2)
CO2 Action verb is greater than PO4 verb. Therefore the correlation is high (3)
PO5: Apply(L1)
CO2 Action verb is less than as PO5 verb by one level. Therefore the correlation is medium(3)

CO3: Apply the encoding techniques (binary, real-valued, permutation) for representing solutions in genetic algorithms
Action Verb : Apply(L3)
PO1: Apply(L3)
CO3 Action verb is same as than PO1 verb. Therefore the correlation is high (3)
PO2: Review (L2)
CO3 Action verb is greater than as PO2 verb. Therefore the correlation is high (3)
PO4: Interpret (L2)
CO3 Action verb is greater than PO4 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
In Soft Computing,the encoding techniques are used to generate solutions using genetic algorithms. Therefore the correlation is medium (2)

CO4: Apply the fuzzy logic concepts to model and solve real-world problems characterized by uncertainty or ambiguity
Action Verb : Apply (L3)
PO1: Apply(L3)
CO4 Action verb is same as PO1 verb. 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: interpret (L2)
CO4 Action verb is greater than PO4 verb. Therefore the correlation is high (3)
PO5: Apply(L3)
CO4 Action verb is same as PO5 verb. Therefore the correlation is high(3)
PO7: Thumb rule
The fuzzy logic is used to solve the societal problems by following professional ethics. Therefore the correlation is medium(2)

CO5: Evaluate the impact of parameter tuning and optimization strategies on the effectiveness of hybrid models.
Action Verb : Evaluate (L5)
PO1: Apply(L3)
CO4 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 as 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)
PO5: Apply(L3)
CO5 Action verb is greater than as PO5 verb. Therefore the correlation is high (3)
PO11: Thumb rule
We can rate the impact of parameter tuning and optimization strategies on the effectiveness of hybrid models. Therefore the correlation is medium (2)

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI&ML)

Year: IV **Semester: I** **Branch of Study: AIML**

Course Code	Year & Sem	Principles of Data Science (Common to CSE, CIC, AIML)	L	T/CLC	P	C
20AOE3303	IV-I		4	2	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the different levels of Data and Steps in Data Science.
CO2: Apply the basics of probability models for data exploration.
CO3: Analyze the basics of statistics models for data exploration.
CO4: Analyze the different data visualization techniques.
CO5: Analyze the suitable model for real time applications.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The Different levels of Data and Steps in Data Science			L2
CO2	Apply	The basics of probability models		for data exploration	L3
CO3	Analyze	The basics of statistics models		for data exploration	L4
CO4	Analyze	The different data visualization techniques			L4
CO5	Analyze	the suitable model		for real time applications	L4

UNIT – I	Introduction to Data Science	9 Hrs
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.		
UNIT – II	**Mathematics**	10 Hrs
Mathematics: 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.		
UNIT – III	**Statistics**	9 Hrs
Statistics: Obtaining data, Sampling data, Measuring Statistics, The Empirical rule, Point estimates, Sampling distributions, Confidence intervals, Hypothesis tests.		
UNIT – IV	**Identifying effective and ineffective visualizations**	9 Hrs
Identifying effective and ineffective visualizations: Scatter plots, Line graphs, Bar charts, Histograms, Box plots. Graphs and Statistics lie: Correlation versus causation, Simpson's paradox, Verbal Communication, Thewhy/how/what strategy of presenting.		
UNIT – V	**Applications of Data Science**	9 Hrs
Applications of Data Science- 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.		

Textbooks:

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

Reference Books:

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
CO1	2	1										2	
CO2	3	3				2					3	2	
CO3	3	3	3	3	3			3			3	2	
CO4	3	3	3	3	3						3	2	2
CO5		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	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 PO8 PO11	PO1: Apply(L3) PO2: Identify(L3) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO8: 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 PO8 PO11	PO2: Identify(L3) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO8: Thumb rule PO11: Thumb rule	3 3 3 3 3 3
	60	100 %						

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)

CO2: Apply the basics of probability models for data exploration
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)
PO6: 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)

PO11: 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)

CO3: Analyze the basics of statistics models for data exploration.

