

INDUCTION PROGRAM (3 weeks duration)

- Physical activity
- Creative Arts
- Universal Human Values
- Literary
- Proficiency Modules
- Lectures by Eminent People
- Visits to local Areas

Semester I (First year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		C	CIE	SEE
1	Basic Science course	20ABS9901	Algebra and Calculus	2	1	0	3	30	70	100
2	Basic Science course	20ABS9905	Engineering Chemistry	2	1	0	3	30	70	100
3	Humanities and Social science	20AHS9901	Communicative English	2	1	0	3	30	70	100
4	*Engineering Science Courses	20AES0304	Engineering Workshop Practice	1	0	4	3	30	70	100
5	Engineering Science Courses	20AES0501	Problem Solving and Programming	2	1	0	3	30	70	100
6	Humanities and Social Science LAB	20AHS9902	Communicative English Lab	0	0	3	1.5	30	70	100
7	Basic Science course (LAB)	20ABS9910	Engineering Chemistry Lab	0	0	3	1.5	30	70	100
8	Engineering Science Courses (LAB)	20AES0503	Problem Solving and Programming Lab	0	0	3	1.5	30	70	100
Total credits							19.5	240	560	800

Semester II (First year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		C	CIE	SEE
1	Basic Science courses	20ABS9906	Differential Equations and Vector Calculus	2	1	0	3	30	70	100
2	Basic Science courses	20ABS9903	Engineering Physics	2	1	0	3	30	70	100
3	Engineering Science Courses	20AES0202	Basics of Electrical and Electronics Engineering	2	1	0	3	30	70	100
4	Engineering Science Courses	20AES0509	Basics of Python Programming	2	1	0	3	30	70	100
5	Engineering Science Courses	20AES0301	Engineering Graphics	1	0	4	3	30	70	100
6	Engineering Science Courses (LAB)	20AES0204	Basics of Electrical and Electronics Engineering Lab	0	0	3	1.5	30	70	100
7	Basic Science course (LAB)	20ABS9908	Engineering Physics Lab	0	0	3	1.5	30	70	100
8	Engineering Science Courses (LAB)	20AES0510	Basics of Python Programming Lab	0	0	3	1.5	30	70	100
9	Mandatory Course (AICTE Suggested)	20AMC9902	Constitution of India	2	0	0	0	30	-	30
Total Credits							19.5	270	560	830

Semester III (Second year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		C	CIE	SEE
1	Basic Science courses	20ABS9913	Probability & Statistics, Partial differential equations	2	1	0	3	30	70	100
2	Professional core course	20APC0101	Mechanics of Materials	2	1	0	3	30	70	100
3	Professional core course	20APC0102	Surveying	2	1	0	3	30	70	100
4	Professional core course	20APC0103	Fluid Mechanics	2	1	0	3	30	70	100
5	Humanities and social science	20AHSMB01	Managerial Economics and Financial Analysis	2	1	0	3	30	70	100
6	Professional core courses (LAB)	20APC0104	Strength of Materials Lab	0	0	3	1.5	30	70	100
7	Professional core courses (LAB)	20APC0105	Surveying Lab	0	0	3	1.5	30	70	100
8	Professional core courses (LAB)	20APC0106	Fluid Mechanics Lab	0	0	3	1.5	30	70	100
9	Skill Oriented Course*	20APC0107	Basics of CAD	0	1	2	2	100	-	100
10	Mandatory course (AICTE suggested)	20AMC9903	Environmental Studies	2	1	0	0	30	-	30
Total Credits							21.5	370	560	930

Semester IV (Second year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		C	CIE	SEE
1	Basic Science courses	20ABS9922	Mathematical Modelling and optimization techniques	2	1	0	3	30	70	100
2	Professional core course	20APC0108	Strength of Materials	2	1	0	3	30	70	100
3	Professional core course	20APC0109	Hydraulic Engineering	2	1	0	3	30	70	100
4	Professional core course	20APC0110	Structural Analysis-I	2	1	0	3	30	70	100
5	Professional core course	20APC0111	Concrete Technology	2	1	0	3	30	70	100
6	Humanity Science Courses	20AHS9905	Universal Human Values	2	1	0	3	30	70	100
7	Professional core courses (LAB)	20APC0112	Hydraulic Machinery Lab	0	0	3	1.5	30	70	100
8	Professional core courses (LAB)	20APC0113	Concrete Technology Lab	0	0	3	1.5	30	70	100
9	Professional core courses (LAB)	20APC0114	Computer-aided Civil Engineering Drawing Lab	0	0	3	1.5	30	70	100
10	Skill Oriented Course*	20APC0115	Land survey with 2D drafting /Soft Skills	0	1	2	2	100	-	100
Total Credits							24.5	370	630	1000

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

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

Honors/ Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)	3	1	0	4	30	70	100
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Semester V (Third year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		C	CIE	SEE
1	Professional core course	20APC0116	Soil Mechanics	2	1	0	3	30	70	100
2	Professional core course	20APC0117	Building Technology	2	1	0	3	30	70	100
3	Professional core course	20APC0118	Engineering Geology	2	1	0	3	30	70	100
4	Open Elective course / Job Oriented Elective	20APE0417	Sensor Networks	2	1	0	3	30	70	100
		20APC0323	Operations Research							
		20AOE0302	Management Science							
5	Professional Elective courses	20APE0101	Structural Analysis-II	2	1	0	3	30	70	100
		20APE0102	Water Harvesting and Conservation							
		20APE0103	Cost Effective Housing Techniques							
6	Professional core courses (LAB)	20APC0119	Soil Mechanics Lab	0	0	3	1.5	30	70	100
7	Professional core courses (LAB)	20APC0120	Engineering Geology Lab	0	0	3	1.5	30	70	100
8	Skill Oriented Course*	20APC0121	Building planning & Drawing Lab	0	1	2	2	100	-	100
9	Mandatory course (AICTE suggested)	20AMC9904	Professional Ethics and Human Values	2	1	0	0	30	-	30
10	CSP	20CSP0101	Community service project	0	0	0	1.5	100	-	100
Total Credits							21.5	440	490	930
Honors/ Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)				3	1	0	4	30	70	100
S. No	Professional Electives*		Open Electives*							
1	Air Pollution and Control		An introduction to Artificial intelligence							
2	Basic construction materials		Industrial Safety Engineering							
3	Pavement Materials		Leadership and Team Effectiveness							
4	Energy Efficiency, Acoustics and Day lighting in Building		Education for Sustainable Development							
5	Remote Sensing Essentials		Organizational Behavior							
6	Ground Improvement		Environment and Development							
7	Availability And Management Of Groundwater Resources		Indian Art: Materials, Techniques And Artistic Practices							
8	Integrated Waste Management For A Smart City		Human Resource Development							
9	Sustainable Transportation Systems		Entrepreneurship							
10	Bridge Engineering		Geographic Information System							
11	Municipal Solid Waste Management		Patent Law for Engineers and Scientists							
12	Admixtures And Special Concretes		Forests and their Management							
13	Characterization of Construction Materials		Talent Acquisition and Management							
14	Soil Structure Interaction		Principles of Management							
15	Water Supply Engineering		E-Business							

