ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI

(AUTONOMOUS)

COMPUTER SCIENCE AND ENGINEERING (CSE)

(Effective for the batches admitted in 2020-21)

Semester I (First year)

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T	P	C			
1	BS	20ABS9901	Algebra & Calculus	3	0	0	3	30	70	100
2	BS	20ABS9904	Chemistry	3	0	0	3	30	70	100
3	ES	20AES0501	Problem Solving and Programming	3	0	0	3	30	70	100
4	ES	20AES0301	Engineering Graphics	1	0	4	3	30	70	100
5	ES	20AES0505	Information Technology and Numerical Methods	3	0	0	3	30	70	100
6	ES LAB	20AES0506	Computer Science and Engineering Workshop	0	0	3	1.5	30	70	100
7	BS LAB	20ABS9909	Chemistry Lab	0	0	3	1.5	30	70	100
8	ES LAB	20AES0503	Problem Solving and Programming Lab	0	0	3	1.5	30	70	100
			Total credits				19.5	240	560	800

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Semester II (First year)

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T	P	C			
1	BS	20ABS9902	Applied Physics	3	0	0	3	30	70	100
2	BS	20ABS9911	Probability and Statistics	3	0	0	3	30	70	100
3	HS	20AHS9901	Communicative English	3	0	0	3	30	70	100
4	ES	20AES0502	Data Structures	3	0	0	3	30	70	100
5	ES	20AES0507	Web Design	1	0	4	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	20AES0504	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) – AK20

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T	P	C			
1	BS	20ABS9914	Discrete Mathematical Structures	3	0	0	3	30	70	100
2	PC	20APC0503	Digital Electronics & Microprocessors	3	0	0	3	30	70	100
3	PC	20APC0502	Database Management Systems	3	0	0	3	30	70	100
4	PC	20APC0526	Basics of Python Programming	3	0	0	3	30	70	100
5	ES	20AES0205	Basics of Electrical and Electronics Engineering	3	0	0	3	30	70	100
6	PC Lab	20APC0505	Database Management Systems Lab	0	0	3	1.5	30	70	100
7	PC Lab	20APC0527	Basics of Python Programming Lab	0	0	3	1.5	30	70	100
8	ES Lab	20AES0206	Basics of Electrical and Electronics Engineering Lab	0	0	3	1.5	30	70	100
9	SC	20ASC0501	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

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Semester IV (Second year) – AK20

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T	P	C			
1	PC	20APC0506	Computer Organization	3	0	0	3	30	70	100
2	PC	20APC0511	Design And Analysis Of Algorithms	3	0	0	3	30	70	100
3	PC	20APC0512	Object Oriented Programming through Java	3	0	0	3	30	70	100
4	PC	20APC0515	Operating Systems	3	0	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	3	0	0	3	30	70	100
7	PC Lab	20APC0504	Computer Organization Lab	0	0	2	1	30	70	100
8	PC Lab	20APC0514	Object Oriented Programming through Java Lab	0	0	4	2	30	70	100
9	PC Lab	20APC0513	Operating Systems Lab	0	0	3	1.5	30	70	100
10	SC	20ASC0502	Server Side Scripting	1	0	2	2	100	0	100
			Total credits				24.5	370	630	1000

Community service Project with credits

(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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(Effective for the batches admitted in 2020-21)
Semester V (Third year)

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T	P	C			
1	PC	20APC0516	Computer Networks	3	0	0	3	30	70	100
2	PC	20APC0518	Formal Languages & Automata Theory	3	0	0	3	30	70	100
3	PC	20APC0519	Software Engineering	3	0	0	3	30	70	100
4	OE-1	20APE0418 20AOE0303 20AOE9925	Sensors and IoT Optimization Techniques Deterministic & Stochastic Statistical Methods	3	0	0	3	30	70	100
5	PE-1	20APE0501 20APE0502 20APE0503	Data Warehousing and Mining Design Patterns Computer Graphics	3	0	0	3	30	70	100
6	PC Lab	20APC0520	Software Engineering Lab	0	0	3	1.5	30	70	100
7	PC Lab	20APC0517	Computer Networks Simulation Lab	0	0	3	1.5	30	70	100
8	SC	20ASA0503	Mobile Application Development	1	0	2	2	100	0	100
9	MC	20AMC9901	Biology for Engineers	3	0	0	0	30	0	30
10	CSP	20CSP0501	Community service project	0	0	0	1.5	100	0	100
Total credits							**21.5**	**440**	**490**	**930**

OE/JOEs for NPTEL

S. No	Job Oriented Elective (12 weeks)	Open Elective (12 weeks)
1	The Joy Of Computing Using Python	Blockchain and its Applications
2	Software Testing	Introduction to Cyber Security
3	Privacy And Security In Online Social Media	Business analytics and data mining modeling using R.
4	Data analytics with python	Decision making with spread sheet
5	Development using UML, JAVA and Patterns.	Introduction To Wireless And Cellular Communications
6	Programming In Modern C++	Text, Textuality And Digital Media
7	Data Structure And Algorithms Using Java	Psychology Of Learning
8	Computational Complexity	Public Speaking
9	Cyber Security and Privacy	Organizational Behaviour
10	Ethical Hacking	Entrepreneurship
11	Parameterized Algorithms	Introduction to Film Studies
12	Computational number theory and algebra	Partition of India in print media and Cinema.
13	Hardware Security	Data Analysis and decision making
14	GPU architecture and programming	Education for sustainable development
15	Introduction to game theory and mechanism	Training and development
16	Statistical learning for reliability analysis	Literature Culture and Media
17	Advanced distributed systems.	Introduction to Cultural Studies
18	Secure computation: part-1	Science, Technology and Society
19	Secure computation: part-2	Human Resource Development
20	Pattern recognition and application	E- Business.

*Student shall register any number of MOOC courses listed 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)

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T	P	C			
1	PC	20APC0521	Artificial Intelligence	3	1	0	3	30	70	100
2	PC	20APC0523	Compiler Design	3	0	0	3	30	70	100
3	PC	20APC0528	Cloud Computing	3	0	0	3	30	70	100
4	PE-2	20APE0504 20APE0505 20APE0506	Machine Learning Real Time Operating Systems Agile Methodologies	3	0	0	3	30	70	100
5	PC Lab	20APC0522	Artificial Intelligence Lab	0	0	3	1.5	30	70	100
6	PC Lab	20APC0524	Compiler Design Lab	0	0	3	1.5	30	70	100
7	PC Lab	20APC0529	Cloud Computing 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				18.5	340	490	830
Industry Internship (Mandatory) for 6-8 Weeks duration during summer vacation										

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Semester VII (Fourth year)

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T	P	C			
1	PE-3	20APE0507 20APE0508 20APE0509 20APE0510	Predictive Analytics Natural Language Processing Deep Learning Techniques Computer Vision	3	0	0	3	30	70	100
2	PE-4	20APE0511 20APE0512 20APE0513	Cryptography and Network Security Adhoc & Sensor Networks Distributed Systems	3	0	0	3	30	70	100
3	PE-5 CBCC	20APE0514 20APE0515 20APE0516	Data Analytics Software Project Management Linux Environment System	3	0	0	3	30	70	100
4	JOE/OE-2	20AOE0501 20AOE0502 20AOE0503	Information Retrieval Techniques Soft Computing Principles of Data science	3	0	0	3	30	70	100
5	OE-3	20APE0407 20APE0411 20AOE3601 20APE0415	Digital Image Processing Embedded Systems Enabling Technologies for data science and analytics :IOT Wireless Communications	3	0	0	3	30	70	100
6	HE	20AOE0302 20AOE9901 20AHSMB02	Management Science English for Research Paper Writing Entrepreneurship Development	3	0	0	3	30	70	100
7	SA	20ASA0504	Devops	1	0	2	2	100	0	100
8	PR	20APR0501	Evaluation of Industry Internship(III-II Summer Internship)	0	0	0	3	100	0	100
			Total credits				23	380	420	800

Semester VIII (Fourth year)

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T	P	C			
1	OE-4	20AOE0504	MOOCS	0	0	0	3	25	75	100
2	PR	20APR0502	Internship	0	0	0	3	100		100
3	PR	20APR0503	Project work	0	0	0	9	60	140	200
			Total credits				15	185	215	400

LIST OF COURSES FOR HONOURS In B.Tech -CSE

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

S.NO	SUB.CODE	COURSE NAME	WEEKS	CREDITS
1	20AHN0501	DESIGN AND IMPLEMENTATION OF HUMAN COMPUTER INTERFACES	12 Weeks	3 or 4
2	20AHN0502	SOCIAL NETWORKS	12 Weeks	3 or 4
3	20AHN0503	NO SQL DATABASES	12 Weeks	3 or 4
4	20AHN0504	ADVANCED IOT APPLICATIONS	12 Weeks	3 or 4
5	20AHN0505	INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS	12 Weeks	3 or 4
6	20AHN0506	GETTING STARTED WITH COMPETITIVE PROGRAMMING	12 Weeks	3 or 4
7	20AHN0507	COMMUNICATION NETWORKS	12 Weeks	3 or 4
8	20AHN0508	COMPUTER NETWORKS AND INTERNET PROTOCOL	12 Weeks	3 or 4
9	20AHN0509	ALGORITHMIC GAME THEORY	12 Weeks	3 or 4
10	20AHN0510	SCALABLE DB.	12 Weeks	3 or 4
11	20AHN0511	APPLIED ACCELERATED ARTIFICIAL INTELLIGENCE.	12 Weeks	3 or 4
12	20AHN0512	AI: SEARCH METHODS FOR PROBLEM SOLVING.	12 Weeks	3 or 4
13	20AHN0513	ARTIFICIAL INTELLIGENCE: KNOWLEDGE REPRESENTATION AND REASONING	12 Weeks	3 or 4
14	20AHN0514	MULTI-CORE COMPUTER ARCHITECTURE-STORAGE	12 Weeks	3 or 4
15	20AHN0515	SOCIAL NETWORK ANALYSIS.	12 Weeks	3 or 4
		TOTAL		**20**

MINOR DEGREE IN COMPUTER SCIENCE AND ENGINEERING FOR ECE, EEE, CE & ME

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

S.NO	SUB.CODE	COURSE NAME	WEEKS	CREDITS
1	20AMN0501	OPERATING SYSTEMS	12 Weeks	3 or 4
2	20AMN0502	COMPUTER ORGANIZATION	12 Weeks	3 or 4
3	20AMN0503	COMPUTER NETWORKS	12 Weeks	3 or 4
4	20AMN0504	DESIGN AND ANALYSIS OF ALGORITHMS	12 Weeks	3 or 4
5	20AMN0505	OBJECT ORIENTED PROGRAMMING THROUGH JAVA	12 Weeks	3 or 4
6	20AMN0506	PROGRAMMING IN MODERN C++	12 Weeks	3 or 4
7	20AMN0507	DATA ANALYTICS WITH PYTHON	12 Weeks	3 or 4
8	20AMN0508	SOFTWARE ENGINEERING	12 Weeks	3 or 4
9	20AMN0509	SOFTWARE PROJECT MANAGEMENT	12 Weeks	3 or 4
10	20AMN0510	INTRODUCTION TO DATABASE SYSTEMS	12 Weeks	3 or 4
11	20AMN0511	CLOUD COMPUTING	12 Weeks	3 or 4
12	20AMN0512	FOUNDATION OF CRYPTOGRAPHY	12 Weeks	3 or 4
13	20AMN0513	HARDWARE SECURITY	12 Weeks	3 or 4
14	20AMN0514	COMPUTER NETWORKS AND INTERNET PROTOCOL	12 Weeks	3 or 4
15	20AMN0515	COMMUNICATION NETWORKS	12 Weeks	3 or 4
16	20AMN0516	**MINOR DISCIPLINE PROJECT IN CSE (COMPULSORY)**	-	5
		TOTAL		**20**

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Semester I (First year)

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T	P	C			
1	BS	20ABS9901	Algebra & Calculus	3	0	0	3	30	70	100
2	BS	20ABS9904	Chemistry	3	0	0	3	30	70	100
3	ES	20AES0501	Problem Solving and Programming	3	0	0	3	30	70	100
4	ES	20AES0301	Engineering Graphics	1	0	4	3	30	70	100
5	ES	20AES0505	Information Technology and Numerical Methods	3	0	0	3	30	70	100
6	ES LAB	20AES0506	Computer Science and Engineering Workshop	0	0	3	1.5	30	70	100
7	BS LAB	20ABS9909	Chemistry Lab	0	0	3	1.5	30	70	100
8	ES LAB	20AES0503	Problem Solving and Programming Lab	0	0	3	1.5	30	70	100
			Total credits				19.5	240	560	800

Course Code	Year & Sem	Algebra and Calculus	L	T	P	C
20ABS9901	I-I		3	0	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	PO12
CO1		3										
CO2	3											
CO3	3											
CO4		3										
CO5		3										

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

Correlation matrix

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

Justification:

CO1: Apply the matrix algebra techniques for solving various linear equations.
Action Verb: Analyze (L4)
PO2 Verbs: Analyze (L4)
CO1 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
CO2: Analyze the linear transformations of quadratic forms and mean value theorems.
Action Verb: Analyze (L4)
PO2 Verbs: Analyze (L4)
CO2 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
CO3: Apply the fundamental concepts of partial derivatives for multi variable functions.
Action Verb: Apply (L3)
PO2 Verbs: Analyze (L4)
CO3 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

CO4: Evaluate the multiple integrals in cartesian, polar, cylindrical, and spherical co-ordinate systems.
Action Verb: Evaluate (L5)
PO1 Verb: Apply (L3)
CO4 Action Verb is high level to PO1 verb; Therefore correlation is high (3).

CO5: Evaluate the improper integrals using special functions like Beta and Gamma.
Action Verb: Evaluate (L5)
PO1 Verb: Apply (L3)
CO5 Action Verb is high level to PO1 verb; Therefore correlation is high (3).

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Course Code	Year & Sem	Chemistry	L	T	P	C
20ABS9904	I-I	(Common to I Sem- CSE & CIC, II Sem EEE, ECE)	3	0	0	3

Course Outcomes:

After studying the course, student will be able to

CO 1: **Understand** the interaction of energy levels between atoms and molecules

CO 2: **Apply** the electrochemical principles to the construction of batteries, fuel cells and electrochemical sensors

CO 3: **Analyze** the preparation and mechanism of polymers

CO 4: **Analyze** the separation of gaseous and liquid mixtures using instrumental methods

CO 5: **Apply** the purification technique to remove hardness of water and to check the quality of water

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Understand**	The interaction of energy levels between atoms and molecules			L2
2	**Apply**	The electrochemical principles		to the construction of batteries, fuel cells and electrochemical sensors	L3
3	**Analyze**	The preparation and mechanism of polymers			L4
4	**Analyze**	The separation of gaseous and liquid mixtures	Using instrumental methods		L4
5	**Apply**	The purification technique to remove hardness of water		to check the quality of water	L3

Unit 1: Structure and Bonding Models   (10 hrs)

Planck's quantum theory, Schrodinger wave equation, significance of Ψ^1 and Ψ^2 , applications to hydrogen, particle in a box and their applications for conjugated molecules, crystal field theory – salient features – energy level diagrams for transition metal ions – splitting of orbital's in tetrahedral and octahedral complexes, magnetic properties, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O_2 , N_2 and CO, calculation of bond order.

Unit 2: Electrochemistry and Applications   (10 hrs)

Electrodes – concepts, reference electrodes (Calomel electrode, Ag/AgCl electrode and glass electrode) electrochemical cell, Nern'st equation, cell potential calculations, numerical problems, concept of pH, pH meter and applications of pH metry (acid-base titrations), potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations), photovoltaic cell – working and applications, photogalvanic cells with specific examples. Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.

Primary cells – Zinc-air battery, alkali metal sulphide batteries, Fuel cells, hydrogen-oxygen, methanol fuel cells – working of the cells.

Secondary cells – lead acid, nickel-metal hydride and lithium ion batteries- working of the batteries including cell reactions, button cells,

Unit 3: Polymer Chemistry   (10 hrs)

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, copolymerization (stereospecific polymerization) with specific examples and mechanisms of polymer formation. Plastics - Thermoplastics and Thermosettings, Preparation,

properties and applications of – Bakelite, urea-formaldehyde, Nylon-66, carbon fibres, Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – polyacetylene, polyaniline, polypyrroles – mechanism of conduction and applications.

Unit 4: Instrumental Methods and Applications   (10 hrs)

Principle and applications of Colorimetry, AAS, AES, UV-Viscible spectrophotometry (Beer-Lambert's law, Instrumentation ,Principles and applications of Chromatographic techniques(GC & HPLC), separation of gaseous mixtures and liquid mixtures(GC & HPLC methods).

Unit 5: Water Technology   (10 hrs)

Introduction –Soft Water and hardness of water, Estimation of hardness by EDTA Method - Boiler troubles **-** scale and sludge, Industrial water treatment – specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO) standards, zeolite and ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electrodialysis.

Text books:

1. Jain and Jain, Engineering Chemistry, 16/e, Dhanpat Rai, 2013.

2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

Reference books:

1. J. D. Lee, Concise Inorganic Chemistry, 5/e, Oxford University Press, 2008.
2. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
3. Ben L. Feringa and Wesley R. Browne, Molecular Switches, 2/e, Wiley-VCH, 2011.
4. Willard Merritt Dean Settle, 7 th Edition Instrumental methods for analysis

Mapping of COs to POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2													
CO2	3														
CO3		3												
CO4		3												
CO5	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)
	Register (Hrs)	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	10	10	15.6	2	Understand	L2	PO1	PO1: Apply (L3)	2
2	10	17	26.5	3	Apply	L3	PO1	PO1: Apply (L3)	3
3	10	12	18.7	3	Analyze	L4	PO2	PO2: Analyze (L4)	3
4	10	13	20.3	3	Analyze	L4	PO2	PO2: Analyze (L4)	3
5	10	12	18.7	3	Apply	L3	PO1	PO1: Apply (L3)	3
	50	64							

CO1: Understand the interaction of energy levels between atoms and molecules
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: Apply the electrochemical principles to the construction of batteries, fuel cells and electrochemical sensors
Action Verb: Apply (L3)
PO1 Verbs: Apply (L3)
CO2 Action Verb is equal to PO1 verb; Therefore correlation is high (3).
CO3: Analyze the preparation and mechanism of polymers
Action Verb: Analyze (L4)
PO2 Verb: Analyze (L4)
CO3 Action Verb level isequal to PO2 verb; Therefore correlation is high (3).
CO4: Analyze the separation of gaseous and liquid mixtures using instrumental methods
Action Verb: Analyze (L4)
PO2 Verb: Analyze (L4)
CO4 Action Verb level isequal to PO2 verb; Therefore correlation is high (3).
CO5: Apply the purification technique to remove hardness of water and to check the quality of water
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	Problem Solving And Programming	L	T	P	C
20AES0501	I-I		3	0	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	PO12	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 Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
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 PO12	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO12: Thumb rule	3 2 3 2
3	19	25%	3	CO3: Understand	L2	PO1 PO2 PO12	PO1: Apply(L3) PO2: Review (L2) PO12: Thumb rule	2 3 2
4	15	20%	2	CO4: Apply	L3	PO1 PO2 PO3 PO12	PO1: Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO12: Thumb rule	3 3 3 2
5	12	16%	2	CO5: Analyze	L4	PO1 PO2 PO3 PO12	PO1: Apply(L3) PO2: Review (L2) PO3: Develop(L3) PO12: 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)
PO12: 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)
PO12: 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)
PO12: 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)
PO12: Thumb rule
For some Data Structures operations to perform Sorting and Searching Techniques are used to create programs. Therefore, the correlation is medium (2)

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

Course Outcomes:

After studying the course, student will be able to

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

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

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

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

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

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

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

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	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3							3			2	2
CO2	2		2							3			2	2
CO3	2		2							3			2	2
CO4	3		3							3			2	2
CO5	3		3							3			2	2

Co-relation Matrix:

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

Justification Statements:

CO1: Apply the concepts of engineering curves for technical drawing
Action Verb: Apply (L3)
PO1 Verb: **Apply (L3)**
CO1 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Develop (L3)**
CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO10 Verb: Thumb Rule (TR)
CO1: Engineering graphics involves creating visual representations and technical drawings to communicate design ideas, concepts and specifications. Therefore, the correlation is high (3)

CO2: Understand the quadrant system to locate the position of points and projection of lines.
Action Verb: Understand (L2)
PO1 Verb: **Apply (L3)**
CO2: Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)
PO2 Verb: **Develop (L3)**
CO2: Action verb is less than PO2 verb by one level. Therefore, the correlation is medium (2)

PO10 Verb: Thumb Rule (TR)

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

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

Action Verb: Analyze (L4)

PO1 Verb: **Apply (L3)**

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

PO2 Verb: **Develop (L3)**

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

PO10 Verb: Thumb Rule (TR)

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

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

Action Verb: Analyze (L4)

PO1 Verb: **Apply (L3)**

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

PO2 Verb: **Develop (L3)**

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

PO10 Verb: Thumb Rule (TR)

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

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

Action Verb: Apply (L3)

PO1 Verb: **Apply (L3)**

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

PO2 Verb: **Develop (L3)**

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

PO10 Verb: Thumb Rule (TR)

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

Course Code	Year & Sem	Information Technology and Numerical Methods	L	T	P	C
20AES0505	I-I	**(common to CSE,CSE(DS),CIC)**	**3**	**0**	**0**	**3**

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the Digital World and Exploring Cyber space.
CO2: **Analyze** the needs of hardware and software required for a computation task.
CO3: **Analyze** Peripheral devices networking and internet concepts.
CO4: **Apply** the concepts of Errors, Algebraic & Transcendental Equations to solve different Engineering problems.
CO5: **Analyze** the relevant numerical methods in interpolation, curve fitting, numerical differentiation and integration.
CO6: **Evaluate** the numerical solutions of ordinary differential equations by using different methods.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the Digital World		Exploring Cyber space.	L2
CO2	Analyze	the needs of hardware and software required for a computation task			L4
CO3	Analyze	Peripheral devices, networking and internet concepts			L4
CO4	Apply	the concepts of Errors, Algebraic & Transcendental Equations		to solve different Engineering problems.	L3
CO5	Analyze	the relevant numerical methods in interpolation, curve fitting, numerical differentiation and integration.			L4
CO6	Evaluate	the numerical solutions of ordinary differential equations	by using different methods.		L5

Information Technology

UNIT – I		8 Hrs

INTRODUCTION TO INFORMATION TECHNOLOGY Your Digital World: The Practical User: How Becoming Computer Savvy Benefits You, Information Technology & Your Life: The Future Now, Infotech Is All Pervasive: Cell phones, Email, the Internet, & the E-World, The "All-Purpose Machine": The Varieties of Computers, Understanding Your Computer: How Can You Customize (or Build) Your Own PC?, Where Is Information Technology Headed?

THE INTERNET & THE WORLD WIDE WEB Exploring Cyberspace: Connecting to the Internet: Narrowband, Broadband, & Access Providers, How Does the Internet Work? The World Wide Web, Email & Other Ways of Communicating over the Net, The Online Gold Mine: Telephony, Multimedia, Webcasting, Blogs, E-Commerce, & the Social Web, The Intrusive Internet: Snooping, Spamming, Spoofing, Phishing, Pharming, Cookies, & Spyware.

UNIT – II		9 Hrs

SOFTWARE Tools for Productivity & Creativity: SOFTWARE: TOOLS FOR PRODUCTIVITY & CREATIVITY, **System Software:** The Power Behind the Power, The Operating System: What It Does? Other System Software: Device Drivers & Utility Programs, Common Features of the User Interface,

Common Operating Systems, Application Software: Getting Started, Word Processing, Spreadsheets, Database Software, Specialty Software

HARDWARE: THE CPU & STORAGE How to Choose a Multimedia Computer System: HARDWARE: THE CPU & STORAGE: HOW TO CHOOSE A MULTIMEDIA COMPUTER SYSTEM, Microchips, Miniaturization, & Mobility, the System Unit: The Basics, More on the System Unit, Secondary Storage, Future Developments in Processing & Storage

UNIT – III		8 Hrs

HARDWARE: INPUT & OUTPUT Taking Charge of Computing & Communications: Input & Output, Input Hardware, Output Hardware, Input & Output Technology & Quality of Life: Health & Ergonomics, The Future of Input & Output

COMMUNICATIONS, NETWORKS, & SAFEGUARDS The Wired & Wireless World: From the Analog to the Digital Age, Networks, Wired Communications Media, Wireless Communications Media, Cyber Threats, Hackers, & Safeguards

Textbooks:

1. Using Information Technology 9th Edition By Brian Williams and Stacey Sawyer, Mcgraw Hill Publications
2. "Computer Oriented Numerical Methods" by V Rajaraman

Reference Books:

1. Uttam K Roy, ―Web Technologiesǁ, 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 PHPǁ, 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 Programǁ, Prentice Hall, 5 th Edition, 2011.
6. Numerical Methods by E Balaguruswamy

<div align="center">Numerical Methods</div>

UNIT – I		15 Hrs

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.

Solution of Algebraic and Transcendental Equations: The Bisection Method – The Method of False Position– NewtonRaphson Method, Solution of linear simultaneous equation: Crout's triangularisation method, Gauss - Seidal iteration method

UNIT – II		15 Hrs

Interpolation: Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

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 – III		16 Hrs

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. Initial Value Problem, Eigen Value Problem and Boundary-value Problem

TEXT BOOKS:

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

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3											2	
CO2		3		3	3									
CO3	3	3											3	
CO4	3													

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
CO5	3							
CO6	3							

Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	11	36%	3	CO1: understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	10	33%	3	CO2: Analyze	L4	PO2 PO4 PO5	PO2: Identify(L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3
3	9	31%	3	CO3: Analyze	L4	PO1 PO2 PO10	PO1: Apply(L3) PO2: Identify(L3) PO12:Thumbrule	3 3 3
	30	100 %						

Justification Statements :

CO1: Understand the Digital World and Exploring Cyber space.

Action Verb : Understand (L2)
PO1 Verb : Apply(L3)
CO1 Action verb is less than level of PO1 verb by one level. Therefore, the correlation is medium of (2)
PO2 Verb : Review(L2)
CO1 Action verb is Same as level of PO2 Therefore, the correlation is High(3)
CO2: Analyze the needs of hardware and software required for a computation task.
Action Verb : Analyze(L4)
PO2 Verb Identify(L3)
CO2 Action verb is more than level of PO2 verb by one level. Therefore, the correlation is High(3)
PO4 Verb : Analyze(L4)

CO2 Action verb is same as level of PO4 verb Therefore, the correlation is High(3)
PO5: Apply(L3)
CO2 Action verb is hreater than level of PO2 verb by one level. Therefore, the correlation is High(3)

CO3: Analyze Communications, networking and internet concepts.
Action Verb : Analyze(L4)

PO1: Apply(L3)
CO3 Action verb is greater than level of PO1 verb by one level. Therefore, the correlation is High(3)
PO2: Identify(L3)

CO3 Action verb is greater than level of PO2 verb by one level. Therefore, the correlation is High(3)
PO12:Thumbrule
CO3:Networking and Peripheral concepts of updates required .so one its to learn frequently Therefore, the correlation is High(3)

Correlation matrix

Unit No.	CO					Program Outcom	PO(s) :Action Verb and BTL(for PO1 to	Level of Correlati
	Lesson	%	Correlatio	Co's Action verb	BTL			

	plan(Hrs)		n			e (PO)	PO12)	on (0-3)
4	15	33%	3	CO4: **Apply**	L3	PO1	PO1: Apply(L3)	3
5	15	33%	3	CO5: Analyze	L4	PO2	PO2: Analyze(L4)	3
6	16	34%	3	CO6: **Evaluate**	L5	PO2	PO2: Analyze(L4)	3
	30	100 %						

Justification Statements :

CO4: **Apply** the concepts of Errors, Algebraic & Transcendental Equations to solve different Engineering problems.
Action Verb : Apply (L3)
PO1 Verb : Apply(L3)
CO4 Action verb is same as PO1 verb. Therefore, the correlation high (3)

CO5: **Analyze** the relevant numerical methods in interpolation, curve fitting, numerical differentiation and integration.
Action Verb : Analyze(L4)
PO2 Verb Analyze(L4)
CO5 Action verb is same as PO2 verb. Therefore, the correlation is High(3)

CO6: **Evaluate** the numerical solutions of ordinary differential equations by using different methods.

Action Verb : Evaluate (L5)

PO2: Analyze(L4)

CO6 Action verb is greater than level of PO2 verb. Therefore, the correlation is High(3)

Course Code	Year & Sem	Computer Science And Engineering Workshop	L	T	P	C
20AES0506	I-I		0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO 1: Understand the Process of assembling and disassembling of a computer system.