Action Verb : Analyze (L4)

PO1: Apply(L3)

CO3 Action verb is greater than PO1 verb level by one level. Therefore the correlation is high (3)

PO2: Identify(L3)

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

PO3: Develop(L3)

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

PO8 : Thumb rule

Team work is required create multiple probability models for data exploration. Hence the correlation is high (3)

PO11 : 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)

CO4: Analyze the different data visualization techniques.

Action Verb : Analyze(L4)

PO1: Apply(L3)

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

PO2: Identify(L3)

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

PO3: Develop(L3)

CO4 Action verb is greater than PO3 verb level by one level. 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 level by one level. Therefore the correlation is high (3)

PO11 : 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)

CO5: Analyze the suitable model for real time applications.

Action Verb : Analyze(L4)

PO2: Identify(L3)

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

PO3: Develop(L3)

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

PO4: Analyze(L4)

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

PO5: Apply(L3)

CO5 Action verb is greater than PO5 verb level by one level. Therefore the correlation is high (3)

PO8 : Thumb rule

Team work is required build model for real time applications. Hence the correlation is high(3)

PO11 : Thumb rule

For some of data exploration applications, models should be created for new trends of data. Therefore the correlation is high (3)

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI&ML)

Year: IV **Semester: I** **Branch of Study: AIML**

Course Code	Year & Sem	Digital Image Processing	L	T/CLC	P	C
20APE0415	IV-I		3	0	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

UNIT - I		15Hrs
IMAGE PROCESSING FUNDAMENTALS: 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		
UNIT - II		14Hrs
IMAGE TRANSFORMS: Discrete Fourier Transform- Discrete Cosine Transforms- Discrete Sine Transform,Walsh-Hadamard Transforms- Haar Transform-Hotelling Transform, Comparison of properties of the above.		
UNIT - III		15Hrs
IMAGE ENHANCEMENT TECHNIQUES: Background enhancement by point processing Histogram processing, Spatial filtering, Enhancement infrequency Domain, Image smoothing, Image sharpening, Color image enhancement		
UNIT - IV		16Hrs
IMAGE RESTORATION: Degradation model, Algebraic approach to restoration–Inverse filtering–Least Mean Square filters, ConstrainedLeast square restoration, Blind Deconvolution. **IMAGE SEGMENTATION:** Edge detection-,Edge linking, Threshold based segmentation methods–Regionbased Approaches –Template matching–use of motion in segmentation.		
UNIT - V		15Hrs
IMAGE COMPRESSION: 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.		
Textbooks:		
R.C .Gonzalez & R.E. Woods, "Digital Image Processing", Addison Wesley/Pearson education, 3rd Edition, 2010. A.K.Jain,"Fundamentals of Digital Image processing",PHI.		
Reference Books:		
Rafael C. Gonzalez, Richard E woods and Steven L.Eddins, "Digital Image processing using MATLAB", Tata McGrawHill, 2010.		

2. Sjayaraman,SEsakkirajan,TVeerakumar,"Digitalimageprocessing",TataMcGrawHill 3. WilliamK.Pratt,"DigitalImageProcessing",JohnWilely,3rdEdition,2004.
Online Learning Resources:
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					2		
CO4	3			3	3	2					3		
CO5	3	2	2			2					2		

Correlation matrix

Unit No.	CO				BTL	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				
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, PO11	PO1: Apply(L3) PO3: Develop(L3) PO5: Apply(L3) PO6:Thumb rule PO11:Thumb rule	3 3 3 2 1 2
4	16	21%	3	Analyze	L4	PO1, PO4, PO5, PO6, PO11	PO1: Apply(L3) PO4: Analyze(L4) PO5: Apply(L3) PO6: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)CO3 Action Verb level is in the same level of PO3 verb. Therefore,the correlation is high (3).

PO5 Verb: Apply (L3)CO3 Action Verb is equal to PO5 verb. Therefore, the correlation is high (3).

PO6: CO3 using Thumb rule, L2 correlates PO6 as medium (2).

PO11: CO3 using Thumb rule, L3 correlates PO11 as medium (2).

CO4: Analyze various image restoration and image segmentation techniques.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)CO4 Action Verb is more than the PO1 verb.Therefore,the correlation is high (3).

PO4 Verb: Formulate (L4)CO4 Action Verb level is equal to PO4 verb. Therefore,the correlation is high (3).