Semester VI (third year)

Sl. No.	Category	Course Code	Course Title	Hours per week				Credits	Scheme of Examination (Max. Marks)		
				L	T	P	C		CIE	SEE	Total
1	Professional core course	20APC0122	Environmental Engineering	2	1	0	3	30	70	100	
2	Professional core course	20APC0123	Highway Engineering	2	1	0	3	30	70	100	
3	Professional core course	20APC0124	Foundation Engineering	2	1	0	3	30	70	100	
4	Professional Elective courses	20AMOC0102	Rural Water Resources Management	2	1	0	3	25	75	100	
			Intelligent Transport System								
			Remote Sensing and GIS								
5	Professional core courses (LAB)	20APC0125	STAAD Lab	0	0	3	1.5	30	70	100	
6	Professional core courses (LAB)	20APC0126	Environmental Engineering lab	0	0	3	1.5	30	70	100	
7	Professional core courses (LAB)	20APC0127	Highway Engineering Lab	0	0	3	1.5	30	70	100	
8	Skill Oriented Course*	20AHE9902	Principal of Effective Public Speaking	0	1	2	2	100	-	100	
9	Mandatory course (AICTE suggested)	20AMC9901	Biology for Engineers	2	1	0	0	30	-	30	
Total Credits							18.5	335	495	830	
Honors/ Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)				3	1	0	4	30	70	100	
Industrial/ Research Internship (Mandatory) 2 Months during summer vacation											

Semester VII (Fourth year)

Sl. No.	Category	Course Code	Course Title	Hours per week				Credits	Scheme of Examination (Max. Marks)		
				L	T/CLC	P	C		CIE	SEE	Total
1	Professional Elective courses	20APE0107	Estimation Costing & Valuation	2	1	0	3	30	70	100	
		20APE0108	Environmental Impact Assessment and Management								
		20APE0109	Railways airport Docks and Harbours								
2	Professional Elective courses	20APE0104	Design and Drawing of Reinforced Concrete Structures	2	1	0	3	30	70	100	
		20APE0111	Design and Drawing of Irrigation structures								
		20APE0112	Water shed and River management								
3	Professional Elective courses	20APE0113	Design and Drawing of Steel Structures	2	1	0	3	30	70	100	
		20APE0114	Advanced Structural Design								
		20APE0115	Bridge Engineering								
4	Elective course / Job Oriented Elective	20AMOC0103	Computer Networks	2	1	0	3	25	75	100	
			Entrepreneurship Development								
			Intellectual Property Rights								
5	Professional Elective courses (CBCS)	20APE0116	Pre-stressed Concrete	2	1	0	3	30	70	100	
		20APE0117	Ground Improvement Techniques								
		20APE0118	Repair and Rehabilitation of Structures								
6	Humanities & Social Science Elective*	20AOE9901	English For Research Paper Writing	2	1	0	3	30	70	100	
		20AHE9903	Professional Communication								
7	Skill Advanced Course*	20APC0129	Structural Analysis Design software	0	1	2	2	100	-	100	
Industrial/ Research Internship 2 months (Mandatory) after Third Year (to be evaluated during VII semester)				0	0	0	3	100	-	100	
Total credits							23	375	425	800	
Honors/ Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)				3	1	0	4	30	70	100	

Semester VIII (Fourth year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		C	CIE	SEE
1	MOOC (NPTEL) (12 Weeks)	20MOC0101		3	0	0	3	25	75	100
2	Internship (3 Months)	20APR0102		0	0	0	3	100	-	100
3	Major Project	20APR0103		0	0	0	9	60	140	200
Total credits							15	185	215	400
Grand Total							163	2585	3935	6520

INDUCTION PROGRAM (3 weeks duration)	
<input type="checkbox"/>	Physical activity
<input type="checkbox"/>	Creative Arts
<input type="checkbox"/>	Universal Human Values
<input type="checkbox"/>	Literary
<input type="checkbox"/>	Proficiency Modules
<input type="checkbox"/>	Lectures by Eminent People
<input type="checkbox"/>	Visits to local Areas

Semester I (First year)

Sl. No.	Category	Course Code	Course Title	Hours per week				Credits	Scheme of Examination (Max. Marks)		
				L	T/CLC	P	C		CIE	SEE	Total
1	Basic Science course	20ABS9901	Algebra and Calculus	2	1	0	3	30	70	100	
2	Basic Science course	20ABS9905	Engineering Chemistry	2	1	0	3	30	70	100	
3	Humanities and Social science	20AHS9901	Communicative English	2	1	0	3	30	70	100	
4	*Engineering Science Courses	20AES0304	Engineering Workshop Practice	1	0	4	3	30	70	100	
5	Engineering Science Courses	20AES0501	Problem Solving and Programming	2	1	0	3	30	70	100	
6	Humanities and Social science LAB	20AHS9902	Communicative English Lab	0	0	3	1.5	30	70	100	
7	Basic Science course (LAB)	20ABS9910	Engineering Chemistry Lab	0	0	3	1.5	30	70	100	
8	Engineering Science Courses (LAB)	20AES0503	Problem Solving and Programming Lab	0	0	3	1.5	30	70	100	
Total credits							19.5	240	560	800	

I YEAR

I SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20ABS9901	ALGEBRA AND CALCULUS	2	1	0	3

Course Outcomes: After studying the course, students 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.