CO 2: Analyze the Software Installation steps to trouble shoot the Hardware and software

CO 3: Apply the basic formulas and functions, formatting text & objects on a required content.

 CO 4: Apply the designs and templates for creating effective presentations.

CO 5: Understand the fundamentals of the Internet of Things (IoT) and its real-world applications.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the Process of assembling and disassembling of a computer system			L2
CO2	**Analyze**	the Software Installation steps		to trouble shoot the Hardware and software	L4
CO3	**Apply**	the basic formulas and functions, formatting text & objects on a required content			L3
CO4	**Apply**	the designs and templates		for creating effective presentations	L3
CO5	**Understand**	the fundamentals of the Internet of Things (IoT) and its real-world applications			L2

Preparing your computer

Task 1: Assembling a Computer: Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods available (eg: beeps). Students should record the process of assembling and trouble shooting a computer. **(CO1)**

Task 2: Install Operating system: Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process. **(CO2)**

Productivity tools

Task 3: Word Processor: Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the colour, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit a user manual of the word processor considered. **(CO3)**

Task 4: Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet application considered.**(CO3)**

Task 5: Presentations: creating, opening, saving and running the presentations, selecting the style for slides, formatting the slides with different fonts, colours, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyperlinking, running the slide show, setting the timing for slide show. Students should submit a user manual   of the Presentation tool considered.**(CO4)**

IoT

Task 6: Raspberry Pi

Study the architecture of Raspberry pi, configure software, Install SD card, Connect the cables, Install Raspbian (or any other) operating system, Configure Wi-Fi, Remotely connect to your Raspberry Pi.**(CO5)**

Story Telling

Task 7: Storytelling

Use Adobe spark or any other tool to create Graphics, Webpages, and Videos. **(CO5)**

Reference Books:

1. B. Govindarajulu, "IBM PC and Clones Hardware Trouble shooting and Maintenance", 2nd edition, Tata McGraw-Hill, 2002
2. "MOS study guide for word, Excel, Powerpoint & Outlook Exams", Joan Lambert, Joyce Cox, PHI.
3. "Introduction to Information Technology", ITL Education Solutions limited, Pearson Education.
4. Rusen, "Networking your computers and devices", PHI
5. Bigelows, "Trouble shooting, Maintaining & Repairing PCs", TMH.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3											2	
CO2	3	3	3	3	3								2	2
CO3	3	3	3	2	3							3	2	2
CO4	3		3	2	3							3	2	
CO5	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 PO12)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1	PO1: Apply(L3)	2
			PO2	PO2: Review(L2)	3
2	CO2: Analyze	L4	PO1	PO1: Apply(L3)	3
			PO2	PO2: Identify (L3)	3
			PO3	PO3: Develop(L3)	3
			PO4	PO4: Analyze (L4)	3
			PO5	PO5: Apply (L3)	3
3	CO3: Apply	L3	PO1	PO1: Apply(L3)	3
			PO2	PO2: Review (L2)	3
			PO3	PO3: Develop(L3)	3
			PO4	PO4: Analyze (L4)	2
			PO5	PO5: Apply (L3)	3
			PO12	PO12: Thumb rule	3
4	CO4: Apply	L3	PO1	PO1: Apply(L3)	3
			PO3	PO3: Develop(L3)	3
			PO4	PO4: Analyze (L4)	2
			PO5	PO5: Apply (L3)	3
			PO12	PO12: Thumb rule	3
5	CO5: Understand	L2	PO1	PO1: Apply(L3)	2
			PO2	PO2: Identify (L3)	2

Justification Statements :

CO 1: Understand the Process of assembling and disassembling of a computer 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 as PO2 verb. Therefore, the correlation is high (3)

CO 2: Analyze the Software Installation steps to trouble shoot the Hardware and software
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)

CO 3: Apply the basic formulas and functions, formatting text & objects on a required content
Action Verb: Apply (L3)
PO1: Apply (L3)
CO3 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2: Review(L2)
CO3 Action verb is less than as PO2 verb. Therefore, the correlation is medium(2)
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. Therefore, the correlation is medium(2))
PO5: Apply (L3)
CO3 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

PO12: Thumb rule
Documentation and presentation is learning process to find the solution better manner the correlation is high (3)

CO 4: Apply the designs and templates for creating effective presentations.

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)
PO4: Analyze (L4)
CO4 Action verb is less than PO4 verb. Therefore, the correlation is medium (2)
PO5: Apply (L3)
CO4 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

PO12: Thumb rule
Spread sheets in Excel is the trending approach in the current days Therefore, the correlation is high (3)
CO 5: Understand the fundamentals of the Internet of Things (IoT) and its real-world applications

Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO5 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)
PO2 Verb: Review(L2)
CO5 Action verb is less than PO2 verb. Therefore, the correlation is medium (2)

Course Code	Year & Sem	CHEMISTRY LAB	L	T	P	C
20ABS9909	I-I	**(Common to I Sem – CSE, CIC, II Sem ECE/EEE)**	0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO1: Analyze the hardness of ground water sample.
CO2: Apply the internal and external indicators in volumetric analysis.
CO3: Analyze the preparation and applications of advanced polymer materials.
CO4: Apply the electro analytical technique to measure the strength of acids.
CO5: Analyze the mixture of components by chromatographic techniques.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Analyze	The Hardness of ground water sample.			**L4**
CO2	Apply	The internal and external indicators		In volumetric analysis	**L3**
CO3	Analyze	The preparation and applications advanced polymer materials			**L4**
CO4	Apply	The electro analytical technique		to measure the strength of acids	**L3**
CO5	Analyze	The Mixture of components	By chromatographic techniques		**L4**

List of Experiments:

1. Determination of Hardness of a groundwater sample. (CO1)
2. Estimation of iron (II) using Diphenylamine indicator (Dichrometry – Internal indicator method) (CO2)
3. Determination of pH metric titration of strong acid vs. strong base (CO4)
4. Conductometric titration of strong acid vs. strong base (CO4)
5. Determination of Fe (II) in Mohr's salt by potentiometric method. (CO4)
6. Determination of percentage of Iron in Cement sample by colorimetry
7. Determination of Strength of an acid in Pb-Acid battery (CO2)
8. Preparation of phenol-formaldehyde resin (CO3)
9. Preparation of TIO_2/ZnO nano particles (Precipitation Method) (CO3)
10. Estimation of Calcium in port land Cement (CO2)
11. Adsorption of acetic acid by charcoal (CO2)
12. Thin layer chromatography (CO5)

Note: Any TEN of the listed experiments are to be conducted. Out of which any TWO Experiments may be conducted in virtual mode.

Reference:

- "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C.Denney, J.D.Barnes and B. Sivasankar

Mapping of COs to POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				3										
CO2				3										
CO3				3										
CO4				3										
CO5				3										

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

CO-PO mapping justification:

CO	CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Verb	**BTL**			
1	Analyze	**L4**	PO4	PO4: Analyze (L4)	3
2	Apply	**L3**	PO4	PO4: Analyze (L3)	2
3	Analyze	**L4**	PO4	PO4: Analyze (L4)	3
4	Apply	**L3**	PO4	PO4: Analyze (L3)	2
5	Analyze	**L4**	PO4	PO4: Analyze (L4)	3

CO1: Analyze the hardness of ground water sample.

Action Verb: Analyze **(L4)**

PO4 Verb: Analyze (L4)

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

CO2: Apply the internal and external indicators in volumetric analysis.

Action Verb: Apply **(L3)**

PO4 Verb: Analyze (L3)

CO2 Action Verb is less than PO4 verb; therefore, correlation is less (2)

CO3: Analyze the preparation and applications of advanced polymer materials.

Action Verb: Analyze **(L4)**

PO4 Verb: Analyze (L4)

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

CO4: Apply electro analytical technique to measure the strength of acids.

Action Verb: Apply **(L3)**

PO4 Verb: Analyze (L4)

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

CO5: Analyze mixture of components by chromatographic techniques.

Action Verb: Analyze **(L4)**

PO4 Verb: Analyze (L4)

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

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

Course Outcomes:

After studying the course, student will be able to

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

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

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

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

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

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

List of Experiments
1. Assemble and disassemble parts of a Computer **(CO1)**
2. Design a C program which reverses the number**(CO1)**
3. Design a C program which finds the second maximum number among the given list of numbers. **(CO2)**
4. Construct a program which finds the kth smallest number among the given list of numbers. **(CO2)**
5. Design an algorithm and implement using C language the following exchanges a ← 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	PO12	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 PO12)	Level of Correlation (0-3)
1	CO1: Analyze	L4	PO1	PO1: Apply(L3)	3
			PO2	PO2: Review(L2)	3
2	CO2: Analyze	L4	PO1	PO1: Apply(L3)	3
			PO2	PO2: Identify (L3)	3
			PO3	PO3: Develop(L3)	3
			PO4	PO4: Analyze (L4)	3
			PO5	PO5: Apply (L3)	3
3	CO3: 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
			PO12	PO12: 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
			PO5	PO5: Apply (L3)	3
			PO12	PO12: 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 :

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: idetify(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)

PO12: 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)

PO12: 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 AND SCIENCES, TIRUPATI (AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)

AK20 REGULATION

(Effective for the batches admitted in 2020-21)

Semester II (First year)

S.No	Category	Course Code	Course Title	L	T	P	Credits C	CIE	SEE	TOTAL
1	BS	20ABS9902	Applied Physics	3	0	0	3	30	70	100
2	BS	20ABS9911	Probability and Statistics	3	0	0	3	30	70	100
3	HS	20AHS9901	Communicative English	3	0	0	3	30	70	100
4	ES	20AES0502	Data Structures	3	0	0	3	30	70	100
5	ES	20AES0507	Web Design	1	0	4	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	20AES0504	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

Course Code	Year & Sem	APPLIED PHYSICS	L	T	P	C
20ABS9902	I-II		3	0	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	PO12	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).

Course Code	Year & Sem	Probability and Statistics	L	T	P	C
20ABS9911	I-II		3	0	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), x2 - 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	PO12	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)
COMPUTER SCIENCE AND ENGINEERING (CSE)

Course Code	Year & Sem	COMMUNICATIVE ENGLISH	L	T	P	C
20AHS9901	I-II		3	0	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	PO12	PSO1	PSO2
CO1										3				
CO2									2	3				
CO3										3				
CO4										3				

CO5								3				

Corelation Matrix

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

Justification Statements :

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

Action Verb: Understand (L2)

CO1 Action Verb Understand is of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 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 PO12 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 PO12 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 PO12 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 PO12 as high (3).

Course Code	Year & Sem	Data Structures (common to CSE,CIC,CSE(DS))	L	T	P	C
20AES0502	I-II		3	0	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	PO12	PSO1	PSO2
CO1	2	3											2	
CO2	3	3		3								2	2	1
CO3	3	3		3								2	2	1
CO4	1	2	3	3			3					3	2	2
CO5	3	3	3	2								3	2	2

Correlation matrix

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO12)	Level of Correlation (0-3)
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 PO12	PO1: Apply(L3) PO2: Review (L2) PO4: Develop (L3) PO12: Thumb rule	3 3 3 2
3	15	20%	2	CO3: Apply	L3	PO1 PO2 PO4 PO12	PO1: Apply(L3) PO2: Review (L2) PO4: Develop (L3) PO12: Thumb rule	3 3 3 2
4	13	18%	2	CO4: Evaluate	L5	PO1 PO2 PO3 PO4 PO7 PO12	PO1: Apply(L3) PO2: Formulate (L6) PO3: Develop (L3) PO4: Analyze(L4) PO7: Thumb rule PO12: Thumb rule	1 2 3 3 3 3
5	14	19%	2	CO5: Apply	L3	PO1 PO2 PO3 PO4 PO12	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze(L4) PO12: 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)
PO12: 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)
PO12: Thumb rule
For some of Non-Linear Data Structure applications, array and structure concepts are used to write programs. Therefore, the correlation is medium (2)

CO4: Evaluate the real time problems using graphs and hashing techniques
Action Verb: Evaluate (L5)

PO1: Apply(L3)
CO4 Action verb is less than PO1 verb by two levels. Therefore, the correlation is low (1)
PO2: Review (L2)
CO4 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is greater than PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO4 Action verb is greater than PO4 verb. Therefore, the correlation is high (3)
PO7: Thumb rule
For some of Real Time problems Data Structure applications, Graph concept is indirectly used to sustainable environment development. Therefore, the correlation is high (3)
PO12: 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)
PO12: Thumb rule
For some of data manipulations Sorting and File Organization methods are used to solve storage problems. Therefore, the correlation is high (3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)

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

Course Outcomes:

After studying the course, student will be able to

CO 1: Understand basic HTML tags to design web pages

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

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

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

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

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

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

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

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

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

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

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

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

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

Textbooks:

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

Reference Books:

1. Uttam K Roy, ─Web Technologies‖, Oxford University Press, 1st Edition, 2010.
2. HTML and CSS: Design and Build Websites 1st Edition by Jon Duckett (Author) india price
3. Steven Holzner, ─The Complete Reference PHP‖, Tata McGraw-Hill, 1st Edition, 2007.
4. HTML & CSS: The Complete Reference, Fifth Edition (Complete Reference Series)
5. Deitel and Deitel and Nieto, ─Internet and World Wide Web - How to Program‖, Prentice Hall, 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	PO12	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 PO12)	Level of Correlation (0-3)
1	**CO1: Understand**	L2	PO1 PO3 PO9	PO1: Apply(L3) PO3: Design(L6) PO9: Thumb Rule	2 2 3
2	**CO2: Apply**	L3	PO1 PO3 PO9	PO1: Apply(L3) PO3: Design(L6) PO9: Thumb Rule	3 2 3
3	**CO3: Apply**	L3	PO1 PO3 PO9 PO10 P011	PO1: Apply(L3) PO3: Design(L6) PO9: Thumb Rule PO10: Thumb Rule P011: Thumb Rule	3 2 3 3 3
4	**CO4: Apply**	L3	PO1 PO3 PO9 PO10 PO11 PO12	PO1: Apply(L3) PO3: Design(L6) PO9: Thumb Rule PO10: Thumb Rule PO11: Thumb Rule PO12: Thumb Rule	3 2 3 3 3 3
5	**CO5: Create**	L6	PO1 PO3 PO4 PO9 PO10 PO11 PO12	PO1: Apply(L3) PO3: Design(L6) PO4: Design(L6) PO9: Thumb Rule PO10: Thumb Rule PO11: Thumb Rule PO12: Thumb Rule	3 3 3 3 3 3 3

Justification Statements:

CO1: Understand basic HTML tags to design web pages
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO1 Action verb is lesser than as PO1 verb. Therefore, the correlation is medium (2)
PO3: Design(L6)
CO1 Action verb is lesser than as PO3 verb. Therefore, the correlation is medium (2)
PO9: Thumb Rule
CO1 Using Basic HTML tags, mages and colors, therefore the correlation is high (3)

CO2: Apply Advanced features to your webpage including special effects
Action Verb: Apply (L3)
PO1: Apply (L3)
CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO3: Design(L6)
CO2 Action verb is lesser than as PO3 verb. Therefore, the correlation is high (2)
PO9: Thumb rule
CO2 Using HTML elements like links, adding audio & video to the web page, therefore the correlation is high (3)

CO3: Apply The CSS Knowledge to add colours and text formatting
Action Verb: Apply(L3)
PO1: Apply (L3)
CO3 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO3: Design(L6)

CO3 Action verb is lesser than as PO3 verb. Therefore, the correlation is medium (2)
PO9: Thumb rule
CO3 Styling and decorating with box dimensions, padding. Websites plays very crucial role in present days, therefore the correlation is high (3)
PO10: Thumb rule
CO3 Web pages are used to create blogs to share effective content, therefore the correlation is high (3)
PO11: 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)
PO9: Thumb rule
CO4 Using advanced CSS style presentations, therefore the correlation is high (3)
PO10: Thumb rule
CO4 Using advanced CSS techniques, therefore the correlation is high (3)
PO11: 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)
PO12: 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)
PO9: Thumb rule
CO5 Creating HTML and CSS programs, therefore the correlation is high (3)
PO10: Thumb rule
CO5 Creating HTML and CSS programs, therefore the correlation is high (3)
PO11: 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)
PO12: 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)

Course Code	Year & Sem	COMMUNICATIVE ENGLISH LAB	L	T	P	C
20AHS9902	I-II		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	PO12	PSO1	PSO2
CO1										3				
CO2									2					
CO3										2				
CO4										3				
CO5										3				

Corelation Matrix

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

Justification Statements:

CO1: Evaluate awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.
Action Verb: Evaluate (L5)
CO1 Action Verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 to PO12 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 PO12 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 PO12 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 PO12 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 PO12 as high (3).

Course Code	Year & Sem	Applied Physics Lab	L	T	P	C
20ABS9907	I-II		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	PO12	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).

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

Course Outcomes:

After studying the course, student will be able to

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

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

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

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

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

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

List of Experiments

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	PO12	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 PO12)	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 PO12	PO1: Apply(L3) PO2: Develop (L3) PO3: Design (L6) PO4: Design (L6) PO5:Create(L6) PO12: Thumb rule	3 3 3 3 3 3
3	CO3: Design	L6	PO1 PO2 PO3 PO4 PO5 PO12	PO1: Apply(L3) PO2: Develop (L3) PO3: Design (L6) PO4: Design (L6) PO5:Create(L6) PO12: Thumb rule	3 3 3 3 3 3
4	CO4: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO7 PO12	PO1: Apply(L3) PO2: Review (L2) PO3: Design (L6) PO4: Analysis(L4) PO5:Create(L6) PO7: Thumb rule PO12: Thumb rule	3 3 3 2 2 3 3
5	CO5: Design	L6	PO1 PO2 PO3 PO4 PO5 PO12	PO1: Apply(L3) PO2: Review(L2) PO3: Design(L6) PO4: Analysis(L4) PO5:Create(L6) PO12: 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)
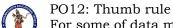CO2 Action verb is same level PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: Design(L3)
CO2 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO4: Design (L6)
CO2 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
PO5 Verb: Create(L6)
CO1 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO12: 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)
PO12: 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)
PO12: 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)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)

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

Course Outcomes:

After studying the course, student will be able to

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

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

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

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

CO5:Understand the population explosion

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

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	PO12	PSO1	PSO2
CO1						2	2							
CO2							2					2		
CO3						2	2							
CO4						2	2							
CO5							2					2		

Correlation matrix

CO	Percentage of contact hours over the total planned contact hours				CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Register (Hrs)	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	**10**	**12**	23	3	**Understand**	**L2**	PO6,PO7	PO6: PO7:	2,2
2	**15**	**15**	28	3	**Understand**	**L2**	PO7,PO12	PO7: PO12:	2,2
3	**8**	**8**	15	2	**Apply**	**L3**	PO6 PO7	PO6: PO7:	2,2
4	**9**	**10**	19	2	**Apply**	**L3**	PO6,PO7	PO6: PO7:	2,2

5	8	8	15	2	Understand	L2	PO7,PO12,	PO7: PO12:	2,2
	50	53	100						

Justification Statements:

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

Action Verb: Understand (L2)

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

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

Action Verb: Understand (L2)

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

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

Action Verb: APPLY (L3)

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

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

Action Verb: APPLY (L3)

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

CO5: Understand the population explosion

Action Verb: Understand (L2)

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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI (AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)

AK20 REGULATIONS

(Effective for the batches admitted in 2020-21)

Semester III (Second year) – AK20

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T	P	C			
1	BS	20ABS9914	Discrete Mathematical Structures	3	0	0	3	30	70	100
2	PC	20APC0503	Digital Electronics & Microprocessors	3	0	0	3	30	70	100
3	PC	20APC0502	Database Management Systems	3	0	0	3	30	70	100
4	PC	20APC0526	Basics of Python Programming	3	0	0	3	30	70	100
5	ES	20AES0205	Basics of Electrical and Electronics Engineering	3	0	0	3	30	70	100
6	PC Lab	20APC0505	Database Management Systems Lab	0	0	3	1.5	30	70	100
7	PC Lab	20APC0527	Basics of Python Programming Lab	0	0	3	1.5	30	70	100
8	ES Lab	20AES0206	Basics of Electrical and Electronics Engineering Lab	0	0	3	1.5	30	70	100
9	SC	20ASC0501	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**

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

Course Outcomes:

After studying the course, student will be able to

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

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

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

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

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

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

Unit I: Mathematical Logic: 9 hrs

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

Unit II: Set theory: 9 hrs

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

Unit III: Elementary Combinatorics: 9 hrs

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

Unit IV: Recurrence Relations: 9 hrs

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

Unit V: Graphs: 9 hrs

Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multigraphs and Euler Circuits, Hamiltonian

Graphs, Chromatic Numbers, The Four Color Problem equation using finite difference approximation.

Text books and Reference books:

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

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

Mapping of COs to POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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	P	C
20APC0503	II-I		3	0	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	PO12	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 PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL				
1	14	23%	3	CO1: Understand	L2	PO1 PO3 PO9	PO1: Apply(L3) PO2: Identify(L3) PO9: Thumb Rule	2 2 2
2	10	17%	2	CO2: Analyze	L4	PO1 PO3 PO9	PO1: Apply(L3) PO2: Identify(L3) PO9: Thumb Rule	3 3 2
3	12	20%	2	CO3: Evaluate	L3	PO1 PO2 PO9 PO10	PO1: Apply(L3) PO2: Identify(L3) PO9: Thumb Rule PO10: Thumb Rule	3 3 2 2
4	10	17%	2	CO4: Apply	L3	PO1 PO3 PO9 PO10	PO1: Apply(L3) PO3: Develop(L3) PO9: Thumb Rule PO10: Thumb Rule	3 3 2 2
5	14	23%	3	CO5: Analyze	L4	PO1 PO3 PO4 PO10	PO1: Apply(L3) PO3: Develop(L3) PO4: Apply(L3) PO10: Thumb Rule	2 2 2 2
	60	100 %						

Justification Statements:

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

Action Verb : Understand (L2)

PO1 Verb : Apply(L3)

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

PO2 Verb : Identify(L3)

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

PO9: Thumb rule
To involvement of individual must know all the basic concept to understand team work outcomes. Therefore the correlation is medium (2)

CO 2: Analyze the different logic circuit by combining sequential and combinational circuits
Action Verb : Analyze (L4)
PO1: Apply(L3)
CO2 Action verb is less than PO1 verb. Therefore, the correlation is high (3)
PO2: Identify(L3)
CO2 Action verb is less than PO2 verb. Therefore, the correlation is high (3)
PO9: Thumb rule
At the time of design sequential and combinational circuits were need to form the team and develop required circuits in long period. Therefore the correlation is medium (2)

CO 3: Evaluate the different sequential logic circuits for construct complex circuits like counters and registers.
Action Verb : Evaluate (L5)
PO1: Apply(L3)
CO3 Action verb is greater than PO1 verb. Therefore, the correlation is High (3)
PO2: Identify (L3)
CO3 Action verb is greater than PO2 verb. Therefore, the correlation is High (3)
PO9: Develop (L3)
Need to analyze real time application from the whole team for construct complex circuits. Therefore, the correlation is high(3)
PO10: Thumb rule
For resolving solutions to complex problem required a strong engineering concepts. Therefore, the correlation is high(3)

CO 4: Apply the 8086 microprocessors to design application for real world issues.
Action Verb :Apply (L3)
PO1: Apply(L3)
CO4 Action verb is same as PO1 verb. Therefore the correlation is high (3)
PO3: Develop(L3)
CO4 Action verb is same as PO3 verb. Therefore the correlation is high(3)
PO9: Thumb rule
To implement real world application, the individual should have deep knowledge about 8086 microprocessors. Therefore, the correlation is medium. Therefore the correlation is medium(2)
PO10: Thumb rule
Once the model ready with 8086 microprocessors, need to narrate about model with understandable manner Therefore the correlation is medium (2)

CO 5: Analyze the 8051 micro controller to construct complex microprocessor working model for real world problems.
Action Verb : Analyze (L4)
PO1: Apply(L3)
CO5 Action verb is greater than PO1 verb. Therefore the correlation is high(3)
PO3: Develop (L3)
CO5 Action verb is greater than PO3 verb. Therefore the correlation is high(3)
PO4: Analyze (L4)
CO5 Action verb is same as PO4 verb. Therefore the correlation is high(3)
PO9: Thumb rule
Once the model ready with 8085 micro controllers, need to narrate about model with understandable manner Therefore the correlation is high(3)

Course Code	Year & Sem	Database Management Systems	L	T	P	C
20APC0502	II-I	(common to CSE,CIC,AIDS,AIML,CSE(DS))	3	0	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.

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

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

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	PO12	PSO1	PSO2
CO1	2	3												
CO2	3	3										2		
CO3	3	3	3	2	3			2	2			2		

Unit No.	CO						Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL				
1	13	14%	2	CO1 :Understand	L2		PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	19	20%	2	CO2 :Apply	L3		PO1 PO2 PO12	PO1: Apply(L3) PO2: Review(L2) PO12: Thumb rule	3 3 2
3	18	19%	2	CO3 :Apply	L3		PO1	PO1: Apply(L3)	3

| CO4 | 3 | 3 | 3 | 3 | 3 | | | 3 | | | | | 2 | |
| CO5 | | 3 | 3 | 3 | 3 | | | 2 | 2 | | | 2 | | |

						PO2	PO2: Review(L2)	3
						PO3	PO3: Develop (L3)	3
						PO4	PO4: Analyze (L4)	2
						PO5	PO5: Apply(L3)	3
						PO8	PO8: Thumb rule	2
						PO9	PO9: Thumb rule	2
						PO12	PO12: Thumb rule	2
4	18	19%	2	CO4 :Analyze	L4	PO1	PO1: Apply(L3)	3
						PO2	PO2: Analyze(L4)	3
						PO3	PO3: Develop (L3)	3
						PO4	PO4: Analyze (L4)	3
						PO5	PO5: Apply(L3)	3
						PO8	PO8: Thumb rule	3
5	25	27%	3	CO5 :Analyze	L4	PO2	PO2: Analyze(L4)	3
						PO3	PO3: Develop (L3)	3
						PO4	PO4: Analyze (L4)	3
						PO5	PO5: Apply(L3)	3
						PO8	PO8: Thumb rule	2
						PO9	PO9: Thumb rule	2
						PO12	PO12: Thumb rule	2
	93	100 %						

Correlation matrix

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)
PO12: 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)
PO12: 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)
PO8: 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)
PO8 : Thumb rule
Since ethical principles should be followed for transaction management. Therefore the correlation is medium(2)
PO9 : Thumb rule
Team work is required for transaction management and recovery of failure transactions. Hence the correlation is medium (2)
PO12: Thumb rule
In real time transaction management is continuously updating. Therefore the correlation is medium (2)

Course Code	Year & Sem	Basics of Python Programming	L	T	P	C
20APC0526	II-I	**(common to CSE,CIC)**	3	0	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.

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

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

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

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	PO12	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 PO12)	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 PO12	PO1:Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO5: Apply(L3) PO12: Thumb rule	3 3 3 3 2
3	10	19%	2	CO3 : Apply	L3		PO1 PO2 PO3 PO4 PO12	PO1: Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO4: Analyze (L4) PO12: Thumb rule	3 3 3 2 2
4	9	17%	2	CO4 : Apply	L3		PO1 PO2 PO3 PO4 PO12	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze(L4) PO12: Thumb rule	3 3 3 2 2
5	11	20%	3	CO5 :Analyze	L4		PO1 PO2 PO3 PO4 PO12	PO1:Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO4: Analyze (L4) PO12: 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)

PO12: 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)

PO12: 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)

PO12: 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)

PO12: Thumb rule

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

Course Code	Year & Sem	BASICS OF ELECTRICAL AND ELECTRONICS	L	T	P	C
20AES0205	II-I	ENGINEERING	3	0	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: Apply the concepts of Kirchhoff Laws and the basic theorems for Electrical Circuits.

CO2: Analyze the operational characteristics of D.C motor, generator, induction motor and transformer.

CO3: Understand the basic operation of Electrical Power generation and transmission systems.

CO4: Understand the operations of different diodes, transistors and op-amps.

CO5: Analyze the characteristics of BJT, FET and OPAMP applications.

CO6: Understand various modulation concepts and examples of Communication Systems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Apply	The Concepts of Kirchhoff Laws and basic theorems for Electrical circuits			L3
CO2	Analyze	The operational characteristics of D.C motor, generator, induction motor and transformer.			L4
CO3	Understand	The Basic operation of electrical power generation and transmission systems			L2
CO4	Understand	The operations of different diodes, transistors and op-amps.			L2
CO5	Analyze	The characteristics		of BJT, FET and OPAMP applications.	L4
CO6	Understand	Various modulation concepts and examples of Communication Systems.			L2

PART-A
BASIC ELECTRICAL ENGINEERING

UNIT - I	DC & AC Circuits	**9Hrs**

Electrical circuit elements (R - L and C) - Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Superposition Theorem - Representation of sinusoidal waveforms - peak and rms values - phasor representation - real power - reactive power - apparent power - power factor - Analysis of single-phase ac circuits consisting of RL - RC - RLC series circuits.