PO5 Verbs: Develop (L3)CO4 Action Verb is more than the PO5 verb.Therefore, correlation is high (3).

PO6: CO4 using Thumb rule, L2 correlates PO6 as medium (2).

PO11: CO4 using Thumb rule, L4 correlates PO11 as high (3).

CO5: Evaluate different coding methods for image compression to save memory & bandwidth.

Action Verb: Evaluate (L5)

PO1 Verb: Apply (L3)CO5 Action verb is more than the PO1 verb. Therefore, the correlation is high (3).

PO2 verb: Formulate (L6)CO5 Action verb is less than the PO2 verb by one level. Therefore, the correlation is medium(2).

PO3 verb: Develop (L6)CO5 Action verb is less than the PO3 verb by one level. Therefore, the correlation is medium (2)

PO6: CO5 using Thumb rule, L2 correlates PO6 as medium (2).

PO11: CO5 using Thumb rule, L3 correlates PO11 as medium (2).

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI&ML)

Year: IV **Semester: I** **Branch of Study: AIML**

Course Code	Year & Sem		L	T/CLC	P	C
20AOE3004	IV-I	EMBEDDED SYSTEMS	3	0	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

UNIT – I	INTRODUCTION TO EMBEDDED SYSTEMS	9 Hrs
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.		
UNIT – II	**EMBEDDED PROCESSOR ARCHITECTURE**	**9Hrs**
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.		
UNIT – III	**OVERVIEW OF MICROCONTROLLER AND EMBEDDED SYSTEMS**	**9 Hrs**
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.		
UNIT – IV	**MICROCONTROLLER FUNDAMENTALS FOR BASIC PROGRAMMING**	**9 Hrs**
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).		
UNIT – V	**EMBEDDED COMMUNICATIONS PROTOCOLS AND INTERNET OF THINGS**	**9 Hrs**
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 2. 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 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	PO1: Apply(L3)	2
			PO2	PO2 : Identify (L3)	2
			PO3	PO3: Develop (L3)	2
			PO4	PO4 : Analyze (L4)	1
2	CO2 : Analyze	L4	PO1	PO1: Apply(L3)	2
			PO2	PO2: Identify (L3)	2
			PO3	PO 3: Develop (L3)	2
			PO4	PO4: Interpret (L2)	2
			PO5	PO5: Apply(L3)	2
3	CO3 : Understand	L2	PO1	PO1: Apply(L3)	2
			PO2	PO2: Identify (L3)	2
			PO3	PO 3: Develop (L3)	2
			PO4	PO4: Interpret (L2)	3
			PO5	PO5: Apply(L3)	2
4	CO4 :Analyze	L4	PO1	PO1: Apply(L3)	2
			PO2	PO2: Identify (L3)	2
			PO3	PO 3: Develop (L3)	2
			PO4	PO4: Interpret (L2)	1
			PO5	PO5: Apply(L3)	2
5	CO5 : Analyze	L4	PO1	PO1: Apply(L3)	2
			PO2	PO2: Identify (L3)	2
			PO3	PO 3: Develop(L3)	2
			PO4	PO4: Interpret (L2)	1
			PO5	PO5: Apply(L3)	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)
CO1 Action verb is greater than PO1 verb by one level. Therefore the correlation is moderate (2)
PO4 Verb : Analyze (L4)
CO1 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)
CO2 Action verb is less than PO1 verb by one level. Therefore the correlation is Medium (2)
PO2 Verb : Identify (L3)
CO2 Action verb is less than PO1 verb by one level. Therefore the correlation is Medium (2)
PO 3 Verbs: Develop (L3)
CO1 Action Verb is greater than PO 3 verb by onelevel; therefore correlation is moderate (2).
PO4: Interpret (L2)
CO2 Action verb is greater than PO4 verb by two levels. Therefore the correlation is moderate (2)
PO5: Apply(L3)
CO2 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)
CO3 Action verb is greater than PO1 verb by one level. Therefore the correlation is moderate (2)
PO2 Verb : Identify (L3)
CO3 Action verb is greater than as PO2 verb by one level. Therefore the correlation is moderate (2)
PO 3 Verbs: Develop (L3)
CO1 Action Verb is greater than PO 3 verb by one level; therefore correlation is moderate (2).
PO4: Interpret (L2)
CO3 Action verb is samePO4 verb. Therefore the correlation is high (3)
PO5: Apply(L3)
CO3 Action verb is same as PO5 verb by one level. Therefore the correlation is moderate (2)