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Analyze	the matrix algebra techniques	for solving various linear equations		L4
CO2	Analyze	the linear transformations of quadratic forms and mean value theorems.			L4
CO3	Apply	the fundamental concepts of partial derivatives	for multi variable functions		L3
CO4	Evaluate	the multiple integrals	in cartesian, polar, cylindrical, and spherical co-ordinate systems		L5
CO5	Evaluate	the improper integrals	using special functions like Beta and Gamma		L5

UNIT I : MATRIX OPERATIONS AND SOLVING SYSTEMS OF LINEAR EQUATIONS

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

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

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

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

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

TEXTBOOKS:

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

REFERENCES:

1. Dr.T.K.Viyengar, B.Krishna Gandhi, S. Ranganathamam 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.

CORRELATION OF COS WITH THE POS & PSOS:

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

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	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
	66	100						

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)

I YEAR

I SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20ABS9905	ENGINEERING CHEMISTRY	2	1	0	3

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

CO1: Apply the purification technique to remove hardness of water and to check the quality of water

CO2: Apply the electrochemical principles to the energy storage devices and corrosion prevention techniques

CO3: Analyze the preparation and applications of polymers and fuels

CO4: Apply the cement and concrete techniques in manufacturing process for engineering fields

CO5: Analyze the properties and applications of colloids and nano materials

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Apply	The purification technique to remove hardness of water		to check the quality of water	L3
CO2	Apply	The Electrochemical principles to the energy storage devices and corrosion prevention techniques			L3
CO3	Analyze	The Preparation and applications of polymers and fuels			L4
CO4	Apply	The Cement and concrete techniques in manufacturing process		for engineering fields	L3
CO5	Analyze	The Properties and applications of colloids and nanomaterials			L4

UNIT 1: WATER TECHNOLOGY

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.

UNIT 2: ELECTROCHEMISTRY AND APPLICATIONS:

Electrodes – concepts, electrochemical cell, Nernst equation, cell potential calculations.

Primary cells – 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.

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, environmental factors (pH, temperature, DO) affecting corrosion rate, protection – corrosion inhibitors with specific examples, cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

UNIT 3: POLYMERS AND FUEL CHEMISTRY:

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. Thermoplastics and Thermo-sets, Elastomers – applications with specific examples.

Conducting polymers – polyacetylene, polyaniline, polypyrroles – mechanism of conduction and applications. Fuels – Types of fuels, calorific value, numerical problems based on calorific value; Analysis of coal, refining of petroleum, liquid fuels, fuels for IC engines, knocking and anti-knock agents, Octane and Cetane values, cracking of oils; alternative fuels- propane, methanol and ethanol, bio fuels.

UNIT 4: CEMENT AND CONCRETE CHEMISTRY:

Introduction to building materials – Portland cement, constituents, manufacturing process-raw materials for manufacturing process, reactions below 1300 °C and reactions between 1300 and 1450 °C, reactions during cooling, grinding or storage, chemical equations, phases of cement clinker (alite, belite, aluminate and ferrite), reactivity of clinker phases, parameters to characterize the clinker formation: lime saturation factor (LSF), silica ratio (SR) and alumina ration (AR), chemistry of setting and hardening of cement (hydration, hydrolysis, equations), scheme of concrete formation, admixtures for concrete improvement – retarders, accelerators, air-entraining agents, grinding agents, super plasticizers, dispersants, etc.

UNIT 5: SURFACE CHEMISTRY AND APPLICATIONS:

Introduction to surface chemistry, colloids, nanometals and nanometal oxides, micelle formation, synthesis of colloids (any two methods with examples), chemical and electrochemical methods (not more than two methods) of preparation of nanometals and metal oxides, stabilization of colloids, characterization of surface by physicochemical methods (SEM, TEM, XRD), adsorption isotherm, BET equation (no derivation), applications of colloids and nanomaterials – catalysis, medicine, sensors, etc.

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. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
2. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth-Heinemann, 1992. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.

CORRELATION OF COS WITH THE POS & PSOS

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

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 PO11)	Level of Correlation (0-3)
	Register (Hrs)	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	10	12	18.4	3	Apply	L3	PO1	Apply (L3)	3
2	10	22	33.8	3	Apply	L3	PO1	Apply (L3)	3
3	10	12	18.4	3	Analyze	L4	PO2	Analyze (L4)	3
4	10	6	9.2	1	Apply	L3	PO1	Apply (L3)	3
5	10	13	20	3	Analyze	L4	PO2	Analyze (L4)	3
	50	65	100						

JUSTIFICATION STATEMENTS:

CO1: Apply the purification technique to remove hardness of water and to check the quality of water

PO1 Verbs: Apply (L3)

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

CO2: Apply the electrochemical principles to the energy storage devices and corrosion prevention techniques

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 applications of polymers and fuels

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 cement and concrete techniques in manufacturing process for engineering fields

Action Verb: Apply (L3)

PO2 Verb: Apply (L3)

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

CO5: Analyze the properties and applications of colloids and nanomaterials

Action Verb: Analyze (L4)

PO1 Verb: Analyze (L4)

CO5 Action verb is equal to PO2 verb; Therefore, the correlation is high (3)

I YEAR

I SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20AHS9901	COMMUNICATIVE ENGLISH	2	1	0	3

Course Outcomes: After studying the course, students 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)

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the context, topic, and pieces of specific information from social or transactional dialogues	spoken by native speakers of English.		L2
CO2	Apply	grammatical structures to formulate sentences and correct word forms.			L3
CO3	Analyze	discourse markers to speak clearly on a specific topic in informal discussions.			L4
CO4	Evaluate	reading/listening texts and to write summaries		based on global comprehension of these texts.	L5
CO5	Create	a coherent paragraph		interpreting a figure/graph/chart/table.	L6

UNIT -1

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 – why questions; word order in sentences.