UNIT - II	DC & AC Machines	**9 Hrs**

Principle and operation of DC Generator - EMF equations - OCC characteristics of DC generator – principle and operation of DC Motor – Performance Characteristics of DC Motor - Speed control of DC Motor – Principle and operation of Single Phase Transformer - OC and SC test on transformer - principle and operation of Induction Motor [Elementary treatment only]

UNIT - III	Basics of Power Systems	**9 Hrs**

Layout & operation of Hydro, Thermal, Nuclear Stations - Solar & wind generating stations – Typical AC Power Supply scheme – Elements of Transmission line – Types of Distribution systems: Primary & Secondary distribution systems.

TEXTBOOKS:

1. D. P. Kothari and I. J. Nagrath - "Basic Electrical Engineering" - Tata McGraw Hill -2010.
2. V.K. Mehta & Rohit Mehta, "Principles of Power System" – S.Chand – 2018.

REFERENCE BOOKS:

1. L. S. Bobrow - "Fundamentals of Electrical Engineering" - Oxford University Press - 2011.
2. E. Hughes - "Electrical and Electronics Technology" - Pearson - 2010.
3. C.L. Wadhwa – "Generation Distribution and Utilization of Electrical Energy", 3rd Edition, New Age International Publications.

<table>
<tr><td colspan="3" align="center">PART-B
(Electronics Engineering)</td></tr>
<tr><td>UNIT – I</td><td></td><td>12Hrs</td></tr>
<tr><td colspan="3">PN JUNCTION DIODE AND SPECIAL DIODE CHARACTERISTICS: Overview of Semiconductors, PN junction diode, Zener diode, Applications of diode as switch and rectifier, Zener diode as regulator, special purpose diodes: schottky diode, tunnel diode, varactor diode, photodiode, phototransistor and LED. BJT construction, operation, configuration and characteristics, JFET and MOSFET construction, operation, characteristics (CS configuration), applications Operational Amplifiers: Introduction, block diagram, basic op-amp circuits: Inverting, Non Inverting, summer, subtractor, voltage follower.</td></tr>
<tr><td>UNIT – II</td><td></td><td>12Hrs</td></tr>
<tr><td colspan="3">TRANSISTOR CHARACTERISTICS: BJT construction, operation, configuration and characteristics, JFET and MOSFET construction, operation, characteristics (CS configuration), applications Operational Amplifiers: Introduction, block diagram, basic op-amp circuits: Inverting, Non Inverting, summer, subtractor, voltage follower.</td></tr>
<tr><td>UNIT – III</td><td></td><td>10Hrs</td></tr>
<tr><td colspan="3">COMMUNICATION SYSTEMS: Introduction, Elements of Communication Systems, EM spectrum, basics of electronic communication, Amplitude and Frequency modulation, Pulse modulation, Communication receivers, Examples of communication systems: Microwave & Satellite, Fibre optic, Television, mobile communication (block diagram approach).</td></tr>
<tr><td colspan="3">Textbooks:</td></tr>
<tr><td colspan="3">1. D.P. Kothari, I.J.Nagrath, Basic Electronics, 2nd edition, McGraw Hill Education(India)Private Limited</td></tr>
<tr><td colspan="3">2. S.K. Bhattacharya, Basic Electrical and Electronics Engineering, 2nd edition, Pearson India Private Limited.</td></tr>
<tr><td colspan="3">Reference Books:</td></tr>
<tr><td colspan="3">1. R. Muthu subramanian, S. Salivahanan, "Basic Electrical and Electronics Engineering", Tata McGraw Hill Education, Reprint 2012.</td></tr>
<tr><td colspan="3">2. David Bell, Electronic Devices and Circuits: Oxford University Press, 5th edition. 2008.</td></tr>
</table>

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2				1							2	
CO2	3	3				1							1	
CO3	2	1				1							1	
CO4	2	3												
CO5	3	3		3										
CO6	2	3												

Correlation matrix

CO	CO					Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	15	33.33	3	Apply	L3	PO1, PO2 , PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6:Thumb Rule	3 2 1
2	17	37.77	3	Analyze	L4	PO1, PO2 , PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6:Thumb Rule	3 3 1
3	13	28.88	3	Understand	L2	PO1, PO2 , PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6:Thumb Rule	2 1 1
	45							

CO1: Apply the concepts of Kirchhoff Laws and the basic theorems for Electrical Circuits.
Action Verb: Apply (L3)
PO1: Apply (L3)
CO1 Action Verb is equal to PO1 verb; Therefore correlation is high (3).
PO2: Analyze (L4)
CO1 Action Verb is less than PO2 verb by one level; Therefore correlation is moderate (2).
PO6: Using thumb rule, CO1 correlates PO6 as low (1).

CO2: Analyze the operational characteristics of D.C motor, generator, induction motor and transformer.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO2 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	Correlation	Co's Action verb	BTL			
1	**16**	42	3	Understand	**L2**	PO1, PO2	PO1: Apply (L3) PO2:	2 3
2	**12**	32	3	Analyze	**L4**	PO1, PO2,PO4	PO1: Apply (L3) PO2: Review(L2) PO4: Analyze(L4)	3 3 3
3	**10**	26	3	Understand	**L2**	PO1, PO2	PO1:Apply(L3) PO2:Review (L2)	2 3
	38	100%						

Justification Statements:
CO 4: Understand the fundamental concepts of diodes, transistors and op-amps.
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
    CO4 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
PO2 Verbs: Review (L2)
    CO4 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
CO 5: Analyze the characteristics of BJT and MOSFET devices
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
    CO5 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO2 Verbs: Review (L2)
    CO5 Action Verb is greater than PO2 verb by two level; Therefore correlation is high (3).
PO4 Verbs: Analyze (L4**)**
    CO5 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
CO 6: Understand the basic concepts and examples of Communication Systems.
Action Verb: Understand (L2)

PO1 Verbs: Apply (L3)
    CO6 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (2).
PO2 Verbs: Review (L2)
    CO6 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

Course Code	Year & Sem	**Database Management System Lab**	**L**	**T**	**P**	**C**
20APC0505	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 deptno is 9.
e. Delete any column data from the table **(CO1)**

3. Create a table called Customer table

Name	Type

Cust name	Varchar2(20)
Cust street	Varchar2(20)
Cust city	Varchar2(20)

    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. |
| |

       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 deptname 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 twosuch sailors.
       c. Find the sname, bid and reservation date for each reservation.
       d. Find the ages of sailors whose name begin and end with B and has at least 3characters.
       e. List in alphabetic order all sailors who have reserved redboat.
       f. Find the age of youngest sailor for each rating level. **(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 than or equal to 10. Else display an error message. Otherwise Display the remainder in words. **(CO2)**

Week-5: PROCEDURES AND FUNCTIONS

1. Write a function to accept employee number as parameter and return Basic +HRA together as single column. **(CO2)**
2. Accept year as parameter and write a Function to return the total net salary spent for a given year. **(CO2)**
3. Create a function to find the factorial of a given number and hence find NCR. **(CO2)**
4. Write a PL/SQL block 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 then apply the logic for GCD of two numbers. GCD of two numbers is performed by dividing the greater number by the smaller number till the remainder is zero. If it is zero, the divisor is the GCD if not the remainder and the divisors of the previous division are the new set of two numbers. The process is repeated by dividing greater of the two numbers by the smaller number till the remainder is zero and GCD is found.
3. Write the PL/SQL programs to create the procedure for factorial of given number. **(CO3)**
4. Write the PL/SQL programs to create the procedure to find sum of N natural number. **(CO3)**
5. Write the PL/SQL programs to create the procedure to find Fibonacci series. **(CO3)**
6. Write the PL/SQL programs to create the procedure to check the given number is perfect or not **(CO3)**

Week-8: CURSORS

1. Write a PL/SQL block that will display the name, dept no, salary of 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 by the quantity specified in the item transaction in case the item id is not present in the item master table then the record is inserted in the item master table. **(CO4)**
2. Write a PL/SQL block that will display the employee details along with salary using cursors. **(CO4)**
3. To write a Cursor to display the list of employees who are working as 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 particular subject for the above case study, do the following:
1. Analyze the data required.
2. Normalize the attributes.
Create the logical data model using E-R diagrams**(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 personal details of every patient are recorded. A separate register is to be held to store the information of the tests undertaken and the results of a prescribed treatment. A number of tests may be conducted for each patient. Each patient is assigned to one leading consultant but may be examined by another doctor, if required. Doctors are specialists in some branch of medicine and may be leading consultants for a number of patients, not necessarily from the same ward. For the above case study, do the following.
1. Analyze the data required.
2. Normalize the attributes.
Create the logical data model using E-R diagrams**(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 and insurance details. It is the company policy not to keep any car for a period exceeding one year. All major repairs and maintenance are done by subcontractors (i.e. franchised garages), with whom CRC has long-term agreements. Therefore the data about garages to be kept in the database includes garage names, addresses, range of services and the like. Some garages require payments immediately after a repair has been made; with others CRC has made arrangements for credit facilities. Company expenditures are to be registered for all outgoings connected with purchases, repairs, maintenance, insurance etc. Similarly the cash inflow coming from all sources: Car hire, car sales, insurance claims must be kept of file. CRC maintains a reasonably stable client base. For this privileged category of customers special credit card facilities are provided. These customers may also book in advance a particular car. These reservations can be made for any period of time up to one month. Casual customers must pay a deposit for an estimated time of rental, unless they wish to pay by credit card. All major credit cards are accepted. Personal details such as name, address, telephone number, driving license, number about each customer are kept in the database. For the above case study, do the following:
1. Analyze the data required.
2. Normalize the attributes.
Create the logical data model using E-R diagrams**(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 of study. The students are reading for a degree (such as BA, BA (Hons.) M.Sc., etc) within the framework of the modular system. The college provides a number of modules, each being characterized by its code, title, credit value, module leader, teaching staff and the department they come from. A module is coordinated by a module leader who shares teaching duties with one or more lecturers. A lecturer may teach (and be a module leader for) more than one module. Students are free to choose any module they wish but the following rules must be observed: Some modules require pre- requisites modules and some degree programs have compulsory modules. The database is also to contain   some information about students including their numbers, names, addresses, degrees they read for, and their past performance i.e. modules taken and examination results.
For the above case study, do the following: **(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.

Online Learning Resources/Virtual Labs:

http://www.scoopworld.in http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3		3								1	
CO2	1	3			3								1	
CO3	3	2		3	3								2	2
CO4	3	2		3	3									
CO5			3		3	2						2		

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO12)	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 PO12	PO3:Design(L6) PO5:Create(L6) PO6:Thumb rule PO12: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)

PO12: Verb:Thumb rule

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

Course Code	Year & Sem	Basics of Python Programming Lab	L	T	P	C
20APC0527	II-I		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 datatypes to read and write data from files.

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

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

List of Experiments:

1. Install Python Interpreter and use it to perform different Mathematical Computations. Try to do all **(CO1)**
the operations present in a Scientific Calculator
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)**

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 $1/\pi$:

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	PO12	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		

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	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
			PO12	PO12: Thumb rule	2
3	CO3 :Analyze	L4	PO1	PO1: Apply(L3)	3
			PO2	PO2: Analyze (L4)	3
			PO3	PO3: Design (L6)	2
			PO4	PO4: Design (L6)	2
			PO9	PO9: Thumb rule	1
			PO12	PO12: Thumb rule	1
4	CO4 :Apply	L3	PO1	PO1: Apply(L3)	3
			PO2	PO2: Analyze (L4)	2
5	CO5 : Design	L6	PO2	PO2: Analyze (L4)	1
			PO3	PO3: Design (L6)	3
			PO4	PO4: Design (L6)	3
			PO5	PO5: Develop (L6)	3
			PO8	PO8: Thumb rule	2
			PO9	PO9: Thumb rule	1
			PO12	PO12: 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)
PO12: 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)

PO9 : Thumb rule

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

PO12: 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)

PO8 : Thumb rule

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

PO9 : Thumb rule

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

PO12: 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)
COMPUTER SCIENCE AND ENGINEERING (CSE)

Course Code	Year & Sem	BASICS OF ELECTRICAL & ELECTRONICS	L	T	P	C
20AES0206	II-I	**ENGINEERING LAB**	0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO1: Apply the Kirchhoff's Laws and Superposition theorem for DC Circuits.

CO2: Analyze the performance of AC and DC Machines by various testing methods.

CO3: Analyze the speed of DC shunt motor using armature and field control methods.

CO4: Analyze the V-I Characteristics of PN and Zener diodes.

CO5: Evaluate the parameters of rectifiers with & without filters

CO6: Analyze the input and output characteristics of BJT and FET.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Apply**	The Kirchhoff's Laws & Superposition theorem for dc circuits			L3
CO2	**Analyze**	The performance of AC and DC Machines	by various testing methods.		L4
CO3	**Analyze**	the speed of DC shunt motor	using armature and field control methods.		L4
CO4	**Analyze**	the V-I Characteristics of PN and Zener diodes			L4
CO5	**Evaluate**	the parameters of rectifiers with & without filters			L5
CO6	**Analyze**	the input and output characteristics of BJT and FET.			L4

List of Experiments:
Part A: Electrical Engineering Lab

1. Verification of Kirchhoff laws-(CO1).
2. Verification of Superposition Theorem-(CO1).
3. Open circuit characteristics of a DC Shunt Generator-(CO2).
4. Speed control of DC Shunt Motor-(CO3).
5. OC & SC test of 1 – Phase Transformer-(CO2).
6. Brake test on 3 - Phase Induction Motor-(CO2).
7. Brake test on DC Shunt Motor-(CO2).

Part B: Electronics Engineering Lab

1. PN Junction Diode Characteristics.
2. Zener Diode Characteristics.
3. Rectifiers (With and Without Filter).
4. BJT Characteristics (CB Configuration).
5. BJT Characteristics (CE Configuration).
6. FET Characteristics (CS Configuration).

Tools Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

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	PO12	PSO1	PSO2
BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB	CO1	3			2					1				2	
	CO2	3			3					1				1	
	CO3	3			3					1				1	
	CO4	3	3												
	CO5	3	3		3										
	CO6	3	3		3										

Justification Table:

CO	CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Verb	BTL			
1	**Apply**	L3	PO1, PO4, PO9	PO1:Apply(L3) PO2:Analyze(L4) PO9:Thumb Rule	3 2 1
2	**Analyze**	L4	PO1, PO4, PO9	PO1:Apply(L3) PO2:Analyze(L4) PO9:Thumb Rule	3 3 1
3	**Analyze**	L4	PO1, PO4, PO9	PO1:Apply(L3) PO2:Analyze(L4) PO9:Thumb Rule	3 3 1
4	**Analyze**	L4	PO1, PO2	PO1: Apply (L3) PO2: Review (L2)	3 3
5	**Evaluate**	L5	PO1, PO2, P04	PO1: Apply (L3) PO2: Review (L2) P04: Analyze(L4)	3 3 3
6	**Analyze**	L4	PO1, PO2, P04	PO1: Apply (L3) PO2: Review (L2) P04: Analyze(L4)	3 3 3

CO1: Apply the Kirchhoff's Laws and Superposition theorem for DC Circuits.
Action Verb: Apply (L3)
PO1: Apply (L3)
CO1 Action Verb is same as PO1 verb; Therefore correlation is high (3).
PO4: Analyze (L4)
CO1 Action Verb is less than PO2 verb by one level; Therefore correlation is moderate (2).
PO9: Using Thumb Rule, CO1 correlates to PO9 as low (1).
CO2: Analyze the performance of AC and DC Machines by various testing methods.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO2 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO4: Analyze (L4)
CO2 Action Verb is same as PO4 verb; Therefore correlation is high (3).
PO9: Using Thumb Rule, CO2 correlates to PO9 as low (1).
CO3: Analyze the speed control of DC shunt motor.
Action Verb: Analyze (L4)
PO1: Apply (L3)
C3 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO4: Analyze (L4)
CO3 Action Verb is same as PO4 verb; Therefore correlation is high (3).

PO9: Using Thumb Rule, CO3 correlates to PO9 as low (1).

CO 4: Analyze the V-I Characteristics of PN and Zener diodes.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

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

PO2 Verbs: Review (L2)

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

CO 5: Evaluate the parameters of rectifiers without & with filters

Action Verb: Evaluate (L5)

PO1 Verbs: Apply (L3)

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

PO2 Verbs: Review (L2)

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

PO4 Verbs: Analyze (L4)

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

CO 6: Evaluate the parameters of BJT and FET from their characteristics

Action Verb: Evaluate (L5)

PO1 Verbs: Apply (L3)

      CO6 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).

PO2 Verbs: Review (L2)

      CO6 Action Verb is greater than PO2 verb by one level; Therefore correlation is high (3).

PO4 Verbs: Analyze (L4)

      CO6 Action Verb is equal to PO4 verb Therefore correlation is high (3).

Course Code	Year & Sem	Client-Side Scripting	L	T	P	C
20ASC0501	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	PO12	PSO1	PSO2
CO1	2	3			2							2	3	
CO2	3	3		2	3								2	
CO3	3	3	3	3	3					3			2	
CO4	3	3	3	2	3							2	2	
CO5	3	3	3	3	2							3	2	

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1 PO2 PO5 PO12	PO1: Apply(L3) PO2: Review(L2) PO5: Apply(L3) PO12: Thumb rule	2 3 2 2
2	CO2: Apply	L3	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Identify(L3) PO4: Analyze(L4) PO5: Apply(L3)	3 3 2 3
3	CO3:Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO10	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO10: Thumb rule	3 3 3 3 3 3
4	CO4: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO12	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO12: Thumb rule	3 3 3 2 3 2
5	CO5: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Create(L6) PO11: Thumb rule	3 3 3 3 2 3

Justification Statements:

CO1: Understand The basic concepts of JavaScript programming for writing simple script in any web browser.

Action Verb : Understand (L2)
PO1: Apply(L3)
CO1 Action verb is less than PO1 verb by one, Therefore the correlation is medium (2)
PO2: Review(L2)
CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO5: Apply(L3)
CO1 Action verb is less than PO2 verb by one, Therefore the correlation is medium (2)
PO12: 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)
PO10: 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)
PO12: 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)
PO12: Thumb rule
The team should be analyze the different kind of cookies. Improve the knowledge towards cookies Therefore the correlation is high(3)

Course Code	Year & Sem	CONSTITUTION OF INDIA	L	T	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, PO12	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, PO12	Thumb Rule Thumb Rule	2 2
4	8	26	2	**Understand**	L2	PO6, PO12	Thumb Rule Thumb Rule	2 2
5	6	20	2	**Understand**	L2	PO6, PO12	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 PO12 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 PO12 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 PO12 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 PO12 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 PO12 as moderate (2).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI (AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)

AK20 REGULATIONS

(Effective for the batches admitted in 2020-21)

Semester IV (Second year)

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T	P	C			
1	PC	20APC0506	Computer Organization	3	0	0	3	30	70	100
2	PC	20APC0511	Design And Analysis Of Algorithms	3	0	0	3	30	70	100
3	PC	20APC0512	Object Oriented Programming through Java	3	0	0	3	30	70	100
4	PC	20APC0515	Operating Systems	3	0	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	3	0	0	3	30	70	100
7	PC Lab	20APC0504	Computer Organization Lab	0	0	2	1	30	70	100
8	PC Lab	20APC0514	Object Oriented Programming through Java Lab	0	0	4	2	30	70	100
9	PC Lab	20APC0513	Operating Systems Lab	0	0	3	1.5	30	70	100
10	SC	20ASC0502	Server Side Scripting	1	0	2	2	100	0	100
			Total credits				24.5	370	630	1000

Community service Project with credits

(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).

Course Code	Year & Sem	Computer Organization	L	T	P	C
20APC0506	II-II	**(common to CSE,CIC,CSE(DS))**	**3**	**0**	**0**	**3**

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the operational concepts and instruction set related to modern processors.

CO2: Evaluate the Arithmetic operations for understanding execution process.

CO3: Understand the hardware requirements of primary and secondary memories to store the data.

CO4: Analyze the Input/Output interfaces to connect multiple devices.

CO5: Apply the pipeline concepts to execute parallel tasks.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the Operational concepts and instruction set related		to modern processors.	L2
CO2	Evaluate	the Arithmetic operations		for understanding execution process.	L5
CO3	Understand	The hardware requirements of primary and secondary memories		to store the data.	L2
CO4	Analyze	the Input/Output interfaces		to connect multiple devices.	L4
CO5	Apply	the pipeline concepts		to execute parallel tasks.	L3

UNIT - I	**Basic Structure of Computer, Machine Instructions and Programs**	9 Hrs

Basic Structure of Computer: Computer Types, Functional Units, Basic operational Concepts, Bus Structure, Software, Performance, Multiprocessors and Multicomputer.
Machine Instructions and Programs: Numbers, Arithmetic Operations and Programs, Instructions and Instruction Sequencing, Addressing Modes, Basic Input/output Operations, Stacks and Queues, Subroutines, Additional Instructions.

UNIT - II	**Arithmetic, Basic Processing Unit**	9Hrs

Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations.
Basic Processing Unit: Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control, and Multi programmed Control.

UNIT - III	**The Memory System**	9 Hrs

The Memory System: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage.

UNIT - IV	**Input/Output Organization**	9 Hrs

Input/Output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces.

UNIT - V	**Pipelining, Large Computer Systems**	9 Hrs

Pipelining: Basic Concepts, Data Hazards, Instruction Hazards, Influence on Instruction Sets.
Large Computer Systems: Forms of Parallel Processing, Array Processors, The Structure of General-Purpose multiprocessors, Interconnection Networks.

Textbooks:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, "Computer Organization", 5th Edition, McGraw Hill Education, 2013.

Reference Books:

1. M.Morris Mano, "Computer System Architecture", 3rd Edition, Pearson Education.
2. Themes and Variations, Alan Clements, "Computer Organization and Architecture", CENGAGE Learning.
3. SmrutiRanjanSarangi, "Computer Organization and Architecture", McGraw Hill Education.

John P.Hayes, "Computer Architecture and Organization", McGraw Hill Education

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3										2		
CO2	3	3	3			2						2	2	
CO3	2	3						2	2					
CO4	3	3	3	3	3			2				2		1
CO5	3	3						2	2				2	

Correlation matrix

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
1	09	20%	2	CO1 :Understand	L2	PO1 PO2 PO12	PO1: Apply(L3) PO2: Review(L2) PO12: Thumb rule	2 3 2
2	09	20%	2	CO2 : Evaluate	L5	PO1 PO2 PO3 PO6 PO12	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO6: Thumb rule PO12: Thumb rule	3 3 3 2 2
3	09	20%	2	CO3 : Understand	L2	PO1 PO2 PO8 PO9	PO1: Apply(L3) PO2: Review(L2) PO8: Thumb rule PO9: Thumb rule	2 3 2 2
4	09	20%	2	CO4 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO8 PO12	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO8: Thumb rule PO12: Thumb rule	3 3 3 3 3 2 2
5	09	20%	2	CO5 : Apply	L3	PO1 PO2 PO8 PO9	PO1: Apply(L3) PO2: Review (L2) PO8: Thumb rule PO9: Thumb rule	3 3 2 2
	45	100 %						

Justification Statements :

CO1: Understand the operational concepts and instruction set related to modern processors.
Action Verb : Understand(L2)
PO1 Verb : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 Verb : Review(L2)
CO1 Action verb is same as PO2 verb. Therefore the correlation is high (3)
PO12: Thumb rule
Identify the deficiencies and demonstrate the need of updating the computer components to meet desired requirements. Therefore the correlation is medium (2)

CO2: Evaluate the Arithmetic operations for understanding execution process
Action Verb : Evaluate (L5)
PO1: Apply(L3)
CO2 Action verb is greater than level PO1 verb by two level. Therefore the correlation is high (3)
PO2: Review (L2)
CO2 Action verb is greater than PO2 verb. Therefore the correlation is high(3)
PO3: Develop (L3)
CO2 Action verb is greater than PO3 verb. Therefore the correlation is high(3)
PO6: Thumb rule

For some of computer applications, Various arithmetic operations are evaluated for understanding execution process of computer systems. Therefore, the correlation is Medium (2)

PO12: Thumb rule

Identify the deficiencies and demonstrate the need of updating the computer instruction set to meet desired requirements. Therefore the correlation is medium(2)

CO3: Understand the hardware requirements of primary and secondary memories to store the data.

Action Verb : Understand (L2)

PO1: Apply(L3)

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

PO2: Review (L2)

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

PO8 : Thumb rule

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

PO9 : Thumb rule

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

CO4: Analyze the Input/Output interfaces to connect multiple devices.Action Verb : Analyze(L4)

Action Verb : Analyze (L4)

PO1: Apply(L3)

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

PO2: Analyze (L4)

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

PO3: Develop (L3)

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

PO4: Analyze (L4)

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

PO5: Apply(L3)

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

PO8: Thumb rule

Since ethical principles shall be followed in creating quality input and output interfaces. Therefore the correlation is medium(2)

PO12: Thumb rule

Identify the deficiencies and demonstrate the need of updating the input and output interfaces to meet desired requirements. Therefore the correlation is medium(2)

CO5: Apply the pipeline concepts to execute parallel tasks.

Action Verb : Apply (L3)

PO1: Apply(L3)

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

PO2: Review (L2)

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

PO8 : Thumb rule

Since ethical principles should be followed in solving problems caused in pipeline hazards. Therefore the correlation is medium(2)

PO9 : Thumb rule

Team work is required to provide the solutions caused due to pipeline hazards. Hence the correlation is medium (2)

Course Code	Year & Sem	**Design And Analysis Of Algorithms**	**L**	**T**	**P**	**C**
20APC0511	II-II	**(common to CSE,CSE(DS))**	**3**	**0**	**0**	**3**

Course Outcomes:

After studying the course, student will be able to

CO1: **Apply** the Divide and conquer method to solve various problems.

CO2: **Apply** the greedy and dynamic programming methods to solve real time problems.

CO3: **Evaluate** the various problems using traversal, backtracking and searching techniques.

CO4: **Apply** the branch and bound methods to solve minimization problems.

CO5: **Analyze** the P, NP, NP hard and NP complete problems for solving reduction problems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Apply	The Divide and conquer method		to solve various problems	L3
CO2	Apply	The greedy and dynamic programming methods		to solve real time problems.	L3
CO3	Evaluate	The various problems	Using traversal, backtracking and searching techniques.		L5
CO4	Apply	The branch and bound methods		to solve minimization problems	L3
CO5	Analyze	The P, NP, NP hard , NP complete problems		for solving reduction problems	L4

UNIT - I		9Hrs
Introduction: What is an Algorithm, Algorithm specification, Performance analysis. **Divide and Conquer:** General method, Binary Search, Finding the maximum and minimum, Merge sort, Quick Sort, Selection sort, Stressen's matrix multiplication.		
UNIT - II		9 Hrs
Greedy Method: General method, Knapsack problem, Job Scheduling with Deadlines, Minimum cost Spanning Trees, Optimal storage on tapes, Single-source shortest paths. **Dynamic programming:** General Method, Multistage graphs, All-pairs shortest paths, Optimal binary search trees, 0/1 knapsack, The traveling sales person problem.		
UNIT - III		9 Hrs
Basic Traversal and Search Techniques: Techniques for binary trees, Techniques for Graphs, Connected components and Spanning trees, Bi-connected components and DFS **Back tracking:** General Method, 8 – queens problem, Sum of subsets problem, Graph coloring and Hamiltonian cycles, Knapsack Problem.		
UNIT - IV		8 Hrs
Branch and Bound: The method, Travelling salesperson, 0/1 Knapsack problem, Efficiency Considerations. **Lower Bound Theory:** Comparison trees, Lower bounds through reductions – Multiplying triangular matrices, inverting a lower triangular matrix, computing the transitive closure.		
UNIT - V		10Hrs
NP – Hard and NP – Complete Problems: NP Hardness, NP Completeness, Consequences of beingin P, Cook's Theorem, Reduction Source Problems, Reductions: Reductions for some known problems		
Textbooks:		
1. "Fundamentals of Computer Algorithms", Ellis Horowitz, S. Satraj Sahani and Rajasekhran, 2nd edition, University Press.2014, 2. "Design and Analysis of Algorithms", Parag Himanshu Dave, Himanshu Bhalchandra Dave, Pearson Education, Second Edition, 2009.		
Reference Books:		

1.	"Introduction to Algorithms", second edition, T.H.Cormen, C.E.Leiserson, R.L.Rivest and C.Stein, PHI Pvt. Ltd./ Pearson Education.
2.	"Introduction to Design and Analysis of Algorithms A strategic approach", R.C.T.Lee, S.S.Tseng, R.C.Chang and T.Tsai, Mc Graw Hill.
3.	"Design and Analysis of algorithms", Aho, Ullman and Hopcroft, Pearson education.