CO4: Analyze micro controller internal blocks for basic programming of embedded system
Action Verb :Analyze(L4)
PO1: Apply(L3)
CO4 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)
CO4 Action Verb is greater than as PO2 verb by one level. Therefore the correlation is moderate(2)
PO4: Interpret (L2)
CO4 Action verb is greater than PO4 verb by two levels. Therefore the correlation is low (1)
PO5: Apply(L3)
CO4 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)
CO5 Action verb is greater than PO1 verb by one level. Therefore the correlation is moderate (2)
PO2 Verb : Identify (L3)
CO5 Action verb is greater than as PO2 verb by one level. Therefore the correlation is moderate(2)
PO 3 Verbs: Develop (L3)
CO5 Action Verb is greater than as PO2 verb by one level. Therefore the correlation is moderate(2)
PO4: Interpret (L2)
CO5 Action verb is greater than PO4 verb by two levels. Therefore the correlation is low (1)
PO5: Apply(L3)
CO5 Action verb is greater than as PO2 verb by one level. Therefore the correlation is moderate (2)

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI&ML)

Year: IV **Semester: I** **Branch of Study: AIML**

Course Code	Year & Sem	Enabling Technologies for Data Science & Analytics: IoT (Common to CSE, AIDS)	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

UNIT – I	**Introduction to Internet of Things**	9 Hrs
Introduction to Internet of Things 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.		
UNIT – II	**IoT and M2M**	9 Hrs
IoT and M2M: 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		
UNIT – III	**Developing Internet of Things**	9 Hrs
Developing Internet of Things: 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.		
UNIT – IV	**Advanced Topics**	9 Hrs
Advanced Topics: 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.		
UNIT – V	**ZigBee**	9 Hrs
ZigBee: 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.		
Textbooks:		
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.
Reference Books:
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
CO1	2	1										1	
CO2	3		3	2	3	2						1	
CO3	3	3	3	3		3	3						1
CO4	3	3	3	2		2							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	11	20%	2	CO1 : Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Analyze(L4)	2 1
2	11	20%	2	CO2 :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	CO3 : Analyze	L4	PO1 PO2 PO3 PO4 PO6 PO7	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze(L4) PO6: Thumb rule PO7: Thumb rule	3 3 3 3 3 3
4	11	20%	2	CO4 : 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	CO5 : Analyze	L4	PO2 PO3 PO4 PO6 PO11	PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze(L4) PO8: Thumb rule PO11: Thumb rule	3 3 3 3 3
	55	100%						

Justification Statements :

CO1: Understand the application and characteristics of IoT
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)

CO2: Apply the network protocols to establish communication between M2M and IoT systems
Action Verb : Apply (L3)
PO1: Apply(L3)
CO2 Action verb is same level as 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 greater than PO4 verb . Therefore the correlation is high (3)
PO5: Apply(L3)
CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO6: Thumb rule
Some of IoT applications are used in society for heath ,safety, legal and cultural issues, . Therefore the correlation is moderate(2)

CO3: Analyze the behaviour of IoT devices and sensors based on real time case studies
Action Verb : Analyze(L4)
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)
PO3: Develop(L3)
CO2 Action verb is greater than PO3 verb . Therefore the correlation is high (3)
PO4: Analyze(L4)
CO2 Action verb is same as PO4 verb . Therefore the correlation is high(3)
PO6 : Thumb rule
It is used to Illustrating the IoT design in Home automation, Cities, Environment, agriculture, productivity applications Therefore the correlation is high(3)
PO7: Thumb rule
Since ethical principles should be followed by IoT Technologies. Hence the correlation is high(3)

CO4: Apply the Map Reduce algorithm on large volume of IoT data for online analytical data processing
Action Verb : Apply(L3)
PO1: Apply(L3)
CO4 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Identify (L3)
CO3 Action verb is same as PO2 verb . Therefore the correlation is high(3)
PO3: Develop(L3)
CO2 Action verb is same 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)
CO4 Action verb is same level as PO5 verb. Therefore the correlation is high (3)
PO6: Thumb rule
Since ethical principles shall be followed in IEEE protocals. Therefore the correlation is medium(2)