Vocabulary -2: Formal/academic words and phrases.

UNIT -2

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 -3

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-4

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 -5

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.

TEXT BOOK:

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

CORRELATION OF COS WITH THE POS & PSOS

	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PSO1	PSO2
CO1									2				
CO2								2	2				
CO3									3				
CO4									3				
CO5									3				

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	10	20	2	Understand	L2	PO9	Thumb Rule	2
2	10	20	2	Apply	L3	PO8 PO9	Thumb Rule Thumb Rule	2 2
3	10	20	3	Analyze	L4	PO9	Thumb Rule	3
4	10	20	3	Evaluate	L5	PO9	Thumb Rule	3
5	10	20	3	Create	L6	PO9	Thumb Rule	3
	50	100						

JUSTIFICATION:

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

Action Verb: Understand (L2)

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

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

Action Verb: Apply (L3)

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

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

Action Verb: Analyze (L4)

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

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

Action Verb: Evaluate (L5)

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

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

Action Verb: Create (L6)

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

I YEAR

I SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20AES0304	ENGINEERING WORKSHOP PRACTICE	1	0	4	3

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

CO1: Understand workshop tools and operational capabilities

CO2: Apply wood working skills to prepare different joints.

CO3: Apply sheet metal operations to prepare different components in real world applications.

CO4: Apply fitting operations for various applications.

CO5: Apply basic electrical engineering knowledge for house wiring practice

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	workshop tools and operational capabilities			L2
CO2	Apply	wood working skills to prepare different joints			L3
CO3	Apply	sheet metal operations to prepare different components in real world applications.			L3
CO4	Apply	fitting operations in various applications			L3
CO5	Apply	basic electrical engineering knowledge for house wiring practice			L3

WOOD WORKING: (CO1 & CO2)

Familiarity with different types of woods and tools used in wood working and make following joints

- a) Half – Lap joint
- b) Mortise and Tenon joint
- c) Corner Dovetail joint or Bridle joint

SHEET METAL WORKING: (CO1 & CO3)

Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

- a) Tapered tray
- b) Conical funnel
- c) Elbow pipe
- d) Brazing

FITTING: (CO1 & CO4)

Study the difference types of fits and tolerances, surface finishing materials. Familiarity with different types of tools used in fitting and do the following fitting exercises

- a) V-fit
- b) Dovetail fit
- c) Semi-circular fit
- d) Bicycle tyre puncture and change of two wheeler tyre

ELECTRICAL WIRING: (CO1 & CO5)

Study the different types of circuits and connections, Familiarities with different types of basic electrical

circuits and make the following connections

- a) Parallel and series
- b) Two-way switch
- c) Godown lighting
- d) Tube light
- e) Three phase motor
- f) Soldering of wires

MAPPING OF COS TO POS AND PSOS

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

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	Understand	L2	PO1	Apply (L3)	2
2	Apply	L3	PO1	Apply (L3)	3
			PO2	Identify (L3)	3
			PO3	Develop (L3)	3
			PO6	Thumb Rule	2
			PO9	Thumb Rule	2
3	Apply	L3	PO1	Apply (L3)	3
			PO2	Identify (L3)	3
			PO3	Develop (L3)	3
			PO6	Thumb Rule	2
			PO9	Thumb Rule	2
4	Apply	L3	PO1	Apply (L3)	3
			PO2	Identify (L3)	3
			PO3	Develop (L3)	3
			PO6	Thumb Rule	2
			PO9	Thumb Rule	2
5	Apply	L3	PO1	Apply (L3)	3
			PO2	Identify (L3)	3
			PO3	Develop (L3)	3
			PO6	Thumb Rule	2
			PO9	Thumb Rule	2

JUSTIFICATION:

CO1: Understand workshop tools and operational capabilities.

Action Verb: Understand (L2)

PO1 Verb: Apply (L3)

CO1 Action Verb is less than one to PO1; Therefore, correlation is medium (2)

CO2: Apply wood working skills to prepare different joints.

Action Verb: Apply (L3)

PO1 Verb: Apply (L3)

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

PO2 verb: Identify (L3)

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

PO3 Verb: Develop (L3)

CO2 Action Verb is equal to PO3 verb; Therefore, correlation is high (3)

PO6: Thumb Rule,

CO2 co-relates with PO6 moderately. Therefore, correlation is chosen as medium (2)

PO7: Thumb Rule,

CO2 co-relates with PO7 moderately. Therefore, correlation is chosen as medium (2)

CO3: Apply sheet metal operations to prepare different components in real world applications.

Action Verb: Apply (L3)

PO1 Verb: Apply (L3)

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

PO2 verb: Identify (L3)

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

PO3 Verb: Develop (L3)

CO3 Action Verb is equal to PO3 verb; Therefore, correlation is high (3)

PO6: Thumb Rule,

CO3 co-relates with PO6 moderately. Therefore, correlation is chosen as medium (2)

PO7: Thumb Rule,

CO3 co-relates with PO7 moderately. Therefore, correlation is chosen as medium (2)

CO4: Apply fitting operations for various applications.

Action Verb: Apply (L3)

PO1 Verb: Apply (L3)

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

PO2 verb: Identify (L3)

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

PO3 Verb: Develop (L3)

CO4 Action Verb is equal to PO3 verb; Therefore, correlation is high (3)

PO6: Thumb Rule,

CO4 co-relates with PO6 moderately. Therefore, correlation is chosen as medium (2)

PO7: Thumb Rule,

CO4 co-relates with PO7 moderately. Therefore, correlation is chosen as medium (2)

CO5: Apply basic electrical engineering knowledge for house wiring practice.

Action Verb: Apply (L3)

PO1 Verb: Apply (L3)

CO5 Action Verb is equal to PO1 verb; Therefore, correlation is high (3)

PO2 verb: Identify (L3)

CO5 Action Verb is equal to PO2 verb; Therefore, correlation is high (3)

PO3 Verb: Develop (L3)

CO5 Action Verb is equal to PO3 verb; Therefore, correlation is high (3)

PO6: Thumb Rule,

CO5 co-relates with PO6 moderately. Therefore, correlation is chosen as medium (2)

PO7: Thumb Rule,

CO5 co-relates with PO7 moderately. Therefore, correlation is chosen as medium (2)

I YEAR

I SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20AES0501	PROBLEM SOLVING AND PROGRAMMING	2	1	0	3

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

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

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

CO3: Understand the various operators to perform mathematical operations.