Online Learning Resources:

nptel videos

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3										2	3	
CO2	3	3				2						2	2	
CO3	3	3	3	3	3	2						2	2	
CO4	3	3										2	2	
CO5	3	3	3	3	3							2	2	

Correlation matrix

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
1	17	23%	3	CO1: Apply	L3	PO1 PO2 PO12	PO1: Apply(L3) PO2: Review(L2) PO12: Thumb rule	3 3 2
2	16	22%	3	CO2: Apply	L3	PO1 PO2 PO6 PO12	PO1: Apply(L3) PO2: Review(L2) PO6: Thumb rule PO12: Thumb rule	3 3 2 2
3	16	22%	3	CO3: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO6 PO12	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO6: Thumb rule PO12: Thumb rule	3 3 3 3 3 2 2
4	13	18%	2	CO4: Apply	L3	PO1 PO2 PO12	PO1: Apply(L3) PO2: Review(L2) PO12: Thumb rule	3 3 2
5	12	15%	2	CO5: Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO12	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO12: Thumb rule	3 3 3 3 3 2
	74	100 %						

Justification Statements :

CO1: Apply the Divide and conquer method to solve various problems.

Action Verb : Apply (L3)
PO1 Verb : Apply(L3)
CO1 Action verb is same level of PO1 verb by one level. Therefore, the correlation is High (3)
PO2 Verb : Review(L2)
CO1 Action verb is greater than PO2 verb. Therefore the correlation is high(3)
PO12: Thumb rule
Divide and conquer strategy is applied to solve various problems, where the work is distributed to many members to complete that task. Therefore the correlation is medium (2)

CO2: Apply the greedy and dynamic programming methods to solve real time problems.
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)
PO6: Thumb rule
Greedy and dynamic programming concepts were applied to solve traffic problems and finding best route to the destination. Therefore, the correlation is medium (2)
PO12: Thumb rule
Finding optimal solution to a real world problems is a continuous activity. Therefore the correlation is medium (2)

CO3: Evaluate the various problems using traversal, backtracking and searching techniques.
Action Verb : Evaluate (L5)
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)
PO6 : Thumb rule
backtracking and searching techniques were applied for GPS. Therefore, the correlation is medium (2)
PO12: Thumb rule
backtracking and searching techniques will give optimal solutions to various problems. Therefore, the correlation is medium (2)

CO4: Apply the branch and bound methods to solve minimization problems.
Action Verb : Apply (L3)
PO1: Apply(L3)
CO4 Action verb is same level of 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)
PO12: Thumb rule
Lower bound techniques were applied to minimize cost of finding best routes. Therefore the correlation is medium(2)

CO5: Analyze the P, NP, NP hard and NP complete problems for solving reduction problems.
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)
PO12: Thumb rule
In research oriented purpose P, NP concepts can be applied. Therefore the correlation is medium (2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI (AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)

Course Code	Year & Sem	Object Oriented Programming through Java	L	T	P	C
20APC0512	II-II	(common to CSE,CIC,CSE(DS))	3	0	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	PO12	PSO1	PSO2
CO1	2	3											1	1
CO2		3	3	2	3						3	3	1	1
CO3	2	3	3	3	3								1	1
CO4	3	3		2	3		2						1	1
CO5		3	3		3						3	3	1	1

Correlation matrix

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
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 PO11 PO12	PO2: Review (L2) PO3: Develop (L3) PO4: Analyze(L4) PO5: Apply(L3) PO11: Thumb Rule PO12: Thumb Rule	3 3 2 3 3 3
3	19	22%	3	CO3 :Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3)	2 3 3 3 3
4	18	21%	3	CO4 :Apply	L3	PO1 PO2 PO4 PO5 PO7	PO1: Apply(L3) PO2: Review (L2) PO4: Analyze(L4) PO5: Apply(L3) PO7: Thumb Rule	3 3 2 3 2
5	15	17%	2	CO5 :Apply	L3	PO2 PO3 PO5 PO11 PO12	PO2: Review (L2) PO3: Develop (L3) PO5: Apply(L3) PO11: Thumb Rule PO12: 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)
PO11: Thumb rule
Create some Java programs to solve real world problems. Therefore the correlation is high (3)
PO12: Thumb rule
Learn java programs to solve. Therefore the correlation is high (3)

CO3: Analyze the exception handling to develop efficient and error free codes
Action Verb : Analyze(L4)
PO1: Apply(L3)
CO3: CO3 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2: Review (L2)
CO3 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

PO3: Develop (L3)
CO3 Action verb is greater than PO3 verb by one level. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is same as PO4 verb. Therefore the correlation is high(3)
PO5: Apply (L3)
CO3 Action verb is greater than PO5 verb by one level. Therefore the correlation is high(3)

CO4: Apply the concepts of multithreading and collection frameworks to solve real world scenarios.
Action Verb : Apply (L3)
PO1: Apply(L3)
CO4 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Review (L2)
CO4 Action verb is greater than PO2 verb by one level. Therefore the correlation is high(3)
PO4: Analyze (L4)
CO4 Action verb is less than PO4 verb by one level. Therefore the correlation is medium (2)
PO5: Apply (L3)
CO4 Action verb is same level as PO5 verb. Therefore the correlation is high (3)
PO7: Thumb rule
To solve some problems we use multithreading and collection frame works. Therefore the correlation is medium(2)

CO5: Apply the concepts of applets and swings for making web and GUI based applications.
Action Verb :Apply (L3)
PO2: Review (L2)
CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO5 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO5: Apply(L3)
CO5 Action verb is same level as PO5 verb. Therefor the correlation is high (3)
PO11: Thumb rule
Java is used to design simple and enterprise applications so need for project management. Therefore the correlation is high(3)
PO12: Thumb rule
It is a programming language so new version available so we need to learn. Therefore the correlation is high(3)

Course Code	Year & Sem	Operating Systems	L	T	P	C
20APC0515	II-II	**(common to CSE,CIC,AIDS,AIML,CSE(DS))**	**3**	**0**	**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:

3. 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	PO12	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

Unit No.	CO						Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	16	19%	2	CO1 : Understand	L2	PO1 PO2 PO12	PO1: Apply(L3) PO2: Review(L2) PO12: Thumb rule	2 3 2

Correlation matrix

2	19	22%	3	CO2 :Apply	L3	PO1 PO2 PO6 PO12	PO1: Apply(L3) PO2: Review(L2) PO6: Thumb rule PO12: Thumb rule	3 3 2 3
3	16	19%	2	CO3 : Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3 3
4	18	21%	3	CO4 : Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO6 PO8 PO12	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO6: Thumb rule PO8: Thumb rule PO12: Thumb rule	3 3 3 3 3 2 3 2
5	17	19%	2	CO5 : Understand	L2	PO1 PO2 PO8 PO12	PO1: Apply(L3) PO2: Review(L2) PO8: Thumb rule PO12: 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)
PO12: 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)
PO12: 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)
PO12: 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)
PO8 : Thumb rule
Ethical principles should be followed for various security issues. Therefore the correlation is high(3)
PO12: Thumb rule
Security services and principles are keep on updating in the today's world. Therefore, the correlation is medium (2)

Course Code	Year & Sem	MANAGERIAL ECONOMICS AND FINANCIAL	L	T	P	C
20AHSMB01	II-II	ANALYSIS	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, Profit and 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	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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)

Course Code	Year & Sem	Universal Human Values	L	T	P	C
20AHS9905	II-II		3	0	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	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Universal Human Values	CO1								2				12		
	CO2							3	3						
	CO3						2	2	2						
	CO4						3	3	3				3		
	CO5						2	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**	PO8,PO12	Thumb Rule	2,2
2	8	22.2	3	**Analyze**	**4**	PO7,PO8	Thumb Rule	3,3

3	7	19.4	2	Apply	3	PO6,PO7,PO8	Thumb Rule	2,2,2
4	8	22.2	3	Evaluate	5	PO6,PO7,PO8,PO12	Thumb Rule	3,3,3,3
5	7	19.4	2	Apply	3	PO6,PO7,PO8,PO12	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 PO12 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 PO12 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 PO12 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 PO12 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 PO12 as moderate (2).

Course Code	Year & Sem	Computer Organization Lab	L	T	P	C
20APC0504	II-II		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	PO12	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 PO12)	Level of Correlation (0-3)
1	CO1: Analyze	L4	PO1 PO2 PO3 PO4	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Interpret (L2)	3 3 3 3
2	CO2: Design	L6	PO1 PO2 PO3 PO4 PO5 PO12	PO1: Apply(L3) PO2: Formulate (L6) PO3: Design(L6) PO4: Analyze (L4) PO5: Create (L6) PO12: Thumb rule	3 3 3 3 3 3
3	CO3: Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review (L2) PO3: Develop(L3) PO4: Interpret (L2) PO5: Apply (L3)	3 3 3 3 3
4	CO4: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO12	PO1: Apply(L3) PO2: Review (L2) PO3: Develop(L3) PO4: Interpret (L3) PO5: Apply (L3) PO12: Thumb rule	3 3 3 3 3 3
5	CO5: Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review (L2) PO3: Develop(L3) PO4: Interpret (L2) PO5: Apply (L3)	3 3 3 3 3

Justification Statements :

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

Action Verb: Analyze(L4)

PO1 Verb: Apply (L3)
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)
PO12: 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)
PO12: 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)

COMPUTER SCIENCE AND ENGINEERING (CSE)

Course Code	Year & Sem	OBJECT ORIENTED PROGRAMMING THROUGH JAVA	L	T	P	C
20APC0514	II-II	**LAB**	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 implementing 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 ─Compute‖ 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	PO12	PSO1	PSO2
CO1		3			2								3	
CO2		3	3	2	3								2	
CO3			3	2	3								2	2
CO4		3	3	3	3								2	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 PO12)	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)

Course Code	Year & Sem	Operating Systems Lab	L	T	P	C
20APC0513	II-II		0	0	3	1.5

Course Outcomes:

CO 1: Understand the basic commands in UNIX operating systems.

CO 2: Apply the concepts of CPU scheduling algorithms to solve real time problems.

CO 3: Apply the concepts of process synchronization methods.

CO 4: Analyze the solutions for virtual memory and Deadlocks.

CO 5: Analyze various file system interfaces.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the basic commands in UNIX operating system			L2
CO2	Apply	the concepts of CPU scheduling algorithms		to solve real time problems	L3
CO3	Apply	the concepts of process synchronization methods			L3
CO4	Analyze	the solutions		for virtual memory and Deadlocks	L4
CO5	Analyze	various file system interfaces			L4

List of Experiments to be implemented in C/Java

1. Practicing of Basic UNIX Commands.**(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	PO12	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 PO12)	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) PO12: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)

PO12 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)

Course Code	Year & Sem	Server Side Scripting	L	T	P	C
20ASC0502	II-II	**(common to CSE,CIC,AIDS,AIML)**	**1**	**0**	**2**	**2**

Course Outcomes:

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

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

CO3: Understand the SQL commands to get database connectivity with PHP

CO4: Create the simple mailing list using XML & JSON.

CO5: Analyze the performance of Apache and database tuning for optimization, securing webserver.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the perquisitions		to connect MYSQL and Apache dynamically through PHP paradigm	L2
CO2	**Analyze**	the working mechanism of different data media and cookies ,sessions in web browser			L4
CO3	**Understand**	the SQL commands		to get database connectivity with PHP	L2
CO4	**Create**	the simple mailing list	using XML & JSON		L6
CO5	**Analyze**	the performance of Apache and database tuning		for optimization, securing webserver	L4

UNIT - I		10 Hrs

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	PO12	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 PO12)	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 PO12	PO1: Apply(L3) PO2: Identify(L3) PO5: Apply(L3) PO12: Thumb rule	3 3 3 3
3	CO3: Apply	L3	PO1 PO2 PO3 PO4 PO10	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO10: Thumb rule	3 3 3 2 2
4	**CO4: Create**	L6	PO1 PO3 PO4 PO5 PO12	PO1: Apply(L3) PO3: Develop (L3) PO4: Analyze (L4) PO5: Create(L6) PO12: Thumb rule	3 3 3 3 3
5	**CO5: Analyze**	L4	PO1 PO2 PO3	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3)	3 3 3

			PO4	PO4: Analyze (L4)	3
			PO5	PO5: Apply(L3)	3
			PO8	PO8: 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)

PO12: Thumb rule

The applications can be designed specifically for all kind of users and also increase session time out as per client requirement.so need to update frequently. Therefore the correlation is medium (2)

CO3:Apply the SQL commands to get database connectivity with PHP

Action Verb : Apply(L3)

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)

PO10: 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)

PO12: 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)
PO8: Thumb rule
The team should follow some ethics for evaluate and Improving the performance .Therefore the correlation is high(3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)
(Effective for the batches admitted in 2020-21)
Semester V (Third year)

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T	P	C			
1	PC	20APC0516	Computer Networks	3	0	0	3	30	70	100
2	PC	20APC0518	Formal Languages & Automata Theory	3	0	0	3	30	70	100
3	PC	20APC0519	Software Engineering	3	0	0	3	30	70	100
4	OE-1	20APE0418 20AOE0303 20AOE9925	Sensors and IoT Optimization Techniques Deterministic & Stochastic Statistical Methods	3	0	0	3	30	70	100
5	PE-1	20APE0501 20APE0502 20APE0503	Data Warehousing and Mining Design Patterns Computer Graphics	3	0	0	3	30	70	100
6	PC Lab	20APC0520	Software Engineering Lab	0	0	3	1.5	30	70	100
7	PC Lab	20APC0517	Computer Networks Simulation Lab	0	0	3	1.5	30	70	100
8	SC	20ASA0503	Mobile Application Development	1	0	2	2	100	0	100
9	MC	20AMC9901	Biology for Engineers	3	0	0	0	30	0	30
10	CSP	20CSP0501	Community service project	0	0	0	1.5	100	0	100
Total credits							**21.5**	**440**	**490**	**930**

Course Code	Year & Sem	Computer Networks	L	T	P	C
20APC0516	III-I		3	0	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understan**d the basics of data communications and networking by using OSI model.

CO2: **Apply** the Data link Layer functionalities to solve real world problems.

CO3: **Analyze** the various routing algorithms and protocols.

CO4: **Analyze** the Transport Layer services by using TCP and UDP protocols.

CO5: **Understand** the various services protocols offered by application layer.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	understand	the basics of data communications and networking 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.			L4
CO4	Analyze	the Transport Layer services	by using TCP and UDP protocols		L4
CO5	understand	The various services protocols offered by application layer			L2

UNIT - I		9 Hrs

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, Switching: Introduction, Circuit Switched Networks, Packet Switching

UNIT - II		9Hrs

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, Connecting devices and virtual LANs: Connecting Devices.

UNIT - III		9 Hrs

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		9 Hrs

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.

UNIT - V		9 Hrs

The Application Layer: Introduction, Client-Server Programming, WWW and HTTP, FTP, e-mail, TELNET, Secure Shell, Domain Name System, SNMP.

Textbooks:

1. "Data communications and networking", Behrouz A. Forouzan, Mc Graw Hill Education, 5th edition, 2012.
2. "Computer Networks", Andrew S. Tanenbaum, Wetherall, Pearson, 5th edition, 2010.

Reference Books:
1. Data Communication and Networks, Bhushan Trivedi, Oxford
2. "Internetworking with TCP/IP – Principles, protocols, and architecture - Volume 1, Douglas E. Comer, 5th edition, PHI
3. "Computer Networks", 5E, Peterson, Davie, Elsevier.
4. "Introduction to Computer Networks and Cyber Security", Chawan- Hwa Wu, Irwin, CRC Publications.
5. "Computer Networks and Internets with Internet Applications", Comer.
Online Learning Resources:
https://www.youtube.com/watch?v=O--rkQNKqls&list=PLbRMhDVUMngf-peFloB7kyiA40EptH1up

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	
CO2	3	2				1							2	
CO3	3	3		3	3	1							2	
CO4	3	3		3	3								3	2
CO5	2	1											1	

Correlation matrix

Unit No.	CO			Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation					
1	15	23%	3	CO1 :Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Analyze (L4)	2 1
2	10	15%	2	CO2 : Apply	L3	PO1 PO2 PO6	PO1: Apply(L3) PO2: Analyze (L4) PO6:Thumb rule	3 2 1
3	15	23%	3	CO3 : Analyze	L4	PO1 PO2 PO4 PO5 PO6	PO1: Apply(L3) PO2: Analyze L4) PO4: Analyze (L4) PO5:Apply(L3) PO6:Thumb rule	3 3 3 3 1
4	11	17%	2	CO4 :Analyze	L4	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Analyze (L4) PO4: Analyze (L4) PO5:Apply(L3)	3 3 3 3
5	15	23%	3	CO5 : Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Analyze (L4)	2 1
	66	100%						

Justification Statements :

CO1: understand the basics of data communications and networking by using OSI model.
Action Verb : Understand(L2)
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 Data link Layer functionalities to solve real world problems.
Action Verb : Apply (L3)
PO1: Apply(L3)
CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Analyze(L4)
CO2 Action verb is less than PO2 verb by One levels. Therefore the correlation is medium (2)
PO6: Thumb rule
Data link Layer functionalities are useful for realtime applications.Therefore the correlation is (1)

CO3: Analyze various routing algorithms and protocols.
Action Verb : Analyze(L4)
PO1: Apply(L3)
CO3 Action verb is greater 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 greater 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 (1)

CO4: Analyze the Transport Layer services by using TCP and UDP protocols.
Action Verb : Analyze(L4)
PO1: Apply(L3)
CO4 Action verb is greater 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 greater than PO5 verb by one level. Therefore the correlation is high (3)

 CO5: Understand various services protocols offered by application layer.
Action Verb : Understand(L2)
PO1 Verb : Apply(L3)
CO5 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 Verb : Analyze(L4)
CO5 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

Course Code	Year & Sem	Formal Languages and Automata Theory	L	T	P	C
20APC0518	III-I	**(common to CSE,AIML)**	**3**	**0**	**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	PO12	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 Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
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 PO12	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO12:Thumb Rule	3 3 3 2 3 2
4	11	15%	2	CO4: Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO12	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO12:Thumb Rule	3 3 3 3 3 3
5	16	22%	3	CO5: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO6 PO8	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO6:Thumb Rule PO8:Thumb Rule	3 3 3 3 3 3 3
	72	100 %						

Justification Statements :

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)
PO12: 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)
PO12: 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)
PO8 : Thumb rule
Since ethical principles should be followed to solve undecidabilty problems by using Turing machines. Therefore the correlation is high (3)

(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)

Course Code	Year & Sem	Software Engineering	L	T	P	C
20APC0519	III-I		3	0	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the different Software Engineering Models

CO2: Analyze the Parameters and prerequisites of software project management.

CO3: Analyze the Design Methodologies of Software Project

CO4: Apply the Coding and Testing Methods for Quality Assurance of the Software project

CO5: Analyze the Software Quality Management Systems (standards) for reliability

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The different Software Engineering Models			L2
CO2	Analyze	The Parameters and prerequisites of SPM			L4
CO3	Analyze	The Design Methodologies of Software Project			L4
CO4	Apply	The Coding and Testing Methods		for Quality Assurance of the Software project	L3
CO5	Analyze	The Software Quality Management Systems (standards)		for reliability	L4

UNIT - I		9 Hrs

Introduction: Evolution, Software Development Projects, Exploratory style of Software Development, Emergence, Notable Changes in Software Development Practices, Computer Systems Engineering

Software Life Cycle Models: A few basic concepts, Waterfall Model and its extensions, RAD, Agile Development Models, Spiral Model, Comparison

UNIT - II		9Hrs

Software Project Management: SPM complexities, Responsibility of a software Development Manager, Project Planning, Metrics for Project Size Estimation, Project Estimation Techniques, Empirical Estimation Techniques, COCOMO, Halstead's Software Science, Staffing Level-Estimation, Scheduling, Organization and Team Structures, Risk Management, Software Configuration Management

Requirement Analysis and Specification: Requirements Gathering and Analysis, SRS, Formal System Specification, Axiomatic Specification, Algebraic Specification, Executable Specification and 4GL

UNIT - III		9 Hrs

Software Design: Overview of the Design Process, Characterize good design, Cohesion and Coupling, Layered Arrangement of Modules, Approaches to Software Design

Function-oriented Software Design: Overview, Structured Analysis, Developing the DFD model of a system, Structured Design, Detailed Design and Review

User Interface Design: Characteristics, Basic Concepts, Types, Fundamentals of Component-based GUI Development, A UI Design Methodology

UNIT - IV		9 Hrs

Object Modeling Using UML: Unified Modeling Language (UML), UML Diagrams, Use Case Model, Class Diagrams, Interaction Diagrams, Activity Diagram, State Chart Diagram, Package, Component, and Deployment Diagrams

Coding and Testing: Coding, Code Review, Software Documentation, Testing, Unit Testing, Black-Box Testing, White-box Testing, Debugging, Program Analysis Tools, Integration Testing, Testing Object-oriented Programs, System Testing, Issues associated with Testing

UNIT - V		9 Hrs

Software Reliability and Quality Management: Software Reliability, Statistical Testing, Software Quality, Software Quality Management System, ISO 9000, SEI Capability Maturity Model, Other

Important Standards, Six Sigma
Software Reuse: What can be reused, Issues, A Reuse Approach, Reuse at Organization level
Emerging Trends: Client-Server Software, Architectures, CORBA, COM, DCOM, SOA, SAAS
Textbooks:
1. Fundamentals of Software Engineering, Rajib Mall, PHI Learning, 5th edition
2. Software Engineering: A Practitioner's Approach, R S Pressman, McGraw Hill Education, 7th edition
Reference Books:
1. Software Engineering, Ian Sommerville, Pearson Education, Tenth edition
2. Pankaj Jalote's Software Engineering: A Precise Approach, Wiley publications
Online Learning Resources:
https://nptel.ac.in/courses/106/105/106105182/
http://peterindia.net/SoftwareDevelopment.html

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2													
CO2	3			3	3								3	
CO3	3		3										3	
CO4	3		3	2									2	2
CO5	3		3	3	3	2	2			2	2		2	2

Correlation matrix

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
1	9	20%	2	CO1 :Understand	L2	PO1	PO1: Apply(L3)	2
2	9	20%	2	CO2 : Analyze	L4	PO1 PO4 PO5	PO1: Apply(L3) PO4: Analyze (L4) PO5:Apply(L3)	3 3 3
3	9	20%	2	CO3 : Analyze	L4	PO1 PO3	PO1: Apply(L3) PO3: Develop (L3)	3 3
4	9	20%	2	CO4 :Apply	L3	PO1 PO3 PO4	PO1: Apply(L3) PO3: Develop (L3) PO4: Analyze (L4)	3 3 2
5	9	20%	2	CO5 : Analyze	L4	PO1 PO3 PO4 PO5 PO6 PO7 PO10 PO11	PO1: Apply(L3) PO3: Develop (L3) PO4: Analyze (L4) PO5:Apply(L3) PO6:Thumb rule PO7:Thumb rule PO10: Thumb rule PO11: Thumb rule	3 3 3 3 2 2 2 2

		45	100 %						

Justification Statements :
CO1: Understand the different Software Engineering Models
Action Verb : Understand(L2)
PO1: Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

CO2: Analyze the Parameters and prerequisites of Software project management
Action Verb : Analyze(L4)
PO1: Apply(L3)
CO2 Action verb is greater than PO1 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:Analyze the Design Methodologies of Software Project
Action Verb : Analyze(L4)
PO1: Apply(L3)
CO3. Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO3 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

CO4:Apply the Coding and Testing Methods for Quality Assurance of the Software project
Action Verb : Apply(L3)
PO1: Apply(L3)
CO4 Action verb is same level as PO1 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)
CO4 Action verb is less than PO4 verb by one level. Therefore the correlation is medium(2)

CO5:Analyze the Software Quality Management Systems (standards) for reliability
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 PO2 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)
PO6 : Thumb rule
For some software projects ,Various projects are evaluated for understanding ,therefore the correlation is Medium(2)
PO9 : Thumb rule
Team work is required for software project, therefore the correlation is Medium(2)
PO11: Thumb rule
Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, therefore the correlation is Medium(2)

(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)

Course Code	Year & Sem	SENSORS AND IOT	L	T	P	C
20APE0418	III-I		3	0	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand the** concepts of data converters and sensor data acquisition systems

CO2:**Understand** the concepts of various sensing technologies.

CO3:**Analyze** the basics of IoT and enabling technologies.

CO4:**Design** basic IoT applications using Arduino

CO5:**Design** IoT applications using Raspberry Pi

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	Data converters and sensor data acquisition systems			**L2**
CO2	**Understand**	Various sensing technologies			**L2**
CO3	**Analyze**	Basics of IoT and enabling technologies			**L4**
CO4	**Design**	IoT applications		To study and design using Arduino	**L6**
CO5	**Design**	IoT applications		To study and design using Arduino	**L6**

UNIT - I	SENSOR DATA ACQUISITION SYSTEMS AND ARCHITECTURES	9 Hrs

Introduction, General measurement system, Analog-to-digital converter architectures-Different types of ADCs – parallel comparator type ADC, Counter type ADC, successive approximation ADC and dual slope ADC Digital-to-Analog conversion-Basic DAC techniques, Weighted resistor DAC, R-2R ladder DAC, inverted R2R DAC

UNIT - II	INTRODUCTION AND CLASSIFICATION OF SENSORS	9Hrs

: Introduction to sensors- Principles, Classifications, Parameters- Characteristics, Passive sensors-Introduction, Resistive Potentiometer, Strain Gauge, Inductive sensor, Capacitive senor, Recent trends in sensor technologies -Film sensors-Thin & Thick, MEMS-Micromachining, Nano sensors.

UNIT - III	INTRODUCTION TO INTERNET OF THINGS	9 Hrs

Characteristics of IoT, Design principles of IoT, IoT Architecture and Protocols, Enabling Technologies for IoT, IoT levels and IoTvs M2M. IoT Design Methodology: Design methodology, Challenges in IoT Design, IoT System Management, IoT Servers

UNIT - IV	BASICS OF ARDUINO	9 Hrs

Introduction to Arduino, Arduino IDE, Basic Commands for Arduino, Connecting LEDs with Arduino, Connecting LCD with Arduino. Arduino IDE Sketch examples – Blink LED, Control Actuator using Bluetooth, Read data from analog and digital sensor

UNIT - V	BASICS OF RASPBERRY PI	9 Hrs

Introduction to Raspberry pi, Installation of NOOBS on SD Card, Installation of Raspbian on SD Card, Terminal Commands, Installation of Libraries on Raspberry Pi, Getting the static IP address of Raspberry Pi, Run a Program on Raspberry Pi, Installing the Remote Desktop Server, Pi Camera, Face Recognition using Raspberry Pi, Installation of I2C driver on Raspberry Pi, SPI (serial peripheral interface) with Raspberry Pi, Programming a Raspberry Pi, Play with LED and Raspberry Pi, Reading the digital input, Reading an edge triggered input, Interfacing of Relay with Raspberry Pi, Interfacing of Relay with Raspberry Pi, Interfacing of LCD with Raspberry Pi, Interfacing LCD with Raspberry Pi in I2C mode, Interfacing of DHT11 sensor with Raspberry Pi, Interfacing of ultrasonic sensor with Raspberry Pi, Interfacing of camera with Raspberry pi.