CO5: Analyze the Zigbee Standards for controlling and sensing of IoT network
Action Verb : Analyze(L4)
PO2: Identify (L3)
CO3 Action verb is greater than PO2 verb . Therefore the correlation is high(3)
PO3: Develop(L3)
CO2 Action verb is greater than PO2 verb. Therefore the correlation is high(3)
PO4: Analyze(L4)
CO2 Action verb is same as PO4 verb. Therefore the correlation is high(3)
PO5: Apply(L3)
CO4 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO6 : Thumb rule
Since ethical principles should be followed to Zigbee devices. Therefore the correlation is high(3)
PO11: 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 MACHINE LEARNING (AI&ML)

Year: IV **Semester: I** **Branch of Study: AIML**

Course Code	Year & Sem	WIRELESSCOMMUNICATIONS	L	T/CLC	P	C
20APE0415	IV-I	(Common to CSE,AIDS, AIML)	4	2	0	3

Course Outcomes:

After studying the course, student will be able to

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 slevel
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

UNIT–I	INTRODUCTIONTOWIRELESSCOMMUNICATIONSANDMULTIPLEACCESSTECHNIQUES	9Hrs

INTRODUCTIONTOWIRELESSCOMMUNICATIONSANDMULTIPLEACCESSTECHNIQUES:
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.

UNIT –II	WIRELESSNETWORKINGANDDATASERVICES	9Hrs

WIRELESSNETWORKINGANDDATASERVICES:
Wireless Networking: Difference between wireless and fixed telephone networks, Development of wireless networks, Traffic routing in wireless networks. Data Services: Dataservices, CCS, BISDN and ATM, Signalling System No7

UNIT–III	MOBILEIPANDWIRELESSACCESSPROTOCOL	9Hrs

MOBILEIPANDWIRELESSACCESSPROTOCOL:
MobileIP: Mobile IP Operation of mobile IP, Co-located address, Registration, Tunneling. WAP: WAP Architecture, overview, WMLscripts, WAPservice, WAP session protocol.

UNIT–IV	WIRELESSLANTECHNOLOGYANDBLUETOOTH	9Hrs

WIRELESSLANTECHNOLOGYANDBLUETOOTH:
Wireless LAN: Infrared LANs, Spread spectrum LANs, Narrow bank 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.

UNIT –V	MOBILEDATANETWORKSANDHIPERLAN	9Hrs

MOBILEDATANETWORKSANDHIPERLAN:
Mobile Data Networks: GPRS and higher datarates, Short messaging service in GSM, HIPERLAN: HIPERLAN-1.

Textbooks:
1. WirelessCommunications,Principles,Practice–TheodoreS.Rappaport,PHI,2ndEd.,2002.2.WirelessCommunicationandNetworking 2. WirelessCommunicationandNetworking–WilliamStallings,PHI,2003. 3. PrinciplesofWirelessNetworks–KavehPahLavenandP.KrishnaMurthy,PearsonEducation,2002.
ReferenceBooks:
1.WirelessDigitalCommunications–KamiloFeher,PHI,1999.

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

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 PO11	PO6: Apply (L3) P11	2 2
	60							

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)
CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
PO6 from thumb rule L2 correlation is moderate (2)
PO11 from thumb rule L2 correlation is moderate (2)
CO4: Analyze the protocols used in wireless LAN technologies.
Action Verb: Analyze (L4)
PO2 Verb: Identify (L3)
CO4 Action Verb is less than PO2 verb; Therefore correlation is moderate(2).
PO6 from thumb rule L4 the correlation is high (3)
PO11 from thumb rule L4 the correlation is high (3)
CO5: Apply Various services in mobile data networks and HIPER LAN.
Action Verb: Apply (L3)
PO6 Verb: Apply (L3)
CO5 Action verb is greater to PO1 verb; therefore the correlation is high (3).
PO6 from thumb rule L2 correlation is moderate (2)
PO11 from thumb rule L2 correlation is moderate (2)

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI&ML)

Year: IV **Semester: I** **Branch of Study: AIML**

Course Code	Year & Sem		L	T/CLC	P	C
20AOE0302	IV-I	**Management science**	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

UNIT – I	**CONCEPTS OF MANAGEMENT AND ORGANISATION**	12 Hrs

CONCEPTS OF MANAGEMENT AND ORGANISATION: 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.