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

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

Course Outcomes	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

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

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

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

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, Multidimensional 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

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.

CORRELATION OF COS WITH THE POS & PSOS

	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	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

CO-PO MAPPING JUSTIFICATION:

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)
	Lesson Plan Hours	%	corr	Verb	BTL			
1	19	25	3	Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	10	14	2	Apply	L3	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO11: Thumb rule	3 2 3 2
3	19	25	3	Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review (L2) PO11: Thumb rule	2 3 2
4	15	20	2	Apply	L3	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO11: Thumb rule	3 3 3 2
5	12	16	2	Analyze	L4	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop(L3) PO11: Thumb rule	3 3 3 2
	75	100						

JUSTIFICATION:

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

Action Verb: Analyze (L4)

PO1 Verb: Apply (L3)

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

PO2 Verb: Review (L2)

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

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

Action Verb: Apply (L3)

PO1: Apply (L3)

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

PO2: Analyze (L4)

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

PO3: Develop (L3)

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

PO11: Thumb rule

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

CO3: Understand the various operators to perform mathematical operations.

Action Verb: Understand (L2)

PO1: Apply (L3)

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

PO2: Review (L2)

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

PO11: Thumb rule

For some mathematical operations to perform operators are used to create programs. Therefore, the

correlation is medium (2)

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

Action Verb: Apply (L3)

PO1: Apply (L3)

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

PO2: Review (L2)

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

PO3: Develop (L3)

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

PO11: Thumb rule

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

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

Action Verb: Analyze (L4)

PO1: Apply (L3)

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

PO2: Review (L2)

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

PO3: Develop (L3)

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

PO11: Thumb rule

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

I YEAR

I SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20AHS9902	COMMUNICATIVE ENGLISH LAB	0	0	3	1.5

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

CO1: Evaluate the 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

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Evaluate	the awareness on mother tongue influence and neutralize it	in order to improve fluency in spoken English		L5
CO2	Understand	the different aspects of the language with emphasis on LSRW skills and		make use of different strategies in discussions	L2
CO3	Apply	the knowledge of vocabulary and skills		in various language learning activities	L3
CO4	Analyze	the speech sounds, stress, rhythm, intonation and syllable division	for better listening and speaking comprehension		L4
CO5	Evaluate	the acceptable etiquette essentials in social and professional presentations			L5

Unit 1

1. Phonetics (CO1)
2. Non - verbal communication (CO2)
3. Vocabulary (word formation, one word substitutes, words often misused & confused, collocations idioms & phrases) (CO3)

Unit 2

1. Reading Comprehension (CO2, CO4)
2. JAM (CO2, CO3)
3. Distinction between Native and Indian English accent (Speeches by TED and Kalam). (CO4)

Unit 3

1. Situational dialogues/Giving Directions (CO1)
2. Describing objects/places/persons (CO2, CO3)

Unit 4

1. Fun – Buzz (Tongue twisters, riddles, puzzles etc) (CO3)
2. Formal Presentations (CO5)

Unit 5

1. Debate (Contemporary / Complex topics) (CO2)
2. Group Discussion (CO2)

SOFTWARE SOURCE

K-Van Solutions Software

REFERENCE

Teaching English - British Council

CORRELATION OF COS WITH THE POS & PSOS:

	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PSO1	PSO2
CO1									3				
CO2								2					
CO3									2				
CO4									3				
CO5									3				

CO-PO MAPPING JUSTIFICATION:

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 PO11)	Level of Correlation (0-3)
	Lesson Plan Hours	%	corr	Verb	BTL			
1	10	20	2	Evaluate	L5	PO9	Thumb Rule	2
2	10	20	2	Understand	L2	PO8	Thumb Rule	2
3	10	20	3	Apply	L3	PO9	Thumb Rule	3
4	10	20	3	Analyze	L4	PO9	Thumb Rule	3
5	10	20	3	Evaluate	L5	PO9	Thumb Rule	3
	50	100						

JUSTIFICATION STATEMENTS:

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

Action Verb: Evaluate (L5)

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

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

Action Verb: Understand(L2)

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

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

Action Verb: Apply (L3)

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

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

Action Verb: Analyze (L4)

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

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

Action Verb: Evaluate (L5)

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

I YEAR

I SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20ABS9910	ENGINEERING CHEMISTRY LAB	0	0	3	1.5

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

CO1: Apply the internal and external indicators in volumetric analysis.

CO2: Prepare advanced polymer materials.

CO3: Analyze the mixture of components by chromatographic techniques

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

CO5: Evaluate the physical properties like surface tension, adsorption and viscosity.

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Apply	The internal and external indicators in		In volumetric analysis	L3
CO2	Prepare	Advanced polymer Bakelite materials			L4
CO3	Analyze	The Mixture of components	By chromatographic techniques		L4
CO4	Apply	The Electro analytical technique to measure the strength of acids.			L3
CO5	Evaluate	The Physical properties like surface tension, adsorption and viscosity			L5

LIST OF EXPERIMENTS:

1. Determination of Hardness of a groundwater sample. (CO1)
2. Estimation of iron (II) using Diphenylamine indicator (Dichrometry – Internal indicator method) (CO1)
3. Determination of pH metric titration of (i) strong acid vs. strong base (CO4)
4. Conductometric titrations of (i) strong acid vs. strong base (ii) Weak acid Vs Strong base (CO4)
5. Determination of Strength of an acid in Pb-Acid battery (CO1)
6. Preparation of phenol-formaldehyde resin (CO2)
7. Preparation of TiO₂/ZnO nano particles(Precipitation Method) (CO2)
8. Estimation of Calcium in port land Cement (CO1)
9. Adsorption of acetic acid by charcoal (CO1)
10. Thin layer chromatography (CO3)
11. Determination of Viscosity of lubricating oils by Red Viscometer 1 &2 (CO5)
12. Determination of Copper by Iodometry (CO1)

MAPPING OF COS TO POS AND PSOS

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

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	Apply	L3	PO4	Analyze (L4)	2
2	Prepare	L4	PO4	Analyze (L4)	3
3	Analyze	L4	PO4	Analyze (L4)	3
4	Apply	L3	PO4	Analyze (L4)	2
5	Evaluate	L5	PO4	Analyze (L4)	3

JUSTIFICATION:

CO1: Apply the internal and external indicators in volumetric analysis.