Textbooks:

1. D. Patranabis, "Sensors & Transducers", PHI, 2nd ed., 2018.

2. Rajesh Singh, AnithaGehlot, Loviraj Gupta, "Internet of Things with Raspberry pi and Arduino" CRC Press, 2020

Reference Books:

1. Jacob Fraden, "Hand book of Modern Sensors", Springer, Fourth Edition, 2010.

2. D. Roy Choudhury&ShailB.Jain, "Linear Integrated Circuits" Fourth Edition, New age International Publications

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1										
CO2	2	2	2	3	2									
CO3	3	3	3	3	3									
CO4	3	3	3	3	3									
CO5	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 PO12)	Level of Correlation (0-3)
1	CO1 :Understand	L2	PO1 PO2 PO3 PO4	PO1: Apply(L3) PO2: Review(L2) PO3 : Develop (L3) PO4 : Analysis(L4)	2 2 2 1
2	CO2 : Understand	L2	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO 3: Develop (L3) PO4: Interpret (L2) PO5: Apply(L3)	2 2 2 3 2
3	CO3 : **Analyze**	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Interpret (L2) PO5: Apply(L3)	3 3 3 3 3
4	CO4 :**Design**	L6	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Interpret (L2) PO5: Apply(L3)	3 3 3 3 3
5	CO5 : **Design**	L6	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO 3: Develop (L3) PO4: Interpret (L2) PO5: Apply(L3)	3 3 3 3 3

Justification Statements :

CO1:Understand the concepts of data converters and sensor data acquisition systems

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 PO1 verb by one level. Therefore the correlation is medium (2)

PO3Verb :Develop (L3)

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

PO4 Verb : Analysis(L4)

CO1 Action verb is less than PO1 verb by two level. Therefore the correlation is low (1)

CO2:Understand the concepts of various sensing technologies

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 Verb : Identify (L3)
CO2 Action verb is less than PO2 verb by one level. Therefore the correlation is Medium (2)
PO 3 Verbs: Develop (L3)
CO2 Action Verb is less than PO 3 verb by one level; therefore correlation is moderate (2).
PO4: Interpret (L2)
CO2 Action verb is same as PO4 verb. Therefore the correlation is high (3)
PO5: Apply(L3)
CO2 Action verb is less than PO1 verb by one level. Therefore the correlation is Medium (2)

CO3: Analyze the basics of IoT and enabling technologies
Action Verb :Analyze(L4)
PO1: Apply(L3)
CO3 Action verb is greaterthan PO1 verb by one level. Therefore the correlation is high (3)
PO2 Verb : Identify (L3)
CO3 Action verb is greater than as PO2 verb by one level. Therefore the correlation is high (3)
PO 3 Verbs: Develop (L3)
CO1 Action Verb is greater than PO3 verb by one levels; therefore correlation is high (3).
PO4: Interpret (L2)
CO3 Action verb is greater than PO4 verb by two levels. Therefore the correlation is high (3)
PO5: Apply(L3)
CO3 Action verb is same as PO5 verb by one level. Therefore the correlation is high (3)

CO4: Design basic IoT applications using Arduino
Action Verb :Design (L6)
PO1: Apply(L3)
CO4 Action verb is greater than PO1 verb by three levels. Therefore the correlation is high (3)
PO2 Verb : Identify (L3)
CO4 Action verb is greater than as PO2 verb by three levels. Therefore the correlation is high(3)
PO 3 Verbs: Develop (L3)
CO4 Action Verb is greater than PO 3 verb by three levels; therefore correlation is high (3).
PO4: Interpret (L2)
CO4 Action verb is greater than PO4 verb by four levels. Therefore the correlation is high (3)
PO5: Apply(L3)
CO4 Action verb is same as PO5 verb by three levels. Therefore the correlation is high (3)

CO5:Design IoT applications using Raspberry Pi
Action Verb :Design (L6)
PO1: Apply(L3)
CO5 Action verb is greater than PO1 verb by three levels. Therefore the correlation is high (3)
PO2 Verb : Identify (L3)
CO5 Action verb is greater than as PO2 verb by three levels. Therefore the correlation is high(3)
PO 3 Verbs: Develop (L3)
CO5 Action Verb is greater than PO3 verb by three levels; therefore correlation is high (3).
PO4: Interpret (L2)
CO5 Action verb is greater than PO4 verb by four levels. Therefore the correlation is high (3)
PO5: Apply(L3)
CO5 Action verb is same as PO5 verb by three levels. Therefore the correlation is high (3)

Course Code	Year & Sem	Optimization Techniques	L	T	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.youtube.com/watch?v=gw_ZEUjI9KM&list=PLYihddLF-CgZGDFVwB1v699kvl4FMeAr-

Co po Mapping

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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											3	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	TR	2
			PSO2	TR	2
2	**CO2: Apply**	L3	PO1	Apply (L3)	3
			PO3	Develop (L3)	3
			PO5	Apply (L3)	3
			PSO1	TR	2
			PSO2	TR	2
3	**CO3: Understand**	L2	PO1	Apply (L3)	2
			PO3	Develop (L3)	2
			PO5	Apply (L3)	2
			PSO1	TR	2
			PSO2	TR	2
4	**CO4: Understand**	L2	PO1	Apply (L3)	2
			PO2	Identify (L3)	2
			PSO1	TR	3
			PSO2	TR	2
5	**CO5: Apply**	L3	PO1	Apply (L3)	3
			PO2	Identify (L3)	3
			PO5	Apply (L3)	3
			PSO1	TR	2
			PSO2	TR	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).

(AUTONOMOUS)

COMPUTER SCIENCE AND ENGINEERING (CSE)

Course Code	Year & Sem	Deterministic and Stochastic Statistical Methods	L	T	P	C
20AOE9925	III-I		3	0	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	PO12
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).

Course Code	Year & Sem	Data Warehousing and Mining	L	T	P	C
20APE0501	III-I		3	0	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	PO12	PSO1	PSO2
CO1	2	3												
CO2	3	3		3	3									
CO3	3	3		3	3							3		
CO4	3	3	3	3	3			3						
CO5	3	3	3	2	3							2		

Correlation matrix

Unit No.	CO						Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL				
1	13	20%	2	CO1 :Understand	L2		PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	11	17%	2	CO2 :Analyze	L4		PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3
3	16	25%	3	CO3 :Evaluate	L5		PO1 PO2 PO4 PO5 PO12	PO1: Apply(L3) PO2: Identify(L3) PO4: Analyze (L4) PO5: Apply(L3) PO12: Thumb rule	3 3 3 3 3
4	13	20%	2	CO4 :Analyze	L4		PO1 PO2 PO3 PO4 PO5 PO8	PO1: Apply(L3) PO2: Identify(L3) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO8: Thumb rule	3 3 3 3 3 3
5	10	15%	2	CO5 :Apply	L3		PO1 PO2 PO3 PO4 PO5 PO12	PO1: Apply (L3) PO2: Identify(L3) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO12: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)
PO12: 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)
PO8: 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)
PO12: Thumb rule
We will apply these mining techniques to create solution. Therefore the correlation is medium(2)

Course Code	Year & Sem	DESIGN PATTERNS	L	T	P	C
20APE0502	III-I		**3**	**0**	**0**	**3**

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the fundamental concepts of design patterns.

CO2: Apply the document editor to analyze creational patterns.

CO3: Analyze the Structural Patterns like Adapter, Bridge, Composite.

CO4: Analyze the behavioral Patterns for understanding the responsibilities between objects.

CO5: Understand the importance of design patterns

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the fundamental concepts of design patterns.			L2
CO2	Apply	the document editor		to analyze creational patterns	L4
CO3	Analyze	the Structural Patterns like Adapter, Bridge, Composite			L3
CO4	Analyze	the behavioral Patterns		for understanding the responsibilities between objects	L5
CO5	Understand	the importance of design patterns			L3

UNIT – I	Introduction to Design Patterns	

Introduction to Design Patterns: Design Pattern Definition, Design Patterns in Small Talk MVC, Describing Design Patterns, Catalog of Design Patterns, Organizing the Catalog, Solving of Design Problems using Design Patterns, Selection of a Design Pattern, Use of Design Patterns.

UNIT – II	Designing A Document Editor, Creational Patterns	

Designing A Document Editor: A Case Study Design problems, Document structure, Formatting, Embellishing the User Interface, Supporting Multiple Look and Feel standards, Supporting Multiple Window Systems, User Operations, Spelling Checking and Hyphenation.

Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.

UNIT – III	Structural Patterns	

Structural Patterns-1: Adapter, Bridge, Composite.

Structural Patterns-2: Decorator, Façade, Flyweight, Proxy, Discuss of Structural Patterns.

UNIT – IV	Behavioral Patterns	

Behavioral Patterns-1: Chain of Responsibility, Command, Interpreter, Iterator.

Behavioral Patterns-2: Mediator, Memento, Observer.

UNIT – V	A Brief History	

Behavioral Patterns-2(cont'd): State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns. What to Expect from Design Patterns, A Brief History, The Pattern Community An Invitation, A Parting Thought.

Textbooks:

1. Design Patterns By Erich Gamma, Pearson Education

Reference Books:

1. Pattern's in JAVA Vol-I By Mark Grand, Wiley DreamTech.

2. Pattern's in JAVA Vol-II By Mark Grand, Wiley DreamTech.

3. JAVA Enterprise Design Patterns Vol-III By Mark Grand, Wiley DreamTech.

4. Head First Design Patterns By Eric Freeman-Oreilly - spd

5. Design Patterns Explained By Alan Shalloway, Pearson Education.

6. Pattern Oriented Software Architecture, F.Buschmann & others, John Wiley & Sons.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3												
CO2	3	3	3	2									2	
CO3	3	3	3	3	3								2	1
CO4	3	3	3	3	3								2	1
CO5	2	2	2	1	2									

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) PO2: Review(L2)	2 3
2	CO2: Apply	L3	PO1 PO2 PO3 PO4	PO1: Apply(L3) PO2: identify(L3) PO3: Develop(L3) PO4: Analyze(L4)	3 3 3 2
3	CO3: 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
4	CO4: 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
5	CO3: Understand	L2	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: identify(L3) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3)	2 2 2 1 2

Justification Statements :
CO1: Understand the fundamental concepts of design patterns.
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 as PO2 verb. Therefore the correlation is high (3)

CO2: Apply the document editor to analyze creational patterns.
Action Verb: Apply (L3)
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)
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)

CO3: Analyze the Structural Patterns like Adapter, Bridge, Composite.
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)

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)

CO4: Analyze the behavioral Patterns for understanding the responsibilities between objects.
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)

CO5: Understand the importance of design patterns
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: identify (L3)
CO5 Action verb is less than PO2 verb by one level.Therefore the correlation is medium(2)
PO3: develop (L3)
CO5 Action verb is less than PO3 verb by one level.Therefore the correlation is medium(2)
PO4: Analyze (L4)
CO5 Action verb is less than PO4 verb by two level.Therefore the correlation is low(1)
PO5: Apply(L3)
CO5 Action verb less than PO5 verb by one level.Therefore the correlation is medium(2)

Course Code	Year & Sem	COMPUTER GRAPHICS	L	T	P	C
20APE0503	III-I	(common to CSE,AIDS)	3	0	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the over view of Computer Graphics System.

CO2: Evaluate various algorithms based on output primitives.

CO3: Apply Two-dimensional Geometric Transformations for designing clipping of lines and polygons.

CO4: Analyze three dimensional graphics and viewing models.

CO5: Apply the removal of hidden surfaces in computer animation.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the over view of Computer Graphics System			L2
CO2	**Evaluate**	various algorithms	based on output primitives		L5
CO3	**Apply**	Two-dimensional Geometric Transformations		for designing clipping of lines and Polygons.	L3
CO4	**Analyze**	three dimensional graphics and viewing models			L4
CO5	**Apply**	the removal of hidden surfaces		in computer animation	L3

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3										2	3	
CO2	3	3				2						2	2	
CO3	3	3	3	3	3	2						2	2	
CO4	3	3										2	2	
CO5	3	3	3	3	3							2	2	

UNIT - I	OVERVIEW OF COMPUTER GRAPHICS SYSTEM	9 Hrs
	OverView of Computer Graphics System – Video display devices – Raster Scan and random scan system – Input devices – Hard copy devices.	
UNIT - II	OUTPUT PRIMITIVES AND ATTRIBUTES	9Hrs
	Drawing line, circle and ellipse generating algorithms – Scan line algorithm – CharacterGeneration – attributes of lines, curves and characters – Antialiasing.	
UNIT - III	TWO DIMENSIONAL GRAPHICS TRANSFORMATIONS AND VIEWING	9 Hrs
	Two-dimensional Geometric Transformations – Windowing and Clipping – Clipping of lines and clipping of polygons.	
UNIT - IV	THREE DIMENSIONAL GRAPHICS AND VIEWING	9 Hrs
	Three-dimensional concepts – Object representations- Polygon table, Quadric surfaces, Splines, Bezier curves and surfaces – Geometric and Modelling transformations – Viewing - Parallel and perspective projections.	
UNIT - V	REMOVAL OF HIDDEN SURFACES	9 Hrs

Visible Surface Detection Methods – Computer Animation.

Textbooks:

Hearn, D. and Pauline Baker,M., Computer Graphics (C-Version), 2nd Edition, Pearson Education, 2002.

Reference Books:

1. Neuman, W.M., and Sproull, R.F., Principles of Interactive Computer Graphics, Mc Graw Hill Book Co., 1979.
2. Roger, D.F., Procedural elements for Computer Graphics, Mc Graw Hill Book Co., 1985.
3. Asthana, R.G.S and Sinha, N.K., Computer Graphics, New Age Int. Pub. (P) Ltd., 1996.
4. Floey, J.D., Van Dam, A, Feiner, S.K. and Hughes, J.F, Computer Graphics, Pearson Education, 2001.

Online Learning Resources:

https://www.youtube.com/watch?v=fwzYuhduME4&list=PL338D19C40D6D1732

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	PO1: Apply(L3)	2
			PO2	PO2: Review(L2)	3
			PO12	PO12: Thumb rule	2
2	CO2: Evaluate	L5	PO1	PO1: Apply(L3)	3
			PO2	PO2: Review(L2)	3
			PO12	PO12: Thumb rule	2
3	CO3: Apply	L3	PO1	PO1: Apply(L3)	3
			PO2	PO2: Review(L2)	3
			PO3	PO3: Develop (L3)	3
			PO4	PO4: Analyze (L4)	3
			PO5	PO5: Apply(L3)	3
			PO12	PO12: Thumb rule	2
4	CO4: Analyze	L4	PO1	PO1: Apply(L3)	3
			PO2	PO2: Review(L2)	3
			PO12	PO12: Thumb rule	2
5	CO5: Apply	L3	PO1	PO1: Apply(L3)	3
			PO2	PO2: Review(L2)	3
			PO3	PO3: Develop (L3)	3
			PO4	PO4: Analyze (L4)	2
			PO5	PO5: Apply(L3)	3
			PO12	PO12: Thumb rule	2

Justification Statements :

CO1: Understand the over view of Computer Graphics System.
Action Verb : Understand (L2)
PO1 Verb : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is Medium (2)
PO2 Verb : Review(L2)
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high(3)
PO12: Thumb rule
Computer Graphics Systems implementation is needed in current scenario. Therefore the correlation is medium (2)

CO2: Evaluate various algorithms based on output primitives.
Action Verb : Evaluate (L5)
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)
PO12: Thumb rule
Development of algorithms using output primitives is a continuous activity. Therefore the correlation is high(3)

CO3: Apply Two-dimensional Geometric Transformations for designing clipping of lines and polygons.
Action Verb : Apply (L3)
PO1: Apply(L3)
CO3 Action verb is same level asPO1 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 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)
PO12: Thumb rule
Two-dimensional Geometric Transformation is regular activity for graphics enhancements. Therefore, the correlation is medium (2)

CO4: Analyze three dimensional graphics and viewing models.
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)
PO12: Thumb rule
Three dimensional graphics and viewing models are widely using models. Therefore the correlation is medium(2)

CO5: Apply the removal of hidden surfaces in computer animation.
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 greater than 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 greater than PO5 verb. Therefore the correlation is high (3)
PO12: Thumb rule
Removal of hidden surfaces in computer animation is regular activity. Therefore the correlation is medium(2)

Course Code	Year &Sem	SOFTWARE ENGINEERING LABORATORY	L	T	P	C
20APC0520	III-I		0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO 1: Understand the functional and non-functional requirements of software model

CO 2: Analyze the knowledge in project managements and its principles.

CO 3: Evaluate the relationship between requirements and usecase using Microsoft project tool.

CO 4: Analyze the modules such as cohesion and coupling.

CO 5: Understand the process to deduct the bugs during testing.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the functional and non-functional requirements of software model			L2
CO2	**Analyze**	the knowledge in project managements and its principles.			L4
CO3	**Evaluate**	the relationship between requirements and usecase		using Microsoft project tool	L5
CO4	**Apply**	the modules such as cohesion and coupling			L4
CO5	**Understand**	the process to deduct the bugs during testing			L2

List of Experiments

1. a) Draw the Control Flow Graph of following using MS-Word: **(CO1)**
     i. if-else
     ii. while
     iii. do-while
     iv. for
b) Draw the Flow chart and CFG for the following Program by using MS Word: **(CO1)**
     if A = 10 then
     if B > C
     A = B
     else
     A = C
     endif
     endif
     print A, B, C.
2. Define Functional and Non-Functional Requirements for Hospital Management System. **(CO1)**
3. Draw the Deliverable and Phase based Work Breakdown Structure for House construction System using MS Word. **(CO2)**
4. Schedule all the Task and sub-Task using the PERT/CPM charts using MS –Excel. **(CO3)**
5. Identify and analyze all the possible risks and its risk mitigation plan for the system to be automated**(CO2)**
6. Diagnose any risk using Ishikawa Diagram (Can be called as Fish Bone Diagram or Cause & Effect Diagram) **(CO2)**
7. Define Complete Project plan for the system to be automated using Microsoft Project Tool**(CO3)**
8. Define the Features, Vision, Business objectives, Business rules and stakeholders in the vision document**(CO3)**
9. Define the functional and non-functional requirements of the system to be automated by using Usecases and document in SRS document**(CO1)**
10. Define the following tracebility matrices:
     i. Usecase Vs. Features
     ii. Functional requirements Vs.Usecases**(CO1)**
11. Estimate the effort using the following methods for the system to be automated:
     i. Function point metric

ii. Usecase point metric**(CO1)**

12. Develop a tool which can be used for quantification of all the non-functional requirements**(CO1)**
13. Write C/C++/Java/Python program for classifying the various types of coupling. **(CO4)**
14. Write a C/C++/Java/Python program for classifying the various types of cohesion. **(CO4)**
15. Write a c program to demonstrate the working of the Following constructs: **(CO4)**
    i) do…while
    ii) while…do
    ii) if-else
    iii) switch
    iv) for loop.
16. A program written in c language for matrix multiplication fails ─Introspect the causes for its failure and write down the possible reasons for its failure. **(CO5)**
17. Take ATM system and study its system specifications and report the various bugs. **(CO5)**
18. Write the test cases for Banking application. **(CO5)**
19. Create a test plan document for Library Management System. **(CO5)**
20. Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Assume that the upper limit for the size of any side is 10. Derive test cases for your program based on boundary-value analysis, execute the test cases and discuss the results. **(CO5)**
21. Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Derive test cases for your program based on decision table approach, execute the test cases and discuss the results. **(CO5)**
22. Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Assume the upper limit for the size of any side is 10. Derive test cases for your program based on equivalence class partitioning, execute the test cases and discuss the results. **(CO5)**
23. Draw standard UML diagrams using an UML modeling tool for a given case study and map design to code and implement a 3 layered architecture. Test the developed code and validate whether the SRS is satisfied. **(CO5)**
    A. Identify a software system that needs to be developed.
    B. Document the Software Requirements Specification (SRS) for the identified system.
    C. Identify use cases and develop the Use Case model.
    D. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.
    E. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams
    F. Draw relevant State Chart and Activity Diagrams for the same system.
    G. Implement the system as per the detailed design
    H. Test the software system for all the scenarios identified as per the usecase diagram
    I. Improve the reusability and maintainability of the software system by applying appropriate design patterns.
    J. Implement the modified system and test it for various scenarios
    Suggested domain for validate the following system:
        i. Passport automation system.p
        ii. Book bank
        iii. Exam registration
        iv. Stock maintenance system.
        v. Online course reservation system

Reference Books:

1. Rajib Mall, "Fundamentals of Software Engineering", 5th Edition, PHI, 2018.
2. Pressman Roger, "Software Engineering- Practioner Approach", McGraw Hill, 7 th Edition, 2012.
3. Ian Somerville, "Software Engineering", Pearson 2, 10 th Edition, 2017.
4. Jalote Pankaj, "An integrated approach to Software Engineering", Narosa, 3 rd Edition, 2005.
5. Richard Fairley, "Software Engineering Concepts", Tata McGraw Hill, 1997.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3											2	

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

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO12)	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 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: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO12	PO1: Apply(L3) PO2: Review (L2) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3) PO11: Thumb rule	3 3 3 3 3 3
4	CO4: Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3)	3 3 2 3
5	CO5: Understand	L3	PO1 PO2	PO1: Apply(L3) PO2: Identify (L3)	3 3

Justification Statements :

CO1: Understand the functional and non-functional requirements of software model
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: Analyze the knowledge in project managements and its principles.
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)
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)
PO11: Thumb rule
Knowledge on projects and management principles are required. the correlation is high(3)

CO 3: Evaluate the relationship between requirements and usecase using Microsoft project tool.
Action Verb: Evaluate (L5)
PO1: Apply (L3)
CO3 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Review(L2)
CO3 Action verb is less than as PO2 verb. Therefore, the correlation is medium(2)

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. 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
Documentation and presentation is learning process to find the solution better manner Therefore the correlation is high (3)

CO 4: Analyze the modules such as cohesion and coupling.
Action Verb: Apply(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 same 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)

CO 5: Understand the process of deduct the bugs during testing..
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)

Course Code	Year & Sem	COMPUTER NETWORKS SIMULATION LAB	L	T	P	C
20APC0517	III-I		0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the error detection/correction techniques.

CO2: Analyze the methods to simulate data link layer protocols.

CO3: Apply the routing algorithm for implementing network layer protocols.

CO4: Analyze the sending and receiving of packets by using NS2 simulator.

CO5: Apply the socket programming to develop network applications.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the error detection/correction techniques			L2
CO2	**Analyze**	the methods		to simulate data link layer protocols	L4
CO3	**Apply**	the routing algorithm		for implementing network layer protocols	L3
CO4	**Analyze**	the sending and receiving of packets	by using NS2 simulator		L4
CO5	**Apply**	the socket programming		to develop network applications	L3

List of Experiments
1. Study of basic network command and Network configuration commands. **(CO1)**
2. Connect the computers in Local Area Network. **(CO1)**
3. Performing an Initial Switch and Router Configuration **(CO1)**
4. Connecting, Configuring and Troubleshooting a Switched Network **(CO1)**
5. Implementation of Error Detection / Error Correction Techniques **(CO2)**
6. Implementation of Stop and Wait Protocol and sliding window **(CO2)**
7. Implementation and study of Goback-N and selective repeat protocols **(CO2)**
8. Implementation of High Level Data Link Control **(CO2)**
9. Implementation of Link state routing algorithm **(CO3)**
10. Implement the data link layer framing methods such as character, character-stuffing and bitstuffing. **(CO2)**
11. Write a program to compute CRC code for the polynomials CRC-12, CRC-16 and CRC CCIP**(CO2)**
12. 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. **(CO2)**
13. Implement Dijsktra's algorithm to compute the shortest path through a network **(CO3)**
14. Take an example subnet of hosts and obtain a broadcast tree for the subnet. **(CO3)**
15. Implement distance vector routing algorithm for obtaining routing tables at each node. **(CO3)**
16. Write a program for congestion control using Leaky bucket algorithm. **(CO3)**
17. Do the following using NS2 Simulator **(CO4)**
a. NS2 Simulator-Introduction
b. Simulate to Find the Number of Packets Dropped
c. Simulate to Find the Number of Packets Dropped by TCP/UDP
d. Simulate to Find the Number of Packets Dropped due to Congestion
e. Simulate to Compare Data Rate& Throughput.
f. Simulate to Plot Congestion for Different Source/Destination
g. Simulate to Determine the Performance with respect to Transmission of Packets
h. To create scenario and study the performance of network with CSMA/CA protocol and CSMA/CD protocols.
18. Implement the following executing protocols of Internet in action using Wireshark Lab. **(CO4)**

a. Packet Capture and Observations using Packet Sniffer.

b. Explore various aspects of HTTP Protocol.

c. Tracing DNS with Wireshark.

d. Analysis and Obtain various parameters-Values for TCP Protocol in action

19. Introduction to Network Simulator – Packet Tracer **(CO4)**

a. Configuration of a Router using Packet Tracer

b. Network using Packet Tracer

c. Implementation of Static Routing using Packet Tracer

d. Implementation of RIP using Packet Tracer

20. Develop the network application using socket API **(CO5)**

a. Write a Socket program for echo

b. Write a Socket program for Ping

c. Write a Socket program for Chat applications.

d. Write a Socket program for DNS(Domain Name System)

21. Planning Network-based Firewalls **(CO5)**

Reference Books:
Shivendra S.Panwar, Shiwen Mao, Jeong-dong Ryoo, and Yihan Li, ―TCP/IP Essentials A Lab-Based Approach‖, Cambridge University Press, 2004. Cisco Networking Academy, ―CCNA1 and CCNA2 Companion Guide‖, Cisco Networking Academy Program, 3rd edition, 2003. Ns Manual, Available at: https://www.isi.edu/nsnam/ns/ns-documentation.html, 2011. Elloitte Rusty Harold, ―Java Network Programming‖, 3rd edition, O'REILLY, 2011.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3											2	2
CO2	3	3	3	3									2	2
CO3	3	3	3		3			3					2	2
CO4	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 PO12)	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 PO3 PO4	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4)	3 3 3 3
3	CO3: Apply	L3	PO1 PO2 PO3 PO5 PO8	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO5: Apply (L3) PO8: Thumb rule	3 3 3 3 3
4	CO4: Analyze	L4	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze (L4) PO5: Apply (L3)	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: Understand the error detection/correction techniques

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: Analyze the methods to simulate data link layer protocols .
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)
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)

CO3: Apply the routing algorithm for implementing network layer protocols.
Action Verb: Apply (L3)
PO1: Apply (L3)
CO3 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2: idetify(L3)
CO3 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
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)
PO8: Thumb rule
While designing Routing algorithms one should follow ethical principles. Therefore, the correlation is high (3)

CO4: Analyze the sending and receiving of packets by using NS2 simulator.
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)
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)

CO5: Apply the socket programming to develop network applications.
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)
COMPUTER SCIENCE AND ENGINEERING (CSE)

Course Code	Year & Sem	Mobile Application Development	L	T	P	C
20ASA0503	III-I		1	0	2	2

Course Outcomes:

After studying the course, student will be able to

CO1: Understand knowledge on mobile platforms and mobile user interface design requirements

CO2: Analyze various android application design essentials for app development

CO3: Create user interfaces by analyzing user requirements and data persistence

CO4: Create mobile applications for messaging, location-based services and networking

CO5: Analyze mobile applications and publish in different mobile platforms by using Android Studio

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	**Understand**	knowledge on mobile platforms		mobile user interface design requirements	L2
CO2	**Analyze**	various android application		design essentials for App development	L4
CO3	**Create**	user interfaces by analyzing user requirements and data persistance	using android studio		L6
CO4	**Create**	Mobile applications for messaging	using android studio	location-based services and networking	L6
CO5	**Analyze**	mobile applications and publish in different mobile platforms	by using Android Studio		L4

UNIT - I		9 Hrs

Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation,Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.

1.Setting Up the Development Environment
    1.1 Download/Install the SDK
    1.2 Download/Install the Eclipse Plugin
    1.3 Download/Install the SDK Platform Components

2. Test the android development environment by performing the following operations.
    2.1. Add the sample application to a project in Android studio.
    2.2. Create an Android Virtual Device (AVD) for sample project.
    2.3. Create a launch configuration for sample project.
    2.4. Run a sample application in Android Emulator.

UNIT - II		9Hrs

Android Application Design Essentials: Anatomy of an Android applications, Android terminologies,Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.

3.Create "Hello World" Application

4. Develop a program which will implement Sub menu in android application.

5. Develop a program to implement Context menu (Floating List of Menu Items) in android application.

UNIT - III		9 Hrs

ADVANCED USER INTERFACE AND DATA PERSISTENCE Basic views, Picker views, List view, Image

view, Menus with views, Web view, saving and loading user preferences, Persisting data to files, Creating and using databases.

6. Develop a program to implement the List View in android application.

7. Creating the Application Choosing Options (i) CheckBox (ii) RadioButton

8. Develop application by using Linear Layout Views with different attributes.

UNIT - IV		9 Hrs

MESSAGING, LOCATION-BASED SERVICES, AND NETWORKING SMS messaging, sending e-mail, displaying maps, getting location data, monitoring a location, Consuming web services using HTTP

9. Develop a program to implement a Custom Button and handle the displayed message on button click

10. Develop a program to implement the Table layout in View Group that displays child View elements in rows
   and columns.

UNIT - V		9 Hrs

ANDROID SERVICES, PUBLISHING ANDROID APPLICATIONS: Services, Communication between a service and an activity, Binding activities to services, Threading, Preparing for publishing, Deploying APK files. Building the app in android debugging an android app.