UNIT – II	**PLANT LOCATION & WORK STUDY**	10 Hrs

PLANT LOCATION: 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.

WORK STUDY: 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

UNIT – III	**INTRODUCTION TO PERT / CPM**	8 Hrs

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.

UNIT – IV	MATERIALS MANAGEMENT	8 Hrs

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.

UNIT – V	INTRODUCTION TO HUMAN RESOURCE MANAGEMENT	10 Hrs

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:

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									
	CO2	3			3	3								
	CO3	3	3		1									
	CO4	2	2		2									
	CO5	3	3											

Correlation matrix

CO			Program Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO5)	Level of Correlation
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:
CO1: Understand the management principles to take the decisions in all levels for productivity
Action Verb: Understand (L2)
PO1 Verb: **Apply (L3)**
CO1 Action verb is same (lower) level as PO1 verb. Therefore, the correlation is low (2).
PO4 Verb: **Design (L6)**
CO1 Action verb is same (lower) level as PO4 verb. Therefore, the correlation is low (1).
CO2: Analyze the available facilities for location of the industrial plant and also deal the ergonomics to improve the efficiency and safety.
Action Verb: Analyze (L4)
PO1 Verb: **Apply (L3)**
CO2: Action verb is same (greater) level as PO1 verb. Therefore, the correlation is high (3).
PO4 Verb: **Analyse (L4)**
CO2: Action verb is same level as PO4 verb. Therefore, the correlation is high (3).
PO5 Verb: **Apply (L3)**
CO2: Action verb is same (greater) level as PO5 verb. Therefore, the correlation is high (3).
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.
Action Verb: Apply (L3)
PO1 Verb: **Apply (L3)**
CO3: Action verb is same level as PO1 verb. Therefore, the correlation is high (3).
PO2 Verb: **Identify (L3)**
CO3: Action verb is same level as PO2 verb. Therefore, the correlation is high (3).
PO4 Verb: **Design (L6)**
CO3: Action verb is same (lower) level as PO4 verb. Therefore, the correlation is low (1).
CO4: Understand the materials requirement to minimize the inventory costs and to maximize the profit.
Action Verb: Understand (L2)
PO1 Verb: **Apply (L3)**
CO3: Action verb is same (lower) level as PO1 verb. Therefore, the correlation is low (2).
PO2 Verb: **Identify (L3)**
CO3: Action verb is same (lower) level as PO2 verb. Therefore, the correlation is low (2).
PO4 Verb: **Interpret (L2)**
CO3: Action verb is same level as PO4 verb. Therefore, the correlation is low (2).
CO5: Apply the knowledge of the human resources principles in motivating the workers in the industry.
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: **Identify (L3)**
CO5: Action verb is same level as PO2 verb. Therefore, the correlation is high (3).

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI&ML)

Year: IV **Semester: I** **Branch of Study: AIML**

Course Code	Year & Sem		L	T/CLC	P	C
20AOE9901	IV-I	**English For Research Paper Writing**	3	0	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the writing skills and level of readability.

CO2: **Apply** the rules, principles for writing abstract and introduction part of research article.

CO3: **Apply** the right methods to write the review of literature, results and conclusions.

CO4: **Apply** the special skills for writing a title, abstract, review and introduction of literature.

CO5: **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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
1									2		2
2					3				1		
3		2									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)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	15	20	2	Understand	L2	PO9, PO11	Thumb Rule Thumb Rule	2, 2
2	18	23	3	Apply	L3	PO5, PO9	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	PO9	Thumb Rule	2
5	14	18.4	2	Apply	L3	PO9, PO11	Thumb Rule Thumb Rule	2, 2
	76							