Action Verb: Apply (L3)

PO4 Verb: Analyze (L4)

CO1 Action Verb is less than PO4; Therefore, correlation is low (2)

CO2: Prepare advanced polymer materials

Action Verb: Analyze (L4)

PO4 Verb: Analyze (L4)

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

CO3: Analyze the mixture of components by chromatographic techniques.

Action Verb: Analyze (L4)

PO4 Verb: Analyze (L4)

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

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

Action Verb: Apply (L3)

PO4 Verb: Analyze (L4)

CO4 Action Verb is less than PO4; Therefore, correlation is low (2)

CO5: Evaluate the physical properties like surface tension, adsorption and viscosity.

Action Verb: Evaluate (L5)

PO4 Verb: Analyze (L4)

CO5 Action Verb is greater than PO4 verb; Therefore, correlation is high (3)

I YEAR

I SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20AES0503	PROBLEM SOLVING AND PROGRAMMING LAB	0	0	3	1.5

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

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

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

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

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

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

Course Outcomes	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

LABORATORY 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)**
5. Construct a program, which finds the kth smallest number among the given list of numbers. **(CO2)**
6. Design an algorithm and implement using C language the following exchanges $a \leftarrow b \leftarrow c \leftarrow d \leftarrow a$ **(CO2)**
7. Develop a C Program, which counts the number of positive and negative numbers separately and also compute the sum of them. **(CO2)**
8. Implement the C program which computes the sum of the first n terms of the series $\text{Sum} = 1 - 3 + 5 - 7 + 9$ **(CO2)**
9. Design a C program, which determines the numbers whose factorial values are between 5000, and 32565. **(CO2)**
10. Design an algorithm and implement using a C program, which finds the sum of the infinite series $1 - x^2/2! + x^4/4! - x^6/6! + \dots$ **(CO3)**
11. 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)**
12. Implement a C program which converts a hexadecimal, octal and binary number to decimal number and vice versa. **(CO3)**
13. Develop an algorithm which computes the all the factors between 1 and 100 for a given number and

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	PO1	Apply(L3)	3
			PO2	Review(L2)	3
2	Analyze	L4	PO1	Apply(L3)	3
			PO2	Identify (L3)	3
			PO3	Develop(L3)	3
			PO4	Analyze (L4)	3
			PO5	Apply (L3)	3
3	Design	L6	PO1	Apply(L3)	3
			PO2	Formulate (L6)	3
			PO3	Design(L6)	3
			PO4	Analyze (L4)	3
			PO5	Create (L6)	3
			PO11	Thumb rule	3
4	Analyze	L4	PO1	Apply(L3)	3
			PO2	Identify (L3)	3
			PO3	Develop(L3)	3
			PO4	Analyze (L4)	3
			PO5	Apply (L3)	3
			PO11	Thumb rule	3
5	Apply	L3	PO1	Apply(L3)	3
			PO2	Identify (L3)	3
			PO3	Develop(L3)	3
			PO4	Analyze (L4)	2
			PO5	Apply (L3)	3

JUSTIFICATION:

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

Action Verb: Analyze (L4)

PO1 Verb: Apply (L3)

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

PO2 Verb: Review(L2)

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

CO2: Analyze the control statements for solving the problems.

Action Verb: Analyze (L4)

PO1: Apply (L3)

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

PO2: identify(L3)

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

PO3: Develop (L3)

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

PO4: Analyze (L4)

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

PO5: Apply (L3)

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

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

Action Verb: Design (L6)

PO1: Apply (L3)

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

PO2: Formulate(L6)

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

PO3: Design (L6)

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

PO4: Analyze (L4)

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

PO5: create (L6)

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

PO11: Thumb rule

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

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

Action Verb: Analyze (L4)

PO1: Apply (L3)

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

PO2: identify(L3)

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

PO3: Develop (L3)

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

PO4: Analyze (L4)

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

PO5: Apply (L3)

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

PO11: Thumb rule

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

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

Action Verb: Apply (L3)

PO1: Apply (L3)

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

PO2: 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 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)

CIVIL ENGINEERING

AK20 REGULATION

(Effective for the student admitted from the AY 2022-23 & LE from 2023-24)

Semester II (First year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T/CLC	P		C	CIE	SEE
1	Basic Science courses	20ABS9906	Differential Equations and Vector Calculus	2	1	0	3	30	70	100
2	Basic Science courses	20ABS9903	Engineering Physics	2	1	0	3	30	70	100
3	Engineering Science Courses	20AES0202	Basics of Electrical and Electronics Engineering	2	1	0	3	30	70	100
4	Engineering Science Courses	20AES0509	Basics of Python Programming	2	1	0	3	30	70	100
5	Engineering Science Courses	20AES0301	Engineering Graphics	1	0	4	3	30	70	100
6	Engineering Science Courses (LAB)	20AES0204	Basics of Electrical and Electronics Engineering Lab	0	0	3	1.5	30	70	100
7	Basic Science course (LAB)	20ABS9908	Engineering Physics Lab	0	0	3	1.5	30	70	100
8	Engineering Science Courses (LAB)	20AES0510	Basics of Python Programming Lab	0	0	3	1.5	30	70	100
9	Mandatory Course (AICTE Suggested)	20AMC9902	Constitution of India	2	0	0	0	30	-	30
Total credits							19.5	270	560	830

I YEAR		II SEMESTER			
Subject Code	Subject Name	L	T/CLC	P	CREDITS
20ABS9906	DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS	2	1	0	3