11. Develop a program to show how to use Date picker control of ADK in android applications.

12. Develop a program to insert, delete, display, and update the employee details in Android APP

Textbooks:

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011)

2. J. F. DiMarzio, Beginning Android Programming with Android Studio, Wiley India, 4 thEdition, 2017.

3. Wei – Meng Lee, Beginning Android 4 Application Development, Wrox, 2017.

4. Jeff McWherter and Scott Gowell, Professional Mobile Application Development,Wiley India, 1 stEdition, 2012.

Reference Books:

1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd

2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd

3. Android Application Development All in one for Dummies by Barry Burd, Edition:

4. Neils Smyth, Android Stduio Development Essentials, Creative Space Independent publishing platform, 7 th Edition 2016.

5. Paul Deital and Harvey Deital, Android How to Program,Detial associates pu

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2		2								2	2
CO2	3	3	3		3								3	
CO3	3		3		3				3	3				2
CO4		3	3	3	3					3				2
CO5			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 PO12)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1 PO2 PO3 PO5	PO1: Apply(L3) PO2: Identify(L3) PO3: Design(L6) PO5: Apply(L3)	2 2 2 2
2	CO2: Analyze	L4	PO1 PO2 PO3 PO5	PO1: Apply(L3) PO2: Identify(L3) PO3: Design(L6) PO5: Apply(L3)	3 3 2 3

3	CO3: Create	L6	PO1 PO3 PO5 PO9 PO10	PO1: Apply(L3) PO3: Design(L6) PO5: Create(L6) P09: Thumb Rule PO10: Thumb Rule	3 3 3 3
4	CO4: Create	L6	PO2 PO3 PO4 PO5 PO10	PO2: Apply(L3) PO3: Design(L6) PO4: Analyze(L4) PO5: Create(L6) PO10: Thumb Rule	3 3 3 3 3
5	CO5: Analyze	L4	PO3 PO5 PO11 PO12	PO3: Develop(L3) PO5: Create(L6) PO11: Thumb Rule PO12: Thumb Rule	3 2 3 3

Justification Statements:

CO1: Understand knowledge on mobile platforms, mobile user interface design requirements
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO1 Action verb is lesser than as PO1 verb. Therefore, the correlation is medium (2)
PO2 Verb: Identify (L2)
CO1 Action verb is lesser than as PO2 verb. Therefore, the correlation is medium (2)
PO3 Verb: Design (L2)
CO1 Action verb is lesser than as PO3 verb. Therefore, the correlation is medium (2)
PO5 Verb: Apply (L2)
CO1 Action verb is lesser than as PO5 verb. Therefore, the correlation is medium (2)

CO2: Analyze various android application design essentials for app development
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: Design(L6)
CO2 Action verb is lesser than as PO3 verb. Therefore, the correlation is medium (2)
PO5: Apply (L3)
CO2 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

CO3: Create user interfaces by analyzing user requirements and data persistance
Action Verb: Create(L6)
PO1: Apply (L3)
CO3 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO3: Design(L6)
CO3 Action verb is same as PO3 verb. Therefore, the correlation is medium (3)
PO5: Create(L6)
CO3 Action verb is same as PO5 verb. Therefore, the correlation is medium (3)
PO9: Thumbrule
CO3 To bulid better application as a team member or a leader, so the correlation is high (3)
PO10: Thumbrule
CO3 Communicate effectively by Creating and maintaining databases, so the correlation is high (3)

CO4: Create mobile applications for messaging , location-based services and networking
Action Verb: Create(L6)
PO2: Apply (L3)
CO4 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
PO3: Design(L6)

CO4 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze(L4)
CO4 Action verb is greater than as PO4 verb. Therefore, the correlation is high (3)
PO5: Create(L6)
CO4 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO10: Thumbrule
CO4 Location based services by using different mobile applications, so the correlation is high (3)

CO5: Analyze mobile applications and publish in different mobile platforms by using Android Studio
Action Verb: Analyze(L4)
PO3: Develop(L3)
CO5 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
PO5: Create(L6)
CO5 Action verb is lesser than as PO5 verb. Therefore, the correlation is medium (2)
PO11: Thumbrule
CO5 Based on user requirements creating applications for multidisciplinary environments, so the correlation is high (3)
PO12: Thumbrule
CO5 For maintaining long life applications gradual updates are necessary, so the correlation is high (3)

Course Code	Year & Sem	BIOLOGY FOR ENGINEERS	L	T	P	C
20AMC9901	III-I		3	0	0	0

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the structure of cells and basics in living organisms

CO2: Understand the importance of various biomolecules and enzymes in living organisms

CO3: Analyze the functioning of physiology in respiratory system and digestive system.

CO4: Understand the DNA technology and gen cloning in living organisms.

CO5: Apply the biological principles in different technologies for the production of medicines and pharmaceuticals.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	the structure of cells and basics in living organisms			L2
2	Understand	the importance of various biomolecules and enzymes		in living organisms	L2
3	Analyze	the functioning of physiology		in respiratory system and digestive system	L4
4	Understand	the DNA technology and gen cloning		in living organisms	L2
5	Apply	the biological principles in different technologies	for the production of medicines and pharmaceuticals		L3

Unit I: Introduction to Basic Biology   **(10 hrs.)**

Evolution: Different patterns of evolution, Darwin's theory of evolution, Cell as Basic unit of life, cell theory, Cell shapes, Cell structure, Cell cycle. Chromosomes. Prokaryotic and eukaryotic Cell. Plant Cell, Animal Cell, Plant tissues and Animal tissues, Brief introduction to five kingdoms of classification, Tissue Engineering.

Unit II: Introduction to Biomolecules   **(10 hrs.)**

Carbohydrates, lipids, proteins, Vitamins and minerals, Nucleic acids (DNA and RNA) and their types. Enzymes, Enzyme application in Industry. Large scale production of enzymes by Fermentation.

Unit III: Human Physiology   **(09 hrs.)**

Digestive system, Respiratory system, (aerobic and anaerobic Respiration). Respiratory organs, respiratory cycle, Central Nerves System and Excretory system.

Unit IV: Introduction to Molecular Biology and recombinant DNA Technology   **(09 hrs.)**

Prokaryotic gene and Eukaryotic gene structure. DNA replication, Transcription and Translation. DNA technology. Introduction to gene cloning.

Unit V: Application of Biology   **(10 hrs.)**

Brief introduction to industrial Production of Enzymes, Pharmaceutical and therapeutic Proteins, Vaccines and antibodies. Basics of biosensors, Properties and Classification of virus, Immune response to virus, Definitions-Pandemic, Epidemic and outbreak, pandemic alert system ranges, Prevention of pandemic disease and pandemic preparation.

Text books:
1. P.K.Gupta, Cell and Molecular Biology, 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	PO12	PSO1	PSO2
1						2								
2						2						2		
3						2								
4						2								
5						2						2		

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

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours				CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Register (Hrs)	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	10		20	2	**Understand**	**L2**	PO6	PO6:	2
2	10		20	2	**Understand**	**L2**	PO6,PO12	PO6: PO12:	2,2
3	9		18	1	**Understand**	**L2**	PO6	PO6	2
4	9		18	1	**Understand**	**L2**	PO6	PO6	2
5	10		20	2	**Apply**	**L3**	PO6,PO12	PO6: PO12:	2,2
	48								

CO1: Understand the structure of cells and basics in living organisms
Action Verb: Understand (L2)
CO1 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO2: Understand the role of biomolecules in industry.
Action Verb: Understand (L2)
CO2 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 andpo12 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 and PO12 as moderate (2).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI

(AUTONOMOUS)

COMPUTER SCIENCE AND ENGINEERING (CSE)

(Effective for the batches admitted in 2020-21)

Semester VI (Third year)

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T	P	C			
1	PC	20APC0521	Artificial Intelligence	3	1	0	3	30	70	100
2	PC	20APC0523	Compiler Design	3	0	0	3	30	70	100
3	PC	20APC0528	Cloud Computing	3	0	0	3	30	70	100
4	PE-2	20APE0504 20APE0505 20APE0506	Machine Learning Real Time Operating Systems Agile Methodologies	3	0	0	3	30	70	100
5	PC Lab	20APC0522	Artificial Intelligence Lab	0	0	3	1.5	30	70	100
6	PC Lab	20APC0524	Compiler Design Lab	0	0	3	1.5	30	70	100
7	PC Lab	20APC0529	Cloud Computing 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				18.5	340	490	830
Industry Internship (Mandatory) for 6-8 Weeks duration during summer vacation										

Course Code	Year & Sem	Artificial Intelligence	L	T	P	C
20APC0521	III-II		3	1	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	PO12	PSO1	PSO2
CO1	2	3												
CO2	3	2	3	2	3								2	2
CO3	3	3	3	3	3	3		3						3
CO4		3	3		3	3		3						3
CO5	3	3	3			3		3	3			3	1	1

Correlation matrix

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
1	10	19%	2	CO1 :Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	13	25%	3	CO2 :Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO4: Analyze (L4) PO5:Apply(L3)	3 2 3 2 3
3	10	19%	2	CO3 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO6 PO8	PO1: Apply (L3) PO2: Analyze (L4) PO3: Develop (L3) PO4: Analyze (L4) PO5:Apply(L3) PO6: Thumb Rule PO8: Thumb Rule	3 3 3 3 3 3 3
4	9	17%	2	CO4 :Evaluate	L5	PO2 PO3 PO5 PO6 PO8	PO2: Review(L2) PO3: Develop (L3) PO5: Apply(L3) PO6: Thumb Rule PO8: Thumb Rule	3 3 3 3 3
5	11	20%	3	CO5 :Analyze	L4	PO1 PO2 PO3 PO6 PO8 PO9 PO12	PO1:Apply(L3) PO2:Analyze(L4) PO3: Develop(L3) PO6:Thumb Rule PO8: Thumb Rule PO9:Thumb Rule PO12: Thumb Rule	3 3 3 3 3 3 3
	53	100 %						

Justification Statements :

CO1: Understand the basic concepts of artificial intelligence and intelligent agents
Action Verb : Understand(L2)
PO1 : **Apply(L3)**
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 : **Review(L2)**
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

CO2: Apply the searching techniques for solving searching problems.
Action Verb : Apply (L3)

PO1: Apply(L3)

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

PO2: Analyze (L4)

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

PO3: Develop (L3)

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

PO4: Analyze (L4)

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

PO5:Apply(L3)

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

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

Action Verb : Analyze (L4)

PO1: Apply (L3)

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

PO2: Analyze (L4)

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

PO3: Develop (L3)

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

PO4: Analyze (L4)

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

PO5:Apply(L3)

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

PO6 : Thumb rule

Apply contextual knowledge is used for society to address the security issues so correlation is high(3)

PO8 : Thumb rule

The ethical knowledge is used to perform operations . Hence the correlation is high (3)

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

Action Verb : 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)

PO8 : Thumb rule

The ethical knowledge is used to perform operations . Hence the correlation is high (3)

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

Action Verb : Analyze(L4)

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 Rule

Apply contextual knowledge is used for society to address the security issues so correlation is medium (2)

PO8: Thumb Rule

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

PO9 : Thumb rule

Team work is required to create robots. Hence the correlation is medium (2)

PO12: Thumb rule

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

Course Code	Year & Sem	Compiler Design	L	T	P	C
20APC0523	III-II		3	0	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the various phases of compiler and compiler construction tools like LEX.

CO2: **Analyze** the different types of parsers like SLR, CLR and LALR by using parsing tables.

CO3: **Analyze** the various intermediate code forms to generate intermediate code.

CO4: **Understand** the basic concept of storage allocations and symbol table management.

CO5: **Apply** the various techniques for code generation and code optimization by using flow graphs.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the various phases of compiler and compiler construction tools like LEX			L2
CO2	Analyze	The different types of parsers like SLR, CLR and LALR	by using parsing tables.		L4
CO3	Analyze	The various intermediate code forms		to generate intermediate code	L4
CO4	Understand	the basic concept of storage allocations and symbol table management			L2
CO5	Apply	The various techniques	by using flow graphs	for code generation and code optimization	L3

UNIT - I		9 Hrs

Introduction: Language processors, The Structure of a Compiler, the science of building a complier.
Lexical Analysis: The Role of the lexical analyzer, Input buffering, Specification of tokens, Recognition of tokens, The lexical analyzer generator Lex, Design of a Lexical Analyzer generator

UNIT - II		9Hrs

Syntax Analysis: Introduction, Context Free Grammars, Writing a grammar, TOP Down Parsing, Bottom Up Parsing,
Introduction to LR Parsing: Simple LR, More Powerful LR Parsers, Using ambiguous grammars, Parser Generators

UNIT - III		9 Hrs

Syntax Directed Translation: Syntax Directed Definitions, Evaluation orders for SDD's, Application of SDT, SDT schemes, Implementing L-attribute SDD's.
Intermediate Code Generation: Variants of syntax trees, three address code, Types and declarations, Translations of expressions, Type checking, control flow statements, backpatching, switch statements, intermediate code for procedure.

UNIT - IV		9 Hrs

Run Time Environment : storage organization, Stack allocation of space, Access to non-local data on stack , Heap management
Symbol Table: Introduction, symbol table entries, operations on the symbol table, symbol table organizations, non block structured language, block structured language.

UNIT - V		9 Hrs

Code Generation: Issues in the design of a code generator, The Target language, Basic blocks and flow graphs, optimization of basic blocks, a simple code generator, register allocation and assignment, optimal code generation for expressions, dynamic programming code generation.
Code Optimization: Introduction, where and how to optimize, principle source of optimization, function preserving transformations, loop optimizations, global flow analysis, machine dependent optimization

Textbooks:
"Compilers Principles, Techniques and Tools", Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman., Pearson, 2016. 　　4.　"Compiler Construction", K.V.N Sunitha, Pearson, 2013
Reference Books:
1. Compiler Design", K. Muneeswaran., Oxford University Press, 2012 2. "Engineering A Compiler", Second Edition, Keith D. Cooper & Linda Torczon., MK(Morga Kaufmann) (ELSEVIER) 3. "Compilers Principles and Practice", Parag H. Dave, Himanshu B. Dave.,PEARSON 4. "Compiler Design", SandeepSaxena, Rajkumar Singh Rathore., S.Chand publications 5. "Compiler Design", SantanuChattopadhyay., PHI
Online Learning Resources:
https://www.youtube.com/watch?v=_ck1Lnm28hQ&list=PLbRMhDVUMngcseCW7wXDvtTDemCuH80fP

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2		2			1				1	3	3
CO2	3	3	3	3	3								2	2
CO3	3	3	3	3	3								2	2
CO4	2	3										1	2	2
CO5	3	2				2						2	2	2

Correlation matrix

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
1	12	22%	3	CO1: Understand	L2	PO1 PO2 PO3 PO5 PO8 PO12	PO1: Apply(L3) PO2:Review(L2) PO3:Develop(L3) PO5:Apply(L3) PO8:Thumb Rule PO12:Thumb Rule	2 3 2 2 1 1
2	12	22%	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	11	20%	2	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	8	14%	2	CO4:Understand	L2	PO1 PO2 PO12	PO1: Apply(L3) PO2: Review(L2) PO12:Thumb Rule	2 3 1
5	12	22%	3	CO5: Apply	L3	PO1 PO2 PO6 PO12	PO1: Apply(L3) PO2: Analyze (L4) PO6:Thumb Rule PO12:Thumb Rule	3 2 2 2
	55	100 %						

Justification Statements :

CO1: Understand the various phases of compiler and compiler construction tools like LEX.
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 level as PO2 verb. 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)
PO5: Apply(L3)
CO2 Action verb is less than PO5 verb by one level. Therefore, the correlation is moderate (2)
PO8: Thumb rule
While constructing the compiler, it is necessary to follow ethics as per norms of engineering practice. Therefore, the correlation is low(1)
PO12: Thumb rule
For compiler design process, it is required to update all phases of compiler. Therefore, the correlation is low(1)

CO2: : Analyze the different types of parsers like SLR, CLR and LALR by using parsing tables.
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: Analyze various intermediate code forms to generate intermediate code.
Action Verb: Analyze(L4)
PO1: Apply(L3)
CO3 Action verb is greater than PO1 verb by one level. 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)

CO4: Understand the basic concept of storage allocations and symbol table management.
Action Verb: Understand(L2)
PO1: Apply(L3)
CO4 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2: Review(L2)
CO4 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO12: Thumb rule
Data storage and management are continuously updating. Therefore, the correlation is low(1)

CO5: Apply various techniques for code generation and code optimization by using flow graphs.
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)
PO6: Thumb rule
Various code generation and code optimization techniques are going to solving societal issues. Therefore, the correlation is high (3).
PO12: Thumb rule
It is necessary for designers to learn optimization techniques for reducing lines of code in programming environment. Therefore, the correlation is high (3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)

Course Code	Year & Sem	Cloud Computing	L	T	P	C
20APC0528	III-II	(common to CSE,AIDS)	3	0	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the basics concepts of cloud computing

CO2: **Analyze** the cloud architecture and service delivery models

CO3: **Analyze** the <u>need</u> for virtualization in a cloud environment.

CO4: **Evaluate** the map reducing programming model using Hadoop tools

CO5: **Apply** the CIA traid and disaster management for cloud security

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The basics concepts of cloud computing			L2
CO2	Analyze	The cloud architecture and service delivery models			L4
CO3	Analyze	the need for virtualization		in a cloud environment	L4
CO4	Evaluate	The map reducing programming model	using Hadoop tools		L5
CO5	Apply	The CIA traid and disaster management		For cloud security	L3

UNIT - I		9 Hrs

Introduction to Cloud: Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, Characteristics and Benefits, A Closer Look, Cloud Computing Reference Model, Challenges Ahead, Historical Developments, Applications of cloud computing: Healthcare, energy systems, transportation, manufacturing, education, government, mobile communication, application development.

UNIT - II		9 Hrs

Cloud Computing Architecture: Introduction, NIST reference architecture, Cloud Reference Model,Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds,Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Interoperability and Standards, Scalability and Fault Tolerance

UNIT - III		9 Hrs

Virtualization: Introduction to Virtualization concept & Hypervisors, Pros and Cons of Virtualization, Virtual Machine (VM), implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Types of Hypervisors, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

UNIT - IV		9 Hrs

Programming Model: Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job – Design of Hadoop file system, HDFS concepts, dataflow of File read & File write, map reduce applications

Cloud Platforms in Industry: Amazon Web Services- Compute Services, Storage Services.

UNIT - V		9 Hrs

Cloud Security & Disaster Recovery: Cloud Security: Risks, privacy and privacy impacts assessments; Multi-tenancy issues, security in VM, OS, virtualization system security issues and vulnerabilities; Virtualization system-specific attacks: Technologies for virtualization-based security enhancement, legal.

Disaster Recovery: Disasters in the Cloud, Disaster Management, Compromise Response Disaster Recovery

Textbooks:
5. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi from TMH 2013.
6. George Reese Cloud Application Architectures, First Edition, O" Reilly Media 2009.
7. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.
Reference Books:
4. Cloud Computing and SOA Convergence in Your Enterprise A Step-by-Step Guide by David S. Linthicum from Pearson 2010.
5. Cloud Computing 2 nd Edition by Dr. Kumar Saurabh from Wiley India 2012.
6. Cloud Computing – web based Applications that change the way you work and collaborate Online – Micheal Miller.Pearson Education.
Online Learning Resources:
https://www.youtube.com/playlist?list=PLmcndht8X48zKf-jqk9xY5Wg_AhXR8aHb

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2											1	
CO2	3	3			3								2	1
CO3	3	3		2	3				3	3			2	
CO4			3	2	3				2				2	2
CO5		3	3	2		2		2				2	2	

Correlation matrix

Unit No.	CO						Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL				
1	13	22 %	3	CO1:Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Identify(L3)	2 2
2	15	25 %	3	CO2:Analyze	L4	PO1 PO2 PO5	PO1: Apply(L3) PO2: Identify(L3) PO5: Apply(L3)	3 3 3
3	11	19 %	2	CO3:Analyze	L4	PO1 PO2 PO4 PO5 PO9 PO10	PO1: Apply(L3) PO2: Identify(L3) PO4: Analyze(L4) PO5: Develop(L3) PO9: Thumb rule PO10: Thumbrule	3 3 3 3 3 3
4	11	19 %	2	CO4:Evaluate	L5	PO3 PO4 PO5 PO9	PO3: Develop(l3) PO4:Interpret(L5) PO5: Create(L6) PO9: Thumb rule	3 3 2 3
5	9	15 %	2	CO5:Apply	L3	PO2 PO3 PO4 PO6 PO8 PO12	PO2:Review(L2) PO3: Develop(L3) PO4: Analyze(L4) PO6: Thumb rule PO8: Thumb rule PO12: Thumb rule	3 3 2 2 2 2
	59	100 %						

Justification Statements :

CO1: Understand the basics concepts of cloud computing

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: Analyze the cloud architecture and service delivery models

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)

CO3: Analyze the need for virtualization in a cloud environment.

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)

PO4: Analyze (L4)

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

PO5: Develop(L3)

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

PO9 : Thumb rule

Team work is required between cloud provider and consumers. Hence the correlation is high(3)

PO10: Thumb rule

Effective communication is required , reports to be generated between cloud users and providers. Therefore the correlation is high(3)

CO4: Evaluate the map reducing programming model using Hadoop tools

Action Verb : Evaluate(L5)

PO3: Develop(L3)

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

PO4: Interpret (L5)

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)

PO9: Thumb rule

Team work is required between cloud provider and consumers in multi disciplinary activities. Therefore the correlation is high(3)

CO5: Apply the CIA traid and disaster management for cloud security

Action Verb : Apply(L3)

PO2: Review(L2)

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

PO3: Develop(L3)

CO5 Action verb is same level as 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)

PO6 : Thumb rule

Since ethical principles should be followed to create a cloud and providing services to cloud. Therefore the correlation is medium(2)

PO8 : Thumb rule

Team work is required between cloud consumers and providers. Hence the correlation is medium(2)

PO12: Thumb rule

For some of real world applications we use cloud services. Therefore the correlation is medium(2)

Course Code	Year & Sem	MACHINE LEARNING	L	T	P	C
20APE0504	III-II	**(common to CSE,AIDS)**	**3**	**0**	**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, ν-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=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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 PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL				
1	13	19%	2	CO1: Apply	L3	PO1 PO2 PO6	PO1: Apply(L3) PO2: Analyze(L4) PO6: Thumb rule	3 2 2
2	12	18%	2	CO2: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO8 PO12	PO1: Apply(L3) PO2: Analyze(L4) PO3: Design (L6) PO4: Design (L6) PO5: Create(L6) PO8: Thumb rule PO12: Thumb rule	3 3 2 2 2 3 3
3	18	26%	3	CO3: Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3)	3 3 3 3 3
4	12	18%	2	CO4: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO8 PO12	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop(L3) PO4: Analyze(L4) PO5: Create(L6) PO8: Thumb rule PO12: Thumb rule	3 3 3 3 2 3 3
5	13	19%	2	CO5: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO8 PO12	PO1: Apply(L3) PO2: Analyze(L4) PO3: Design (L6) PO4: Design (L6) PO5: Create(L6) PO8: Thumb rule PO12: 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)

PO8 : Thumb rule

While creating hypothesis one need to follow the ethical principles. Therefore, the correlation is High (3)

PO12: 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)

PO8 : Thumb rule

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

PO12: 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)
PO8 : Thumb rule
While making decisions for solving real world problems one must follow the ethical principles. Therefore, the correlation is High (3)
PO12: Thumb rule
For developing solutions for future problems a continuous study is need. Therefore, the correlation is high (3)

Course Code	Year & Sem	REAL TIME OPERATING SYSTEMS	L	T	P	C
20APE0505	III-II	**(common to CSE,CIC)**	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	PO12	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		Program	PO(s) :Action Verb and	Level of
	Co's Action verb	BTL	Outcome (PO)	BTL(for PO1 to PO12)	Correlation (0-3)
1	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	CO2: Apply	L3	PO1 PO2 PO12	PO1: Apply(L3) PO2: Review(L2) PO12: 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)
PO12: 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)

Course Code	Year & Sem	AGILE METHODOLOGIES	L	T	P	C
20APE0506	III-II		3	0	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the different stages of Agile Software Development Life Cycle.

CO2: Analyze the principles and practices to produce high Quality Software.

CO3: Apply different Integration Tools to track and manage changes to a set of Files over time.

CO4: Analyze the various release plans to mitigate their risks in Software Projects.

CO5: Analyze test Driven Development for Tuning Application Performance.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	Different stages of Agile Software Development Life Cycle			L2
CO2	Analyze	The Principles and Practices		to Produce high Quality Software	L4
CO3	Apply	Different Integration tools to track and manage Changes to a set of Files over time			L3
CO4	Analyze	The various release plans to Mitigate their risks in Software Projects			L4
CO5	Analyze	Test Driven Development		for Tuning Application Performance	L4

UNIT - I	Introduction	9 Hrs
Agile: Why Agile? - How to be Agile - Understanding XP - Values and Principles - Improve the Process - Eliminate Waste - Deliver Value.		

UNIT - II	Extreme Programming	9Hrs
Practicing XP-Thinking, Pair Programming, Energized Work, Informative Workspace, Root Cause Analysis, Retrospectives, Collaborating, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting.		

UNIT - III	Build and Integration	9 Hrs
Releasing-Done Done, No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation.		

UNIT - IV	Planning	9 Hrs
Planning-Vision, Release Planning, Risk Management, Iteration Planning, Stories, Estimating.		

UNIT - V	Development	9 Hrs
Developing-Incremental Requirements, Customer Tests, Test- Driven Development, Refactoring, Incremental Design and Architecture, Spike Solutions, Performance Optimization.		

Textbooks:

1. James Shore and Shane Warden, " The Art of Agile Development", O'REILLY, 2007.

Reference Books:

1. Robert C. Martin, "Agile Software Development, Principles, Patterns, and Practices" , PHI, 2002.

2. Angel Medinilla, "Agile Management: Leadership in an Agile Environment", Springer, 2012.

3. Bhuvan Unhelkar, "The Art of Agile Practice: A Composite Approach for Projects and Organizations", CRC Press.

4. Jim Highsmith, "Agile Project Management", Pearson education, 2004.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2												
CO2	3	3		3										
CO3	3				3									
CO4		3		3							3			
CO5		3	3											

Correlation matrix

Unit No.	CO Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
1	CO1 :Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Identify(L3)	2 2
2	CO2 : Analyze	L4	PO1 PO2 PO4	PO1: Apply(L3) PO2: Identify (L3) PO4:Analyze(L4)	3 3 3
3	CO3 : Apply	L3	PO1 PO5	PO1: Apply(L3) PO5: Apply(L3)	3 3
4	CO4 : Analyze	L4	PO2 PO4 PO11	PO2: Identify (L3) PO4: Analyze (L4) PO11:Thumbrule	3 3 3
5	CO5 : Analyze	L4	PO2 PO3	PO2: Identify (L3) PO3: Develop(L3)	3 3

Justification Statements :

CO1: Understand the Different stages of Agile Software Development Life Cycle

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: Identify(L3)

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

CO2: Analyze the Principles and Practices to Produce high Quality Software.

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)

PO4:Analyze(L4)

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

PO11: Thumb rule

Therefore the correlation is high(3)

CO3: Apply Different Integration Tools   to track and manage Changes to a set of Files over time

Action Verb : Apply (L3)

PO1: Apply(L3)

CO3 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO5:Apply(L3)

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

CO4: Analyze the various release Plans to Mitigate their Risks in Software Projects.

Action Verb : Analyze(L4)
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)
PO11: Thumb rule
In any project develop estimating cost is the maijor Therefore the correlation is high(3)

CO5:Analyze the test Driven Development for Tuning Application Performance

Action Verb : Analyze (L4)
PO2: Identify(L3)
CO5 Action verb is more than PO2 verb by one level. Therefore the correlation is high(3)
PO3:Develop(L3)
CO5 Action verb is more than PO3 verb by one level. Therefore the correlation is high(3)

Course Code	Year & Sem	**ARTIFICIAL INTELLIGENCE LAB**	**L**	**T**	**P**	**C**
20APC0522	III-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	PO12	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 PO12)	Level of Correlation (0-3)
1	CO1: Apply	L3	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	3 3
2	CO2: Analyze	L4	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze (L4) PO5: Apply (L3)	3 3 3 3
3	CO3: Apply	L3	PO1 PO3 PO4 PO5 PO12	PO1: Apply(L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3) PO12: Thumb rule	3 3 2 3 3
4	CO4: Analyze	L4	PO1 PO2 PO3 PO4 PO12	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4) PO12: Thumb rule	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:

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)

PO12: 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)

PO12: 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)

Course Code	Year & Sem	COMPILER DESIGN LAB	L	T	P	C
20APC0524	III-II		0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO 1: Understand the basic concepts of lexical analyzer and compiler tools.

CO 2: Analyze the lexical analyzer for validating operators.

CO 3: Apply the LL and LALR Parsing tools for constructing a compiler.

CO 4: Analyze the semantic rules to calculate the expression.