CO1: Understand writing skills and level of readability.
Action Verb: Understand (L2)
CO1 Action Verb is Understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).
CO2: Apply the rules, principles for writing abstract and introduction part of research article.
Action Verb: Apply (L3)
CO2 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).
CO2 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).
CO3: Apply the right methods to write the review of literature, results and conclusions.
Action Verb: Apply (L3)
CO3 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)
CO3 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2)
CO4: Apply special skills for writing a title, abstract, review and introduction of literature.
Action Verb: Apply (L3)
CO4 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).
CO5: Apply key skills for results in discussion and conclusion.
Action Verb: Apply (L3)
CO5 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI&ML)

Year: IV **Semester: I** **Branch of Study: AIML**

Course Code	Year & Sem		L	T/CLC	P	C
20AHSMB02	IV-I	ENTREPRENEURSHIP DEVELOPMENT	3	0	0	3

Course Outcomes:

After studying the course, student will be able to

CO1. **Understand** the concept and process of Entrepreneurship to develop entrepreneurial skills

CO2. **Analyze** the different feasibility studies to start a new enterprise.

CO3. **Analyze** the various sources of finance to entrepreneurs.

CO4. **Analyze** the role of central government and state government in promoting women Entrepreneurship.

CO5. **Analyze** the role of incubations in fostering startups.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the concept and process of Entrepreneurship		to develop entrepreneurial skills	L2
CO2	Analyze	the different feasibility studies		to start a new enterprise	L4
CO3	Analyze	the various sources of finance to entrepreneurs			L4
CO4	Analyze	the role of central government and state government		in promoting women Entrepreneurship	L4
CO5	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)
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.pd
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									
	CO3	3									3			
	CO4	3												
	CO5	3												

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 PO9	Apply (L3) Apply (L3) Thumb Rule	3 3 3
CO3	20.75	Analyze	PO1 PO10	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)
PO3: Apply (L3)
CO2 Action verb is more than PO3 verb. Therefore, the correlation is High (3)
PO4: Apply (L3)
CO2 Action verb is more than PO4 verb. Therefore, the correlation is High (3)
PO9: Thumb Rule
As using thumb rule CO2 correlates with PO10. Therefore, the correlation is High (3)

CO3: Analyze the various sources of finance to entrepreneurs.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO3 Action verb is more than PO1 verb by one level. Therefore, the correlation is High (3)
PO10: Thumb Rule
CO3 Action verb blooms level 4 correlates with PO11. Therefore, the correlation is High (3)

CO4: Analyze the role of central government and state government in promoting women Entrepreneurship.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO4 Action verb is more than PO1 verb by one level. Therefore, the correlation is High (3)

CO5: Analyze the role of incubations in fostering startups.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO5 Action verb is more than PO1 verb. Therefore, the correlation is High (3)

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(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI&ML)

Year: IV **Semester: I** **Branch of Study: AIML**

Course Code	Year & Sem		L	T/CLC	P	C
20ASC3305	IV-I	**Exploratory Data Analysis with R**	1	0	2	2

Course Outcomes:

After Studying the Course, student will be able to

CO1: **Evaluate** the installation of R to Perform simple R Programming's.

CO2: **Analyze** the Functionality of R by using add-on Packages.

CO3: **Apply** the Extracted data from files and other sources to perform data Manipulation Tasks.

CO4: **Analyze** the R Graphics and Tables to visualize results of various Stastical operations on Data.

CO5: **Apply** the knowledge of R gained to data analytics for real life applications.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Evaluate**	the installation of R		to Perform simple R Programming's	L5
CO2	**Analyze**	the Functionality of R	by using add-on Packages		L4
CO3	**Apply**	the Extracted data from files and other sources		to perform data Manipulation Tasks	L3
CO4	**Analyze**	the R Graphics and Tables		to visualize results of various stastical operations on Data.	L4
CO5	**Apply**	the knowledge of R gained		to data analytics for real life applications.	L3

1: INTRODUCTION TO COMPUTING (CO1)

a. Installation of R
b. The basics of R syntax, workspace
c. Matrices and lists
d. Subsetting
e. System-defined functions; the help system
f. Errors and warnings; coherence of the workspace

2: GETTING USED TO R: DESCRIBING DATA(CO1)

a. Viewing and manipulating Data
b. Plotting data
c. Reading the data from console, file (.csv) local disk and web
d. Working with larger datasets

3: SHAPE OF DATA AND DESCRIBING RELATIONSHIPS (CO1)

a. Tables, charts and plots.
b. Univariate data, measures of central tendency, frequency distributions, variation, and Shape.
c. Multivariate data, relationships between a categorical and a continuous variable,
d. Relationship between two continuous variables – covariance, correlation coefficients, comparing multiple correlations.
e. Visualization methods – categorical and continuous variables, two categorical variables, two continuous variables.