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

- CO1:** Analyze the mathematical concepts of ordinary differential equations of higher order.
- CO2:** Apply the methods of linear differential equations related to various engineering problems
- CO3:** Analyze the partial differential equations of first and higher order
- CO4:** Understand the vector differential operators such as gradient, curl, divergent
- CO5:** Evaluate the vector integral theorems by using line, surface, and volume integrals

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Analyze	the mathematical concepts of ordinary differential equations	of higher order		L4
CO2	Apply	the methods of linear differential equations	related to various engineering problems		L3
CO3	Analyze	the partial differential equations	of first and higher order		L4
CO4	Understand	the vector differential operators such as gradient, curl, divergent.			L2
CO5	Evaluate	the vector integral theorems	by using line, surface, and volume integrals		L5

UNIT I: LINEAR DIFFERENTIAL EQUATIONS OF HIGHER ORDER

Definitions, complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral (e^{ax} , $\sin ax$ (or) $\cos ax$, X^k , $e^{ax}v$, $x v(x)$), method of variation of parameters.

UNIT II: EQUATIONS REDUCIBLE TO LINEAR DIFFERENTIAL EQUATIONS AND APPLICATIONS

simultaneous linear equations with constant coefficients, Cauchy's and Legendre's linear equations, Applications to oscillations of a spring, L-C-R Circuit problems and Mass spring system.

UNIT III: PARTIAL DIFFERENTIAL EQUATIONS OF FIRST ORDER AND HIGHER ORDER

Linear Equations of First order P.D.E: Method of Grouping, Method of Multipliers.

Non-linear Equations of First Order PDE: $f(p, q) = 0$, $f(z, p, q) = 0$, $f(x, p) = F(y, q)$ and $z = px + qy + f(p, q)$ OR Clairaut's Equation.

Homogenous Linear P.D.E with constant coefficients of Higher order: Finding complementary function, Particular Integrals of e^{ax+by} , $\sin(ax+by)$ Or $\cos(ax+by)$, $X^m Y^n$ and for any function of $F(x, y)$. Non-Homogenous Linear P.D.E of constant coefficient.

UNIT IV: VECTOR DIFFERENTIATION

Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

UNIT V: VECTOR INTEGRATION

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

TEXT BOOKS:

1. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2011.

REFERENCES:

1. Dr.T.K.V.Iyengar, Engineering Mathematics-I,S.Chand publishers
2. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics,Laxmipublication,2008
4. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education.

CORRELATION OF COS WITH THE POS & PSOS

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

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 PO11)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	14	20.8	3	Analyze	L4	PO2	Analyze (L4)	3
2	15	22.3	3	Apply	L3	PO1	Apply (L3)	3
3	14	20.8	3	Analyze	L4	PO2	Analyze (L4)	3
4	9	13.4	2	Understand	L2	PO1	Apply (L3)	2
5	15	22.3	3	Evaluate	L5	PO2	Analyze (L4)	3
	67	100						

JUSTIFICATION:

CO1: Analyze the mathematical concepts of ordinary differential equations of higher order.

Action Verb: Analyze (L4)

PO2 Verbs: Analyze (L4)

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

CO2: Apply the methods of linear differential equations related to various engineering problems.

Action Verb: Apply (L3)

PO1 Verbs: Apply (L3)

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

CO3: Analyze the partial differential equations of first and higher order.

Action Verb: Analyze (L4)

PO2 Verb: Analyze (L4)

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

CO4: Understand the vector differential operators such as gradient, curl, divergent.

Action Verb: Understand (L2)

PO1 Verb: Apply (L3)

CO4 Action Verb is low level to PO1 to one level; Therefore, correlation is moderate (2).

CO5: Evaluate the vector integral theorems by using line, surface, and volume integrals.

Action Verb: Evaluate (L5)

I YEAR

II SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20ABS9903	ENGINEERING PHYSICS	2	1	0	3

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

- CO1:** Analyze the fundamental concepts of mechanics and gravitation.
- CO2:** Apply the basic principles of acoustics and ultrasonics for engineering problems
- CO3:** Analyze the properties and applications of dielectric and magnetic materials.
- CO4:** Analyze the fundamentals of Lasers and optical fibers.
- CO5:** Analyze the working principles of sensors for engineering problems.

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Analyze	The fundamental concepts of mechanics and gravitation			L4
CO2	Apply	The basic principles of acoustics and ultrasonics		For engineering problems	L3
CO3	Analyze	The properties of dielectric and magnetic materials.			L4
CO4	Analyze	The fundamentals of Lasers and optical fibers.			L4
CO5	Analyze	The working principles of sensors		For engineering problems.	L4

UNIT I: MECHANICS

Basic laws of vectors and scalars –Conservative and non-conservative forces- Vector differentiation and Gradient, $F = - \text{grad}V$ - Angular momentum and Torque-Conservation of Energy, Momentum and Angular Momentum - motion of variable mass system, motion of a rocket -Moment of Inertia-radius of Gyration-Gravitational Force, Field and Potential- Kepler’s Laws-Proof of Kepler’s laws.

UNIT II: ACOUSTICS AND ULTRASONICS

Introduction to Acoustics – Reverberation – Reverberation time– Sabine’s formula- Derivation using growth and decay method – Absorption coefficient and its determination –factors affecting acoustics of buildings and their remedies.

Introduction to Ultrasonics – Production of Ultrasonic wave by magnetostriction & piezoelectric methods – Properties-acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, applications.

UNIT III: DIELECTRIC AND MAGNETIC MATERIALS

Dielectric polarizability, Susceptibility and Dielectric constant-Types of polarizations: Electronic , Ionic, Orientation Polarizations (Qualitative)-Frequency dependence of polarization-Lorentz (internal) field-Claussius-Mossotti equation-Applications of Dielectrics.

Introduction-Magnetic dipole moment – Magnetization – Magnetic susceptibility and permeability – Origin of permanent magnetic moment – Classification of Magnetic materials-Domain Concepts of ferromagnetism – Hysteresis – soft and hard magnetic materials-Magnetic device applications.