CO 5: Apply the different dynamic programming to generate machine code.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the basic concepts of lexical analyzer and compiler tools		for writing simple programs	L2
CO2	**Analyze**	the lexical analyzer		for validating operators	L4
CO3	**Apply**	the LL and LALR Parsing tools		for constructing a compiler	L3
CO4	**Analyze**	the semantic rules		to calculate the expression	L4
CO5	**Apply**	the different dynamic programming		to generate machine code	L3

List of Experiments
1. Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines. It should also ignore comments. Although the syntax specification states that identifiers can be arbitrarily long, you may restrict the length to some reasonable value. Simulate the same in C language. **(CO1)**
2. Write a C program to identify whether a given line is a comment or not. **(CO1)**
3. Write a C program to recognize strings under 'a', 'a*b+', 'abb'. **(CO2)**
4. Write a C program to test whether a given identifier is valid or not. **(CO2)**
5. Write a C program to simulate lexical analyzer for validating operators. **(CO2)**
6. Implement the lexical analyzer using JLex, flex or other lexical analyzer generating tools. **(CO3)**
7. Write a C program for implementing the functionalities of predictive parser for the mini language specified in Note 1. **(CO3)**
8. a) Write a C program for constructing of LL (1) parsing. **(CO3)**
b) Write a C program for constructing recursive descent parsing. **(CO3)**
9. Write a C program to implement LALR parsing. **(CO3)**
10. a) Write a C program to implement operator precedence parsing. **(CO4)**
b) Write a C program to implement Program semantic rules to calculate the expression that takes an expression with digits, + and * and computes the value. **(CO4)**
11. Convert the BNF rules into Yacc form and write code to generate abstract syntax tree for the mini language specified in Note 1. **(CO5)**
12. Write a C program to generate machine code from abstract syntax tree generated by the parser. The instruction set specified in Note 2 may be considered as the target code. **(CO5)**

Note 1:
A simple language written in this language is
{int a[3],t1,t2;
T1=2;
A[0]=1;a[1]=2;a[t]=3;
T2=-(a[2]+t1*6)/(a[2]-t1);
If t2>5then
Print(t2)
Else{
Int t3;
T3=99;
T2=25;

Print(-t1+t2*t3);/*this is a comment on 2 lines*/
}endif
}
Comments(zero or more characters enclosed between the standard C/JAVA Style comment brackets/*...*/)can be inserted .The language has rudimentary support for1-dimenstional array,the declaration int a[3] declares an array of three elements,referenced as a[0],a[1] and a[2].Note also you should worry about the scopping of names.

Note 2:
Consider the following mini language, a simple procedural high –level language, only operating on integer data, with a syntax looking vaguely like a simple C crossed with pascal. The syntax of the language is defined by the following grammar.
<program>::=<block>
<block>::={<variable definition><slist>}
|{<slist>}
<variabledefinition>::=int <vardeflist>
<vardec>::=<identifier>|<identifier>[<constant>]
<slist>::=<statement>|<statement>;<slist>
<statement>::=<assignment>|<ifstament>|<whilestatement>
|<block>|<printstament>|<empty>
<assignment>::=<identifier>=<expression>
|<identifier>[<expression>]=<expression>
<if statement>::=if<bexpression>then<slist>else<slist>endif
|if<bexpression>then<slisi>endif
<whilestatement>::=while<bexpreession>do<slisi>enddo
<printstatement>:;=print(<expression>)
<expression>::=<expression>::=<expression><addingop><term>|<term>|<addingop><term>
<bexprssion>::=<expression><relop><expression>
<relop>::=<|<=|==|>=|>|!=
<addingop>::=+|-
<term>::=<term><multop><factor>|<factor>
<Multop>::=*|/
<factor>::=<constant>|<identifier>|<identifier>[<expression>]
|(<expression>)
<constant>::=<digit>|<digit><constant>
<identifier>::=<identifier><letter or digit>|<letter>
<letter or digit>::=<letter>|<digit>
<letter>:;=a|b|c|d|e|f|g|h|I|j|k|l|m|n|o|p|q|r|s|t|u|v|w|x|y|z
<digit>::=0|1|2|3|4|5|^|7|8|9
<empty>::=has the obvious meaning

Reference Books:

1. Modern compiler implementation in C, Andrew w.Appel, Revised Edn, Cambridge University Press
2. Principles of Compiler Design. – A.V Aho, J.D Ullman ; Pearson Education.
3. lex&yacc , -John R Levine, Tony Mason, Doug Brown; O'reilly.
4. Compiler Construction,- LOUDEN, Thomson.
5. Engineering a compiler – Cooper& Linda, Elsevier
6. Modern Compiler Design – Dick Grune, Henry E.Bal, Cariel TH Jacobs, Wiley Dreatech

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3												3
CO2	3	3	3	3	3								3	3
CO3	3		3	3	3							3	3	
CO4	3	3	3	3	3							3	3	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 PO12)	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 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: Apply	L3	PO1 PO3 PO4 PO5 PO12	PO1: Apply(L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3) PO12: Thumb rule	3 3 2 3 3
4	CO4: Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO12	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3) PO12: 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:

CO 1: Understand the basic concepts of lexical analyzer and compiler tools.
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: 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: idetify(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)

CO 3: Apply the LL and LALR Parsing tools for constructing a compiler.
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)

PO12: Thumb rule
Compiler construction is a continues learning process for the users the correlation is high (3)

CO 4: Analyze the semantic rules to calculate the expression.
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)
PO12: Thumb rule
Syntax and semantic error checking is continuous process for testers so the correlation is high(3)

CO 5: Apply the different dynamic programming to generate machine code.
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)

Course Code	Year & Sem	Cloud Computing Laboratory	L	T	P	C
20APC0529	III-II		0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO 1: Understand the various service delivery models of a cloud computing architecture.

CO 2: Analyze the installation of different cloud simulation tools and cloud setup tools.

CO 3: Design the web applications using various cloud platforms

CO 4: Analyze the various virtualization & Virtual Machine Provisioning tools such as Virtual Box, VMware.

CO 5: Apply Hadoop single node cluster and run simple applications.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the service delivery models of a cloud computing architecture.			L2
CO2	**Analyze**	the installation of different cloud simulation tools and cloud setup tools			L4
CO3	**Design**	the web applications	using various cloud platforms		L6
CO4	**Analyze**	the various virtualization & Virtual Machine Provisioning tools such as Virtual Box, VMware.			L4
CO5	**Apply**	Hadoop single node cluster and run simple applications.			L3

List of Experiments

1. To study in detail about cloud computing. **(CO1)**
2. Working of Google Drive to make spreadsheet and notes. **(CO1)**
3. Installation and Configuration of Justcloud. **(CO1)**
4. Working in Cloud9 to demonstrate different language. **(CO1)**
5. Install Google App Engine. Create hello world app and other simple web applications using python/java. **(CO2)**
6. Deployment and Configuration options in Google Cloud**(CO2)**
7. Install Virtual box/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8. **(CO2)**
8. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs**(CO2)**
9. Install Hadoop single node setup**(CO2)**
10. Develop hadoop application to count no of characters, no of words and each character frequency**(CO3)**

Programs on SaaS
11. Create an word document of your class time table and store locally and on the cloud with doc,and pdf format . (use www.zoho.com anddocs.google.com). **(CO3)**
12. Create a spread sheet which contains employee salary information and calculate gross and total sal using the formula DA=10% OF BASIC HRA=30% OF BASIC PF=10% OF BASIC IF BASIC<=3000 12% OF BASIC IF BASIC>3000 TAX=10% OF BASIC IF BASIC<=1500 =11% OF BASIC IF BASIC>1500 AND BASIC<=2500 =12% OF BASIC IF BASIC>2500 (use www.zoho.com and docs.google.com) NET_SALARY=BASIC_SALARY+DA+HRA-PF-TAX**(CO3)**
13. Prepare a ppt on cloud computing –introduction , models, services ,andarchitecture Ppt should contain explanations, images and at least 20 pages (use www.zoho.com and docs.google.com). **(CO4)**
14. Create your resume in a neat format using google and zoho cloud. **(CO4)**

Programs on PaaS

15. Write a Google app engine program to generate n even numbers and deploy it to google cloud. **(CO5)**
16. Google app engine program multiply two matrices. **(CO5)**
17. Write a Google app engine program to display nth largest no from the given list of numbers and deploy it into google cloud. **(CO5)**

Reference Books:

1. spoken-tutorial.org
2. Bart Jacob (Editor), ―Introduction to Grid Computing, IBM Red Books, Vervante, 2005
3. Ian Foster, Carl Kesselman, ―The Grid: Blueprint for a New Computing Infrastructure, 2nd Edition, Morgan Kaufmann

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3												
CO2	3	3	3	3	3									
CO3	3	3	3	3	3					1				
CO4	3	3	3	3	3				3			3		
CO5	3	3	3	2	3							1		

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO12)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1	PO1: Apply(L3)	2
			PO2	PO2: Review(L2)	3
2	CO2: Analyze	L4	PO1	PO1: Apply(L3)	3
			PO2	PO2: Identify (L3)	3
			PO3	PO3: Develop(L3)	3
			PO4	PO4: Analyze (L4)	3
			PO5	PO5: Apply (L3)	3
3	CO3: 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
			PO10	PO10: Thumb rule	1
4	CO4: Analyze	L4	PO1	PO1: Apply(L3)	3
			PO2	PO2: Identify (L3)	3
			PO3	PO3: Develop(L3)	3
			PO4	PO4: Analyze (L4)	3
			PO5	PO5: Apply (L3)	3
			PO9	PO9: 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
			PO12	PO12: Thumb rule	1

Justification Statements :

CO 1: Understand the various service delivery models of a cloud computing architecture.

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)

CO 2: Analyze the installation of different cloud simulation tools and cloud setup tools.

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)
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)

CO 3: Design the web applications using various cloud platforms
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)

PO10: Thumb rule
Effective communication is required, reports to be generated between cloud users and service providers the correlation is low (1)

CO 4: Analyze the various virtualization & Virtual Machine Provisioning tools such as Virtual Box, VMware.
Action Verb: Analyze (L4)
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)

PO9: Thumb rule
Team work is required between cloud providers and cloud vendors to consumers in multi-disciplinary activities therefore, the correlation is high (3)

CO 5: Apply Hadoop single node cluster and run simple applications.
Action Verb: Apply (L3)
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)
PO12: Thumb rule
For some real world applications we can use Hadoop framework techniques therefore, the correlation is low (1)

Course Code	Year & Sem	SOFT SKILLS LAB	L	T	P	C
20ASA0502	III-II		1	0	2	2

Course Outcomes:

After studying the course, student will be able to

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=PfJg-67smf4
        https://www.youtube.com/watch?v=-lXjbph22Fk

UNIT – V:
Grammar : Verbal ability tests.
Vocabulary: Mock interviews, Post interview Etiquette.
Verbal ability tests.
Web links: https://prepinsta.com/infosys-english-verbal-questions/
        https://www.indiabix.com/online-test/verbal-ability-test/random
        https://www.allindiaexams.in/online-test/online-general-english-test/61
Vocabulary: Mock interviews, Post interview Etiquette.
Web links: https://www.youtube.com/watch?v=ZOLCMa2QbdE
        https://www.ziprecruiter.com/blog/the-right-way-to-follow-up-after-a-job-interview/
        https://www.youtube.com/watch?v=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	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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 PO12)	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**	PO12	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 PO12 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 PO12 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 PO12 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 PO12 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 PO12 as high (3).

Course Code	Year & Sem	PROFESSIONAL ETHICS AND HUMAN VALUES	L	T	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 IIlich, 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	PO12
1												2
2								2	2			
3						2			2			
4						2		2				
5					1		2					2

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

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	**8**	27	2	**Understand**	**L2**	PO12	Thumb Rule	2
2	**8**	26	2	**Understand**	**L2**	PO8, PO9	Thumb Rule Thumb Rule	2 2
3	**4**	13	**2**	**Understand**	**L2**	PO6, PO9	Thumb Rule Thumb Rule	2 2
4	**5**	17	**2**	**Understand**	**L2**	PO6, PO8	Thumb Rule Thumb Rule	2 2
5	**5**	17	**2**	**Understand**	**L2**	PO5, PO7,	PO5 : APPLY	1 2

						PO12	Thumb Rule Thumb Rule	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 PO12 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 PO12 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 PO12 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 PO12 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 PO12 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)
COMPUTER SCIENCE AND ENGINEERING (CSE)
(Effective for the batches admitted in 2020-21)

Semester VII (Fourth year)

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T	P	C			
1	PE-3	20APE0507 20APE0508 20APE0509 20APE0510	Predictive Analytics Natural Language Processing Deep Learning Techniques Computer Vision	3	0	0	3	30	70	100
2	PE-4	20APE0511 20APE0512 20APE0513	Cryptography and Network Security Adhoc & Sensor Networks Distributed Systems	3	0	0	3	30	70	100
3	PE-5 CBCC	20APE0514 20APE0515 20APE0516	Data Analytics Software Project Management Linux Environment System	3	0	0	3	30	70	100
4	JOE/OE-2	20AOE0501 20AOE0502 20AOE0503	Information Retrieval Techniques Soft Computing Principles of Data science	3	0	0	3	30	70	100
5	OE-3	20APE0407 20APE0411 20AOE3601 20APE0415	Digital Image Processing Embedded Systems Enabling Technologies for data science and analytics :IOT Wireless Communications	3	0	0	3	30	70	100
6	HE	20AOE0302 20AOE9901 20AHSMB02	Management Science English for Research Paper Writing Entrepreneurship Development	3	0	0	3	30	70	100
7	SA	20ASA0504	Devops	1	0	2	2	100	0	100
8	PR	20APR0501	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)
COMPUTER SCIENCE AND ENGINEERING (CSE)

Course Code	Year & Sem	PREDICTIVE ANALYTICS	L	T	P	C
20APE0507	IV-I		3	0	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the basic concepts of Predictive Analytics in real time applications.

CO2: Analyze the various classification methods for different types of Machine Learning Algorithms.

CO3: Analyze the object segmentation methods for decision tree algorithms.

CO4: Apply the time series methods to find accuracy and performance in prediction.

CO5: Apply the standard optimization procedures for documentation and knowledge sharing.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the basic concepts of Predictive Analytics in real time applications			L2
CO2	Analyze	the various classification methods		for different types of Machine Learning Algorithms	L4
CO3	Analyze	the object segmentation methods		for decision tree algorithms	L4
CO4	Apply	the time series methods		to find accuracy and performance in prediction	L3
CO5	Apply	the standard optimization procedures		for documentation and knowledge sharing	L3

UNIT - I	Introduction to Predictive Analytics & Linear Regression (NOS 2101)	10 Hrs

Introduction to Predictive Analytics & Linear Regression (NOS 2101): What and Why Analytics, Introduction to Tools and Environment, Application of Modeling in Business, Databases & Types of data and variables, Data Modeling Techniques, Missing imputations etc. Need for Business Modeling, Regression — Concepts, Blue property-assumptions-Least Square Estimation, Variable Rationalization, and Model Building etc..

UNIT - II	Logistic Regression (NOS 2101)	10Hrs

Logistic Regression (NOS 2101): Model Theory, Model fit Statistics, Model Conclusion, Analytics applications to various Business Domains etc. Regression Vs Segmentation — Supervised and Unsupervised Learning, Tree Building — Regression, Classification, Over fitting, Pruning and complexity, Multiple Decision Trees etc.

UNIT - III	Objective Segmentation (NOS 2101)	9 Hrs

Objective Segmentation (NOS 2101): Regression Vs Segmentation — Supervised and Unsupervised Learning, Tree Building — Regression, Classification, Over fitting, Pruning and complexity, Multiple Decision Trees etc. Develop Knowledge, Skill and Competences (NOS 9005)

Introduction to Knowledge skills & competences, Training & Development, Learning & Development, Policies and Record keeping. etc.

UNIT - IV	Time Series Methods I Forecasting	8 Hrs

Time Series Methods I Forecasting, Feature Extraction (NOS 2101): Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height. Average, Energy etc and Analyze for prediction.

UNIT - V	Working with Documents (NOS 0703):	8 Hrs

Working with Documents (NOS 0703): Standard Operating Procedures for documentation and knowledge sharing, Defining purpose and scope documents, Understanding structure of documents — case studies, art ides, white papers, technical reports, minutes of meeting etc., Style and format, Intellectual Property and Copyright, Document preparation tools — Vision, PowerPoint, Word, Excel etc., Version Control, Accessing and updating corporate knowledge base, Peer review and feedback.

Textbooks:
Student's Handbook for Associate Analytics-Ill.

Reference Books:

1. Gareth James' Daniela Witten Trevor Hastie Robert Tibshirani. An Introduction to Statistical
2. Learning with Applications in R

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	2		2								
CO2	3	3	3	3	3							3		
CO3	3	3	3	3	3									
CO4	3	3	3	2	3									
CO5	3	3	3	2	3					2				

Mapping of course outcomes with program outcomes

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s): Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1 PO2 PO3 PO5 PO6	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO5: Apply(L3) Thumb Rule	2 3 2 2 2
2	CO2: Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO12	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO12:Thumb Rule	3 3 3 3 3 3
3	CO3: Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3 3
4	CO4: Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 2 3
5	CO4: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO10	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO10:Thumb Rule	3 3 3 2 3 2

Justification Statements:

CO1: Understand the basic concepts of Predictive Analytics in real time applications.

Action Verb: Understand(L2)

PO1: Apply(L3)

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

PO2: Review(L2)

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

PO3: Develop(L3)

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

PO5: Apply(L3)

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

PO6: Thumb Rule

Since basic of predictive analytics are needed to solve large complex engineering problems. Therefore correlation is medium(2).

CO2: Analyze the various classification methods for different types of Machine Learning Algorithms.

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)

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)

PO5: Apply(L3)

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

PO12: Thumb Rule

Machine learning algorithms like supervised and unsupervised learning are used to give predictions for classification methods. Therefore the correlation is high(3).

CO3: Analyze the object segmentation methods for decision tree algorithms.

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)

CO4: Apply the time series methods to find accuracy and performance in prediction.

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: 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 as PO5 verb. Therefore, the correlation is high (3)

CO5: Apply the standard optimization procedures for documentation and knowledge sharing.

Action Verb: Apply(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)

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)

PO10: Thumb Rule

Knowledge sharing and preparing standard documentations are useful to prepare technical reports which helps in understand documentation. Therefore the correlation is medium(2).

Course Code	Year & Sem	Natural Language Processing	L	T	P	C
20APE0508	IV-I		3	0	0	3

Course Outcomes:

After studying the course, student will be able to

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

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

CO3: Analyze grammars and mechanisms of augmented transistion network for NLP

CO4: Apply language models and semantic interpretation to NLP

CO5: Analyze machine translation and multi lingual information retrieval approaches to improve system performance

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

UNIT - I	Introduction to Natural language	9 Hrs

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	9Hrs

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	9 Hrs

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	9 Hrs

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	9 Hrs

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.James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.
2. Multilingual Natural Language Processing Applications : From Theory To PracticeDaniel M.Bikel and Imed Zitouni, Pearson Publications.
3. Natural Language Processing, A paninian perspective, Akshar Bharathi,Vineet chaitanya,Prentice – Hall of India.
Reference Books:
1.Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.
2. Jurafsky, Dan and Martin, James, Speech and Language Processing, 2nd Edition, Prentice Hall, 2008.
3. Manning, Christopher and Henrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
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 PO12	PO1: Apply(L3) PO2: Identify(L3) PO4: Analyze(L4) PO5: Apply(L3) PO12: Thumb rule	3 3 2 3 2
3	CO3 : Analyze	L4	PO1 PO2 PO4 PO5 PO12	PO1: Apply(L3) PO2: Identify(L3) PO4: Analyze(L4) PO5: Apply(L3) PO12: Thumb rule	3 3 3 3 3
4	CO4 : Apply	L3	PO1 PO2 PO3 PO12	PO1: Apply(L3) PO2: Identify(L3) PO3: Develop(L3) PO12: Thumb rule	3 3 3 2
5	CO5 :Analyze	L4	PO1 PO2 PO4 PO6 PO12	PO1: Apply(L3) PO2: Identify(L3) PO4: Analyze(L4) PO6: Thumb rule PO12: Thumb rule	3 3 3 3 3

Justification Statements :

CO1: Understand the basic concepts of NLP concepts to build langue 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 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 parsing techniques to study syntactic structure of sentences in natural language

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 medium(2)

PO5: Apply(L3)

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

PO12: Thumb rule

For developing natural language applications, one needs to learn continuously. Therefore the correlation is medium(2)

CO3: Analyze grammars and mechanisms of augmented transistion network for NLP

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)

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)

PO12 : Thumb rule

For developing natural language applications, one needs to learn continuously.Therefore the correlation is high(3)

CO4: Apply 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)

PO12: Thumb rule

For developing natural language applications, one needs to learn continuously.Therefore the correlation is medium(2)

CO5: Analyze machine translation and multi lingual information retrieval 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)

PO12 : Thumb rule

In language translation retrieval approaches to improve performance gets updated regularly. Therefore the correlation is high(3

Course Code	Year & Sem	Deep Learning Techniques	L	T	P	C
20APE0509	IV-I	**(Common to CSE, AIDS)**	**3**	**0**	**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 through 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	PO12	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 Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
1	13	22%	3	CO1: Understand	L2	PO1 PO2 PO12	PO1: Apply(L3) PO2: Analyze(L4) PO12: Thumb rule	2 1 2
2	09	15%	2	CO2: Understand	L2	PO1 PO2 PO6 PO12	PO1: Apply(L3) PO2: Analyze(L4) PO6: Thumb rule PO12: Thumb rule	2 1 2 2
3	14	23%	3	CO3: Analyse	L4	PO1 PO2 PO3 PO4 PO5 PO6 PO12	PO1: Apply(L3) PO2: Analyze(L4) PO3: Design (L6) PO4: Design (L6) PO5: Create(L6) PO6: Thumb rule PO12: Thumb rule	3 3 1 1 1 2 2
4	10	17%	2	CO4: Apply	L3	PO1 PO2 PO12	PO1: Apply(L3) PO2: Analyze(L4) PO12: Thumb rule	3 2 2
5	14	23%	3	CO5: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO12	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop(L3) PO4: Design (L6) PO5: Create(L6) PO12: 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)
PO12: 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)

PO12: 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)

PO12: 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)

PO12: 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)

PO12: 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)
COMPUTER SCIENCE AND ENGINEERING (CSE)

Course Code	Year & Sem	Computer Vision	L	T	P	C
20APE0510	IV-I		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	PO12	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 PO12)	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 PO12	PO1: Apply(L3) PO2: Review (L2) PO4: Analyze (L4) PO5: Apply(L3) PO12: Thumb rule	3 3 3 3 2
4	CO4 : **Apply**	L3	PO1 PO2 PO3 PO4 PO5 PO8	PO1: Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO4: Interpret (L2) PO5: Apply(L3) PO8: Thumb rule	3 3 3 3 3 2
5	CO5 : **Analyze**	L4	PO1 PO2 PO3 PO4 PO5 PO12	PO1: Apply (L3) PO2: Review(L2) PO3: Develop (L6) PO4: Analyze(L3) PO5:Apply(L3) PO12: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)
PO12: 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)
PO8: 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)

PO12: Thumb rule

We will apply these feature extraction techniques to predictions on problem statement. Therefore the correlation is medium (2)

Course Code	Year & Sem	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
20APE0511	IV-I		3	0	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the basic Security and Cryptography concepts and techniques

CO2: **Analyze** the various cryptography algorithms for data encryption

CO3: **Analyze** the different MAC and HASH algorithms to authenticate a message

CO4: **Apply** the various security mechanisms for E-mail and IP security

CO5: **Analyze** the various security breaches in real world applications

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The basic Security and Cryptography concepts and techniques			L2
CO2	Analyze	The various cryptographic algoritms		for data encryption	L4
CO3	Analyze	The different MAC and HASH algorithms		to authenticate a message	L4
CO4	Apply	The security mechanism		E-mail and IP security	L3
CO5	Analyze	The various security breaches		real world applications	L4

UNIT – I	Security Concepts and Cryptography Concepts and Techniques	12 Hrs

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security.
 Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks

UNIT – II	Symmetric key Ciphers & Asymmetric key Ciphers	10 Hrs

Symmetric key Ciphers: Block Cipher principles &Algorithms (DES, AES, Blowfish), Differential and Linear Cryptanalysis, Block cipher modes of operation, Stream ciphers, RC4,Location and placement of encryption function, **Key distribution Asymmetric key Ciphers:** Principles of public key cryptosystems, Algorithms(RSA, Diffie-Hellman,ECC), Key Distribution

UNIT – III	Message Authentication Algorithms and Hash Functions	8 Hrs

Message Authentication Algorithms and Hash Functions: Authentication requirements, Functions, Message authentication codes, Hash Functions, Secure hash algorithm, Whirlpool, HMAC, CMAC, Digital signatures, knapsack

UNIT – IV	E-Mail Security & IP Security	8 Hrs

E-Mail Security: Pretty Good Privacy, S/MIME.
 IP Security: IP Security overview, IP Security architecture, Authentication Header, encapsulating security payload, combining security associations, key management.

UNIT – V	Web Security, Virus and Firewalls, Case Studies on Cryptography and security	10 Hrs

Web Security: Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction Intruders.
Virus and Firewalls: Intruders, Intrusion detection, password management, Virus and related threats, Countermeasures, Firewall design principles, Types of firewalls**.**
 Case Studies on Cryptography and security: Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability, Virtual Elections.

Textbooks:

1. William Stallings, "Cryptography and Network Security", 5th Edition, Pearson Education, 2011.
2. Atul Kahate, "Cryptography and Network Security", 2nd Edition, Mc Graw Hill, 2010.
3. Bernard Menezes "Network Security and Cryptography", 1stEdition, CENGAGE Learning, 2010.

Reference Books:

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition.
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH.
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning.
6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1												
CO2	3	1	1	1	1	2						2		
CO3	3	1	1	1	1		2	2	1			2		2
CO4	3	2						2						
CO5		2	2	2	2			2	1			2	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 PO12)	Level of Correlation (0-3)
1	14	23%	3	CO1:Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	10	17%	2	CO2 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO6 PO12	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO6: Thumb rule PO12: Thumb rule	3 3 3 3 3 3 3
3	12	20%	2	CO3 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO7 PO8 PO9 PO12	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO7: Thumb rule PO8: Thumb rule PO9: Thumb rule PO12: Thumb rule	3 3 3 3 3 3 3 3 3
4	10	17%	2	CO4 : Apply	L3	PO1 PO2 PO8	PO1: Apply(L3) PO2: Review(L2) PO8: Thumb rule	3 3 2
5	14	23%	3	CO5 :Analyze	L4	PO2 PO3 PO4 PO5 PO8 PO9 PO12	PO2: Review(L2) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO8: Thumb rule PO9: Thumb rule PO12: Thumb rule	3 3 3 3 3 3 3
	60	100 %						

Justification Statements :

CO1: **Understand** the basic Security and Cryptography concepts and techniques
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: **Analyze** the various cryptography algorithms for data encryption

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)

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)

PO5: Apply(L3)

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

PO6: Thumb rule

For some of Security applications, Various Cryptographic algorithms were applied for societal needs. Therefore, the correlation is high(3)

PO12: Thumb rule

For some of Security applications, Various Cryptographic algorithms were analyzed. Therefore the correlation is high(3)

CO3: **Analyze** the different MAC and HASH algorithms to authenticate a message.

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 PO1 verb. Therefore the correlation is high (3)

PO3: Develop(L3)

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

PO4: Analyze (L4)

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

PO5: Apply(L3)

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

PO7 : Thumb rule

sustainable cybersecurity practices will mitigate risk and improve cyber resilience over a long run. Hence the correlation is high(3)

PO8 : Thumb rule

Since ethical principles should be followed to while authenticating a message. Therefore the correlation is high(3)

PO9 : Thumb rule

Team work is required between client and server to perform authentication. Hence the correlation is high(3)

PO12 : Thumb rule

For some of Security applications, Various Cryptographic algorithms were analysed. Therefore the correlation is high(3)

CO4: Apply the various security mechanisms for Email and IP security.

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. Therefore the correlation is high (3)

PO8: Thumb rule

Since ethical principles shall be followed in maintaining IP Security. Therefore the correlation is medium(2)

CO5: Analyze the various security breaches in real world applications.

Action Verb : Analyze (L4)

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)

PO8 : Thumb rule

Since ethical principles should be followed to analyze the security breaches. Therefore the correlation is high(3)

PO9 : Thumb rule

Team work is required between client and server to secure the data. Hence the correlation is high(3)

PO12 : Thumb rule

For some of Security applications, Various Cryptographic algorithms were analysed. Therefore the correlation is high(3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)

Course Code	Year & Sem	ADHOC & SENSOR NETWORKS	L	T	P	C
20APE0512	IV-I		3	0	0	3

Course Outcomes:

After studying the course, student will be able to

CO1**: Understand** the basics of IEEE 802.11 standard and Ad-hoc networks.