4: PROBABILITY DISTRIBUTIONS (CO2)

a. Sampling from distributions – Binomial distribution, normal distribution
b. tTest, zTest, Chi Square test
c. Density functions
d. 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)

a. Null hypothesis significance testing
b. Testing the mean of one sample
c. Testing two means

7: PREDICTING CONTINUOUS VARIABLES(CO3)

a. Linear models
b. Simple linear regression
c. Multiple regression
d. Bias-variance trade-off – cross-validation

8: CORRELATION (CO3)

a. How to calculate the correlation between two variables.

b. How to make scatter plots.

c. Use the scatter plot to investigate the relationship between two variables

9: TESTS OF HYPOTHESES(CO4)

a. Perform tests of hypotheses about the mean when the variance is known.

b. Compute the p-value.

c. Explore the connection between the critical region, the test statistic, and the p-value

10: ESTIMATING A LINEAR RELATIONSHIP (CO4)

Demonstration on a Statistical Model for a Linear Relationship

a. Least Squares Estimates

b. The R Function lm

c. Scrutinizing the Residuals

11: APPLY-TYPE FUNCTIONS(CO5)

a. Defining user defined classes and operations, Models and methods in R

b. Customizing the user's environment

c. Conditional statements

d. Loops and iterations

12: STATISTICAL FUNCTIONS IN R(CO5)

a. Write Demonstrate Statistical functions in R

b. Statistical inference, contingency tables, chi-square goodness of fit, regression, generalized linear models, advanced modeling methods.

Reference Books:

1. SandipRakshit, "Statistics with R Programming", McGraw Hill Education, 2018.
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, "AN Introduction to Statistical Learning: with Applications in R", Springer Texts in Statistics, 2017.
3. Joseph Schmuller, "Statistical Analysis with R for Dummies", Wiley, 2017.
4. K G Srinivasa, G M Siddesh, ChetanShetty, Sowmya B J, "Statistical Programming in R", Oxford Higher Education, 2017.

Online Learning Resources/ Virtual Labs:

1. www.oikostat.ch
2. https://learningstatisticswithr.com/
3. https://www.coursera.org/learn/probability-intro #syllabus
4. https://www.isibang.ac.in/~athreya/psweur/

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3											
CO2	3	1		3							3		
CO3	3	3	3	2							2	1	
CO4	3	1		3							3		
CO5	3	3		2								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: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 PO11	PO1: Apply(L3) PO2: Identify(L2) PO3: Develop (L3) PO4: Analyze(L4) PO11: Thumb rule	3 3 3 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)
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)

PO1: Apply (L3)
CO4 Action verb is more than as PO1 verb. Therefore, the correlation is high (3)
PO2: Formulate (L6)
CO4 Action verb is less than PO2 verb by two levels. Therefore, the correlation is low (1)
PO4: Analysis (L4)
CO4 Action verb is same as PO4 verb. Therefore, the correlation is high (3)

PO11: Thumb rule
For some of R Graphics and Tables concepts are used to create programs. Therefore, the correlation is high (3)

CO5: Apply the knowledge of R gained to data analytics for real life applications.
Action Verb: Apply (L3)

PO1: Apply(L3)
CO5 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2: Identify (L2)
CO5 Action verb is more than PO2 verb. Therefore, the correlation is high (3)
PO4: Analysis (L4)
CO5 Action verb is less than PO4 verb by one levels. Therefore, the correlation is moderate (2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)

B. Tech - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

(Effective for the batches admitted in 2021-22)
Semester VIII (Fourth year)

Sl. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T/CLC	P	C			
1	OE-4	20MOC3301	MOOCS	0	0	0	3	25	75	100
2	PR	20APR3302	Internship	0	0	0	3	100	-	100
3	PR	20APR3303	Project work	0	0	0	9	60	140	200
			Total credits				**15**	**185**	**215**	**400**