CO2: **Analyze** the various design issues of MAC protocol for ADHOC networks

CO3: **Apply** the different routing protocol for ADHOC networks

CO4: **Evaluate** the various multi-cast routing approaches for ADHOC networks

CO5: **Analyze** the various security concepts in ADHOC Wireless network

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the basics of IEEE 802.11 standard and Ad-hoc networks			L2
CO2	**Analyze**	the various design issues of MAC protocol		for ADHOC networks	L4
CO3	**Apply**	the different routing protocol		for ADHOC networks	L3
CO4	**Evaluate**	the various multi-cast routing approaches		for ADHOC networks	L5
CO5	**Analyze**	the various security concepts in ADHOC Wireless network			L4

UNIT – I	**IEEE 802 Networking Standard**	9 Hrs
IEEE 802 Networking Standard. Fundamentals of WLANs, IEEE 802.11 standard. What is Wireless Internet?, Mobile IP, Cellular and Adhoc Wireless Networks, Applications of Adhoc Networks, Issues in Ad Hoc Wireless Networks, Ad Hoc Wireless Internet.		

UNIT – II	**Issues in Designing a MAC Protocol for Ad Hoc**	10 Hrs
Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks, Design Goals of a MAC Protocol for Ad Hoc Wireless Networks, Classification of MAC Protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that used Directional Antennas, Other MAC Protocols.		

UNIT – III	**Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks**	8 Hrs
Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table-Driven Routing Protocols, On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols, Power-Aware Routing Protocols		

UNIT – IV	**Multicast Routing in Ad hoc Wireless Networks**	8 Hrs
Multicast Routing in Ad hoc Wireless Networks- Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An architecture reference model for multicast routing protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols, Mesh-Based Multicast Routing Protocols, Summary of Tree and Mesh-Based Protocols. Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions. TCP over Ad Hoc Wireless Networks, Other Transport Layer Protocols for Ad Hoc Wireless Networks.		

UNIT – V	**Security in Ad Hoc Wireless Networks**	10 Hrs
Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks. Wireless Sensor Networks- Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other issues.		

Textbooks:

Murthy, C. Siva Ram, and B. S. Manoj. Ad hoc wireless networks: Architectures and protocols. Pearson Education India, 2004.

Reference Books:

1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2006.
2. Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication -2002.
3. Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks",Wiley, 2005

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3		3										
CO2	3	3	3	3	3	3								
CO3	3	3	3	2	3									
CO4	1	1		3										
CO5		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 PO12)	Level of Correlation (0-3)
1	CO1:Understand	L2	PO1 PO2 PO4	PO1: Apply(L3) PO2: Review(L2) PO4: Interpret(L2)	2 3 3
2	CO2 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO6	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO6: Thumb rule	3 3 3 3 3 3
3	CO3 : Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3)	3 3 3 2 3
4	CO4 : Evaluate	L5	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Identify(L3) PO4: Interpret(L5) PO5: Apply(L3)	1 1 3 1
5	CO5 :Analyze	L4	PO2 PO3 PO4 PO5 PO8 PO12	PO2: Review(L2) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO8: Thumb rule PO12: Thumb rule	3 3 3 3 3 3

Justification Statements

CO1: **Understand** the basics of IEEE 802.11 standard and Ad-hoc networks.
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)
PO4: Interpret(L2)
CO1 Action verb is same as PO4 verb. Therefore the correlation is high(3)

CO2: **Analyze** the various design issues of MAC protocol for ADHOC networks
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)
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)
PO5: Apply(L3)
CO2 Action verb is greater than PO5 verb .Therefore the correlation is high (3)
PO6: Thumb rule
For designing protocols for various design issues we need to take safety rules. Therefore, the
correlation is high(3)

CO3: **Apply** the different routing protocol for ADHOC networks
Action Verb : Apply(L3)
PO1: Apply(L3)
CO3 Action verb is same 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 same 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: **Evaluate** the various multi-cast routing approaches for ADHOC networks
Action Verb : Evaluate(L5)
PO1: Apply(L3)
CO4 Action verb is two levels lower than PO1 verb. Therefore the correlation is low(1)
PO2: Identify(L3)
CO4 Action verb is two levels lower than PO2 verb. Therefore the correlation is low(1)
PO5: Interpret(L5)
CO3 Action verb is one level lower than PO5 verb. Therefore the correlation is low(1)

CO5: **Analyze** the various security concepts in ADHOC Wireless network
Action Verb : Analyze (L4)
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)
PO8 : Thumb rule
Since ethical principles should be followed to analyze the security breaches. Therefore the correlation
is high(3)
PO12 : Thumb rule
For some of Security applications, Various security issues need to be learned continuously.
Therefore the correlation is high(3)

Course Code	Year & Sem	DISTRIBUTED SYSTEMS	L	T	P	C
20APE0513	IV-I	(common to CSE,CSE(DS))	3	0	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the trends in distributed systems for resource sharing.

CO2: **Apply** the remote method invocation to understand client-server communication.

CO3: **Analyze** the various distributed file systems and file sharing methods.

CO4: **Apply** the various synchronization techniques and distributed algorithms to solve a problem.

CO5: **Analyze** the process and resource management systems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the trends in distributed systems		for resource sharing.	L2
CO2	Apply	the remote method invocation		to understand client-server communication	L3
CO3	Analyze	the various distributed file systems and file sharing methods			L4
CO4	Apply	The various synchronization techniquesand distributed algorithms		to solve a problem	L3
CO5	Analyze	The process and resource management systems			L4

UNIT – I	Introduction to soft computing	10 Hrs

INTRODUCTION: Examples of Distributed Systems – Trends in Distributed Systems – Focus on resource sharing – Challenges. Case study: World Wide Web.

UNIT – II	Communication In Distributed System	10 Hrs

COMMUNICATION IN DISTRIBUTED SYSTEM: System Model – Inter process Communication - the API for internet protocols – External data representation and Multicast communication. Network virtualization: Overlay networks. Case study: MPI Remote Method Invocation And Objects: Remote Invocation – Introduction - Request-reply protocols - Remote procedure call - Remote method invocation. Case study: Java RMI - Group communication - Publish-subscribe systems - Message queues - Shared memory approaches - Distributed objects - Case study: Enterprise Java Beans -from objects to components.

UNIT – III	Peer To Peer Services And File System	9 Hrs

PEER TO PEER SERVICES AND FILE SYSTEM: Peer-to-peer Systems – Introduction - Napster and its legacy - Peer-to-peer –Middleware - Routing overlays. Overlay case studies: Pastry, Tapestry-Distributed File Systems –Introduction - File service architecture – Andrew File system. File System: Features-File model -File accessing models - File sharing semantics Naming: Identifiers, Addresses, Name Resolution – Name Space Implementation – Name Caches – LDAP.

UNIT – IV	Synchronization And Replication	8 Hrs

SYNCHRONIZATION AND REPLICATION: Introduction - Clocks, events and process states - Synchronizing physical clocks- Logical time and logical clocks - Global states – Coordination and Agreement – Introduction - Distributed mutual exclusion – Elections – Transactions and Concurrency Control- Types Consistency Models: Linearizability- Sequential Consistency- Causal Consistency-Eventual Consistency – Transactions -Nested transactions – Locks – Optimistic concurrency control - Timestamp ordering – Atomic Commit protocols -Distributed deadlocks – Replication – Case study –

Coda.			

UNIT – V	**Process & Resource Management**	8 Hrs

PROCESS & RESOURCE MANAGEMENT: Process Management: Process Migration: Features, Mechanism - Threads: Models, Issues, Implementation. Resource Management: Introduction- Features of Scheduling Algorithms –Task Assignment Approach – Load Balancing Approach – Load Sharing Approach.

Textbooks:

1. George Coulouris, Jean Dollimore and Tim Kindberg, ―Distributed Systems Concepts and Design‖, Fifth Edition, Pearson Education, 2012.

Reference Books:

1. Distributed Systems, Principles and Paradigms, Andrew S. Tanenbaum, Maarten Van Steen, 2nd Edition, PHI.

2. Distributed Systems, An Algorithm Approach, Sukumar Ghosh, Chapman&Hall/CRC, Taylor & Fransis Group, 2007.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3										2		
CO2	3	3				2						2	2	
CO3	3	3		3	3	2						2	3	
CO4	3	3										2	2	
CO5	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 PO12)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1 PO2 PO12	PO1: Apply(L3) PO2: Review(L2) PO12: Thumb rule	2 3 2
2	CO2: Apply	L3	PO1 PO2 PO6 PO12	PO1: Apply(L3) PO2: Review(L2) PO6: Thumb rule PO12: Thumb rule	3 3 2 2
3	CO3: Analyze	L4	PO1 PO2 PO4 PO5 PO6 PO12	PO1: Apply(L3) PO2: Review(L2) PO4: Analyze (L4) PO5: Apply(L3) PO6: Thumb rule PO12: Thumb rule	3 3 3 3 2 2
4	CO4: Apply	L3	PO1 PO2 PO12	PO1: Apply(L3) PO2: Review(L2) PO12: Thumb rule	3 3 2
5	CO5: Analyze	L4	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3

Justification Statements :

CO1: Understand the trends in distributed systems for resource sharing.
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)
PO12: Thumb rule
Various trends in distributed systems are applied to solve different problems, where the work is distributed to many systems to minimize the response time. Therefore the correlation is medium (2)

CO2: Apply the remote method invocation to understand client-server communication.
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)
PO6: Thumb rule
Client-Server communication is truly helpful for the society to solve various network issues .
Therefore, the correlation is medium (2)
PO12: Thumb rule
Remote method invocations of client -server communication is a continuous activity. Therefore the correlation is medium (2)

CO3: Analyze the various distributed file systems and file sharing methods
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)
PO4: Analyze (L4)
CO3 Action verb is same level of 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
Efficient file systems and sharing methods are useful for successful executions.
 Therefore, the correlation is medium (2)
PO12: Thumb rule
There is a continuous work with distributed systems. Therefore, the correlation is medium (2)

CO4: Apply the various synchronization techniques and distributed algorithms to solve a problem
Action Verb : Apply (L3)
PO1: Apply(L3)
CO4 Action verb is same level of 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)
PO12: Thumb rule
Various synchronization techniques are helpful in thread executions. Therefore the correlation is medium(2)

CO5: Analyze the process and resource management systems.
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)
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)

Course Code	Year & Sem	DATA ANALYTICS	L	T	P	C
20APE0514	IV-I	(Common to CSE, CIC, AIDS)	3	0	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	PO12	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 Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
1	14	23%	3	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Analyze(L4)	2 1
2	12	19%	2	CO2: Analyze	L4	PO1 PO2 PO6 PO12	PO1: Apply(L3) PO2: Analyze(L4) PO6:Thumb Rule PO12:Thumb Rule	3 3 3 3
3	15	25%	3	CO3: Apply	L3	PO1 PO2 PO6	PO1: Apply(L3) PO2: Analyze(L4) PO6:Thumb Rule	3 2 2
4	15	25%	3	CO4: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO8	PO1: Apply(L3) PO2: Analyze(L4) PO3: Design (L6) PO4: Design (L6) PO5: Create(L6) PO8:Thumb Rule	3 3 2 2 2 3
5	5	8%	1	CO3: Apply	L3	PO1 PO2 PO12	PO1: Apply(L3) PO2: Analyze(L4) PO12: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)
PO12: 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)
PO12: 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)
PO8: 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)
PO12: Thumb rule
For real time applications, Data Analytics concepts are used. Therefore the correlation is moderate (2)

Course Code	Year & Sem	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
20APE0515	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	PO12	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 PO12)	Level of Correlation (0-3)
1	CO1 :Understand	L2	PO1 PO11	PO1: Apply(L3) PO11: Thumb rule	2 2
2	CO2 : Evaluate	L5	PO1 PO2 PO3 PO9 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3:Apply(L3) PO9: Thumb rule PO11: Thumb rule	3 3 3 3 3
3	CO3 : Analyze	L4	PO1 PO2 PO9 PO11	PO1: Apply(L3) PO2: Identify (L3) PO9: Thumb rule PO11: Thumb rule	3 3 3 3
4	CO4 : Analyze	L4	PO1 PO2 PO4 PO9 PO11	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze (L4) PO9: Thumb rule PO11: Thumb rule	3 3 3 3 3
5	CO5 : Apply	L3	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze (L4) PO11: Thumb rule	3 3 2 2

Justification Statements:
CO1: Understand the purpose and importance of project management
Action Verb: Understand (L2)
PO1: Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO11: Thumb rule
To understand the purpose and importance of project management, knowledge on projects and management principles are required. Therefore the correlation is medium (2)
CO2: Evaluate the economics for improving software project quality

Action Verb: Evaluate (L5)
PO1: Apply(L3)
CO2 Action verb is more than PO1 verb. Therefore the correlation is high (3)

PO2: Analyze (L4)

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

PO3: Apply(L3)

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

PO9: Thumb rule

To evaluate the economics for improving software project quality, teamwork and individual performance is required. Therefore the correlation is high(3)

PO11: Thumb rule

To evaluate the economics for improving software project quality, knowledge on projects and management principles are required. Therefore the correlation is high(3).

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)

PO9: Thumb rule

To analyze the phases and process of software project management life cycle, teamwork and individual performance is required. Therefore the correlation is high (3)

PO11: Thumb rule

To analyze the phases and process of software project management life cycle, knowledge on projects and management principles are required. Therefore the correlation is high (3)

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)

PO9: Thumb rule

To analyze process workflows and responsibilities, teamwork and individual performance is required. Therefore the correlation is high(3).

PO11: Thumb rule

To analyze process workflows and responsibilities, knowledge on projects and management principles are required. Therefore the correlation is high(3).

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)

PO11: Thumb rule

To apply process control and instrumentation for CCPDS-R, knowledge on projects and management principles are required. Therefore the correlation is medium (2).

Course Code	Year & Sem	Linux Environment System		L	T	P	C
20APE0516	IV-I	(Common to CSE, CIC, AIDS)		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	PO12	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 PO12)	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 PO12	PO1: Apply(L3) PO2: Review(L2) PO12: 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 PO12	PO1: Apply(L3) PO2: Review(L2) PO12: Thumb rule	3 3 2
5	CO5: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO12	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO12: 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)
PO12: 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)
PO12: 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)
PO12: Thumb rule
File system services usage is a continuous process . Therefore the correlation is medium (2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI (AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)

Course Code	Year & Sem	Information Retrieval Techniques	L	T	P	C
20AOE0501	IV-I		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	PO12	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 PO12)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Identify(L3)	2 2
2	CO2: Understand	L2	PO1 PO2 PO5	PO1: Apply(L3) PO2: Identify(L3) PO5: Apply(L3)	2 2 2
3	CO3: Analyze	L4	PO1 PO2 PO4 PO9	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze(L4) PO9: Thumb rule	2 2 3 1
4	CO4: Design	L4	PO3 PO4	PO3: Design (L6) PO4: Interpret(L5)	3 2
5	CO5: Analyze	L4	PO1 PO2 PO3 PO4 PO6 PO8 PO12	PO2: Formulate(L6) PO3: Design (L6) PO4: Analyze(L4) PO6: Thumb rule PO8: Thumb rule PO12: 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)

PO9 : 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)

PO8 : Thumb rule

Team work is required between recommender system users and providers. Hence the correlation is low (1)

PO12: Thumb rule

For some of real world applications we use recommender systems to provide services. Therefore the correlation is low (1)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)

Course Code	Year & Sem	Soft Computing	L	T	P	C
20AOE0502	IV-I		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	PO12	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 PO12)	Level of Correlation (0-3)
1	CO1 :Understand	L2	PO1	PO1: Apply(L3)	2
			PO2	PO2: Review(L2)	3
2	CO2 : Understand	L2	PO1	PO1: Apply(L3)	2
			PO2	PO2: Review(L2)	3
			PO4	PO4:Interpret(L2)	3
			PO5	PO5:Apply(L3)	2
3	CO3 : Apply	L3	PO1	PO1: Apply(L3)	3
			PO2	PO2: Review (L2)	3
			PO4	PO4: Interpret (L2)	3
			PO5	PO5: Apply(L3)	3
			PO12	PO12: Thumb rule	2
4	CO4 : 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
			PO8	PO8: Thumb rule	2
5	CO5 : Evaluate	L5	PO1	PO1: Apply (L3)	3
			PO2	PO2: Review(L2)	3
			PO3	PO3: Develop (L3)	3
			PO4	PO4: Analyze(L3)	3
			PO5	PO5:Apply(L3)	3
			PO12	PO12:Thumb Rule	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)
PO12: 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)
PO8: 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)

PO12: 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)

Course Code	Year & Sem	Principles of Data Science	L	T	P	C
20AOE0503	IV-I	**(Common to CSE, CIC)**	**3**	**0**	**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	PO12	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 Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
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 PO12	PO1: Apply(L3) PO2: Identify(L3) PO6: Thumb rule PO12: Thumb rule	3 3 2 2
3	12	20%	2	CO3 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO9 PO12	PO1: Apply(L3) PO2: Identify(L3) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO9: Thumb rule PO12: Thumb rule	3 3 3 3 3 3 3
4	10	17%	2	CO4 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO12	PO1: Apply(L3) PO2: Identify(L3) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO12: Thumb rule	3 3 3 3 3 3
5	14	23%	3	CO5 : Analyze	L4	PO2 PO3 PO4 PO5 PO9 PO12	PO2: Identify(L3) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO9: Thumb rule PO12: 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)
PO12: 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)
PO9 : Thumb rule
Team work is required create multiple probability models for data exploration. Hence the correlation is high (3)
PO12 : 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)
PO12 : 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)
PO9 : Thumb rule
Team work is required build model for real time applications. Hence the correlation is high(3)
PO12 : Thumb rule
For some of data exploration applications, models should be created for new trends of data. Therefore the correlation is high(3)

Course Code	Year & Sem	Digital Image Processing	L	T	P	C
20APE0407	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:

1. R.C .Gonzalez & R.E. Woods, "Digital Image Processing", Addison Wesley/Pearson education, 3rd Edition, 2010.
2. A.K.Jain,"Fundamentals of Digital Image processing",PHI.

Reference Books:

1. 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	PO12	PSO1	PSO2
CO1	2	3				2						1		
CO2	2	1												
CO3	3		3		3	2	1					2		
CO4	3			3	3	2	1					3		
CO5	3	2	2			2						2		

Correlation matrix

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).

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
1	15	20%	2	Understand	L2	PO1, PO2, PO6, PO12,	PO1: Apply (L3) PO2: Review (L2) PO6:Thumb rule PO12:Thumb rule	2 3 2 1
2	14	19%	2	Analyze	L4	PO1, PO2	PO1: Apply (L3) PO2: Formulate(L6)	3 1
3	15	20%	2	Apply	L3	PO1, PO3, PO5, PO6, PO7, PO12	PO1: Apply(L3) PO3: Develop(L3) PO5: Apply(L3) PO6:Thumb rule PO7:Thumb rule PO12:Thumb rule	3 3 3 2 1 2
4	16	21%	3	Analyze	L4	PO1, PO4, PO5, PO6, PO7, PO12	PO1: Apply(L3) PO4: Analyze(L4) PO5: Apply(L3) PO6:Thumb rule PO7:Thumb rule PO12:Thumb rule	3 3 3 2 1 3
5	15	20%	2	Evaluate	L5	PO1, PO2, PO3, PO6, PO12	PO1: Apply(L3) PO2: Formulate(L6) PO3: Develop (L6) PO6:Thumb rule PO12:Thumb rule	3 2 2 2 2
	75	100%						

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).
PO12: CO1 using Thumb rule, L1 correlates PO12 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).

PO7: CO3 using Thumb rule, L1 correlates PO7 as low (1).
PO12: CO3 using Thumb rule, L3 correlates PO12 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).
PO7: CO4 using Thumb rule, L1 correlates PO7 as low (1).
PO12: CO4 using Thumb rule, L4 correlates PO12 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).
PO12: CO5 using Thumb rule, L3 correlates PO12 as medium (2).

Course Code	Year & Sem	EMBEDDED SYSTEMS	L	T	P	C
20APE0411	IV-I		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	PO12	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 PO12)	Level of Correlation (0-3)
1	CO1 :Understand	L2	PO1 PO2 PO3 PO4	PO1: Apply(L3) PO2 : Identify (L3) PO3: Develop (L3) PO4 : Analyze (L4)	2 2 2 1
2	CO2 : Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO 3: Develop (L3) PO4: Interpret (L2) PO5: Apply(L3)	2 2 2 2 2
3	CO3 : Understand	L2	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO 3: Develop (L3) PO4: Interpret (L2) PO5: Apply(L3)	2 2 2 3 2
4	CO4 :Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO 3: Develop (L3) PO4: Interpret (L2) PO5: Apply(L3)	2 2 2 1 2
5	CO5 : Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO 3: Develop(L3) PO4: Interpret (L2) PO5: Apply(L3)	2 2 2 1 2

Justification Statements :

CO1: Understand the fundamental concepts of embedded systems, programming languages and tools.

Action Verb: Understand(L2)

PO1 Verb:Apply(L3)
CO1 Action verb is greater than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 Verb :Identify (L3)
CO1 Action verb is greater than PO1 verb by one level. Therefore the correlation is medium (2)
PO3Verb :Develop (L3)
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 greaterthan 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 microcontroller 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)

Course Code	Year & Sem	Enabling Technologies for Data Science & Analytics: IoT	L	T	P	C
20AOE3601	IV-I	**(Common to CSE, AIDS)**	**3**	**0**	**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	PO12	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 Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
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 PO8	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze(L4) PO6: Thumb rule PO8: Thumb rule	3 3 3 3 3 3
4	11	20%	2	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 PO12	PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze(L4) PO8: Thumb rule PO12: 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)
PO8: 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)
PO12: Thumb rule
To create robust and scalable networks by Zigbee. Therefore the correlation is high(3)

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)**
COMPUTER SCIENCE AND ENGINEERING (CSE)

Course Code	Year & Sem	WIRELESSCOMMUNICATIONS	L	T	P	C
20APE0415	IV-I	(CommontoCSE,AIDS)	3	0	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	INTRODUCTIONTOWIRELESSCOMMUNICA TIONSANDMULTIPLEACCESSTECHNIQUES	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	PO12
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 PO12	PO1:Apply (L3) PO2:Identify (L3) PO6 PO12	3 2 2 2
2	12	20	3	Analyze	L4		PO2 PO6 PO12	PO2: Identify (L3) PO6 PO12	3 3 3
3	11	18	2	**Understand**	L2		PO1 PO6 PO12	PO1:Apply(L3) PO6 PO12	3 2 2
4	12	20	2	**Analyze**	L4		PO2 PO6 PO12	PO2: Identify (L3) PO6 PO12	2 3 3
5	12	20	2	**Apply**	L3		PO6 PO6 PO12	PO6: Apply (L3) PO6 P12	2 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)

PO12 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)

PO12 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)

PO12 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)

PO12 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)

PO12 from thumb rule L2 correlation is moderate (2)

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)**

Course Code	Year & Sem	Management science	L	T	P	C
20AOE0302	IV-I		3	0	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	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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	Apply (L3)	2
			PO4	Design (L6)	1
2	Analyse	L4	PO1	Apply (L3)	3
			PO4	Analyse (L4)	3
			PO5	Apply (L3)	3
3	Apply	L3	PO1	Apply (L3)	3
			PO2	Identify (L3)	3
			PO4	Design (L6)	1

4	**Understand**	**L2**	PO1	Apply (L3)	2
			PO2	Identify (L3)	2
			PO4	Interpret (L2)	2
5	**Apply**	**L3**	PO1	Apply (L3)	3
			PO2	Identify (L3)	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).

Course Code	Year & Sem	English For Research Paper Writing	L	T	P	C
20AOE9901	IV-I		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	PO12
1										2		2
2					3					2		
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**	PO10, PO12	Thumb Rule Thumb Rule	2, 2
2	18	23	**3**	**Apply**	**L3**	PO5, PO10	Thumb Rule Thumb Rule	2, 1
3	14	18.4	**2**	**Apply**	**L3**	PO2, PO12	Thumb Rule Thumb Rule	2, 2
4	14	18.4	**2**	**Apply**	**L3**	PO10	Thumb Rule	2
5	14	18.4	**2**	**Apply**	**L3**	PO10, PO12	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 PO12 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 PO12 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 PO12 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 PO12 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 PO12 as moderate (2).

Course Code	Year & Sem	ENTREPRENEURSHIP DEVELOPMENT	L	T	P	C
20AHSMB02	IV-I		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.Rizwana‖ "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	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ENTREPRENEURSHIP DEVELOPMENT	CO1	2													
	CO2			3	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	Apply (L3)	3
			PO4	Apply (L3)	3
			PO10	Thumb Rule	3
CO3	20.75	Analyze	PO1	Apply (L3)	3
			PO11	Thumb Rule	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)
PO10: 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)
PO11: 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)

Course Code	Year & Sem	Devops	L	T	P	C
20ASA0504	IV-I		1	0	2	2

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** different actions performed through Version control tools like Git.

CO2: **Understand** the importance of Maven to Build and deploy Software Applications on server environment

CO3: **Analyze** Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins.

CO4: **Apply** software configuration and provisioning using Ansible.

CO5: **Analyze** to leverage Cloud-based DevOps tools using Azure DevOps

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The different actions performed on versions		Git	L2
CO2	Understand	To deploy Software Applications		Maven & Gradle.	L2
CO3	Analyze	Continuous Integration Testing and Continuous Deployment of applications	Using Jenkins.		L4
CO4	Apply	The software configuration and provisioning	Ansible	to solve server problems	L3
CO5	Analyze	simple web application infrastructure	Git &GitHub		L4

UNIT – I	INTRODUCTION TO DEVOPS	12 Hrs
Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github.		
UNIT – II	COMPILE AND BUILD USING MAVEN & GRADLE	10 Hrs
Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle		
UNIT – III	CONTINUOUS INTEGRATION USING JENKINS	8 Hrs
Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.		
UNIT – IV	CONFIGURATION MANAGEMENT USING ANSIBLE	8 Hrs
Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible		
UNIT – V	BUILDING DEVOPS PIPELINES USING AZURE	10 Hrs
Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file		

PRACTICAL EXERCISES:

1. Create Maven Build pipeline in Azure
2. Run regression tests using Maven Build pipeline in Azure
3. Install Jenkins in Cloud
4. Create CI pipeline using Jenkins
5. Create a CD pipeline in Jenkins and deploy in Cloud
6. Create an Ansible playbook for a simple web application infrastructure
7. Build a simple application using Gradle
8. Install Ansible and configure ansible roles and to write playbooks

Textbooks:

1.Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016.

2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014

Reference Books:

1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni
2. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.
3. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016.
4. Mariot Tsitoara, "Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019.
5. https://www.jenkins.io/user-handbook.pdf
6. https://maven.apache.org/guides/getting-started/

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2												
CO2	2	2				2								
CO3	2	2		3	1				1	1				
CO4	3	3										1		
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 PO12)	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 PO6	PO1: Apply(L3) PO2: Identify(L3) PO6: Apply(L3)	2 2 2
3	CO3: Analyze	L4	PO1 PO2 PO4 PO5 PO9 PO10	PO1: Apply(L3) PO2: Identify(L3) PO4: Analyze (L4) PO5: Create(L6) PO9: Thumb rule PO10: Thumb rule	2 2 3 1 1 1
4	CO4: Apply	L3	PO1 PO2 PO12	PO1: Apply(L3) PO2: Review(L2) PO12: Thumb rule	3 3 1
5	CO5: Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO12	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO12: Thumb rule	3 3 3 3 3 2

Justification Statements :

CO1: Understand different actions performed through Version control tools like Git.
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** the importance of Maven to Build and deploy Software Applications on server environment

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** Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins.
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)

PO9 : Thumb rule
Team work is required between Continuous Integration users and developers at server environment to deployment using Jenkins. Hence the correlation is low (1)
PO10: Thumb rule
Effective communication is required, reports to be generated between continuous development team and developers.Therefore the correlation is low (1)

CO4: **Apply** software configuration and provisioning using Ansible

PO1: Apply(L3)
CO4 Action verb is same level of 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)
PO12: Thumb rule
Software applications configuration and deployment on the server environment link layer. Therefore the correlation is medium(2)

CO5: **Analyze** to leverage Cloud-based DevOps tools using Azure DevOps
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)
PO12: Thumb rule
Perform software process improvement by applying Devops capabilities at enterprise level. Therefore the correlation is medium (2)