UNIT IV: LASERS AND FIBER OPTICS

Introduction-Characteristics of Laser – Spontaneous and Stimulated emission of radiation-Einstein’s Coefficients-Population inversion-Pumping Mechanisms -He- Ne laser, Nd-YAG laser-Semiconductor laser- Applications of lasers.

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

UNIT V: SENSORS

Sensors:(qualitative description only): Different types of sensors and applications; Strain and Pressure sensors- Piezoelectric, magnetostrictive sensors, Fibre optic methods of pressure sensing; Temperature sensors - bimetallic strip, pyroelectric detectors, Hall-effect sensor, smoke and fire detectors.

TEXTBOOKS:

1. M. N. Avadhanulu, P.G. Kshirsagar &TVS Arun Murthy”. A Text book of Engineering Physics”-S.Chand Publications,11th Edition2019
2. Shatendra Sharma, Jyotsna Sharma, “ Engineering Physics”, Pearson Education, 2018.

REFERENCES:

1. K.Thyagarajan “Engineering Physics”,-Mc Graw Hill Publishing Company Ltd, 2016.
2. MKVarma “Introduction to Mechanics”-Universities Press-2015.
3. D.K. Bhattacharya and A.Bhaskaran,“Engineering Physics”-Oxford Publications-2015.
4. IanRSinclair,Sensor andTransducers,3rd eds,2001,Elsevier(Newnes).

CORRELATION OF COS WITH THE POS & PSOS

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

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 PO11)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	17	25	3	Analyze	L4	PO1	Apply (L3)	3
2	10	14.7	2	Apply	L3	PO1	Apply (L3)	3
3	10	14.7	2	Analyze	L4	PO1, PO4	Apply (L3) Analyze (L4)	3 3
4	14	20.5	3	Analyze	L4	PO1	Apply (L3)	3
5	17	25	3	Analyze	L4	PO1 PO5	Apply (L3) Apply (L3)	3 3
	68	100						

JUSTIFICATION STATEMENTS:

CO1: Analyze the fundamental concepts of mechanics and gravitation.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

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

CO2: Apply the basic principles of acoustics and ultrasonics for engineering problems.

Action Verb: Apply (L3)

PO1 Verbs: Apply (L3)

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

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

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

PO4 Verbs: Analyze (L4)

CO3 Action Verb level is equal to PO1 and PO4 verb; Therefore, correlation is high (3).

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

CO4: Analyze the fundamentals of Lasers and optical fibers.

Action Verb: Analyze (L4)

PO1 Verb: Apply (L3)

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

CO5: Analyze the working principles of sensors for engineering problems.

Action Verb: Analyze (L4)

PO1 Verb: Apply (L3)

PO5 Verb: Apply (L3)

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

CO5 Action Verb level is greater than PO5 verb by one level; Therefore, correlation is high (3).

I YEAR		II SEMESTER			
Subject Code	Subject Name	L	T/CLC	P	CREDITS
20AES0202	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	2	1	0	3

Course Outcomes: After studying the course, students 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 fundamental concepts of diodes, transistors and op-amps.
- CO5:** Analyze the concepts of Number Systems, Logic Gates and Digital Circuits
- CO6:** Understand the basic concepts and examples of Communication Systems.

Course Outcomes	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	Basic operation of electrical power generation and transmission systems			L2
CO4	Understand	fundamental concepts of diodes, transistors and its applications			L2
CO5	Analyze	concepts of Number Systems, Logic Gates and Digital Circuits			L4
CO6	Understand	basic concepts and examples of Communication Systems			L2

PART-A (ELECTRICAL ENGINEERING)

UNIT-I: DC & AC CIRCUITS:

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:

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:

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.

TEXT BOOKS:

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.

REFERENCES:

1. L. S. Bobrow - “Fundamentals of Electrical Engineering” - Oxford University Press - 2011.
2. E. Hughes - “Electrical and Electronics Technology” - Pearson - 2010.

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 PO11)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	15	33.33	3	Apply	L3	PO1 PO4 PO9	Apply(L3) Analyze(L4) Thumb Rule	3 2 1
2	17	37.77	3	Analyze	L4	PO1 PO4 PO9	Apply(L3) Analyze(L4) Thumb Rule	3 3 1
3	13	28.88	3	Analyze	L4	PO1 PO4 PO9	Apply(L3) Analyze(L4) Thumb Rule	3 3 1
	45	100						
4	16	42	3	Understand	L2	PO1, PO2	Apply (L3) Review(L2)	2 3
5	12	32	3	Analyze	L4	PO1 PO2 PO4	Apply (L3) Review(L2) Analyze(L4)	3 3 3
6	10	26	3	Understand	L2	PO1, PO2	Apply(L3) Review (L2)	2 3
	38	100						

JUSTIFICATION STATEMENTS:

CO1: Apply the concepts of Kirchoff 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).

PO2: Analyze (L4)

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

PO6: Using thumb rule, CO2 correlates PO6 as low (1).

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

Action Verb: Understand (L2)

PO1: Apply (L3)

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

PO2: Analyze (L4)

CO3 Action Verb is less than PO2 verb by two level; Therefore, correlation is low (1).

PO6: Using thumb rule, CO3 correlates PO6 as low (1).

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 concepts of Number Systems, Logic Gates and Digital Circuits.

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).

I YEAR

II SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20AES0509	BASICS OF PYTHON PROGRAMMING	2	1	0	3

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

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

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

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

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

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

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

UNIT - I

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

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

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

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

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

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

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

JUSTIFICATION:

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

Action Verb: Understand(L2)

PO1 Verb: Apply(L3)

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

PO2 Verb: Review(L2)

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

PO5: Apply(L3)

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

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

Action Verb: Apply (L3)

PO1: Apply(L3)

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

PO2: Review (L2)

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

PO3: Develop (L3)

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

PO5: Apply(L3)

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

PO11: Thumb rule

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

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

Action Verb: Apply(L3)

PO1: Apply(L3)

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

PO2: Review (L2)

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

PO3: Develop (L3)

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

PO4: Analyze (L4)

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

PO11: Thumb rule

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

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

Action Verb: Apply(L3)

PO1: Apply(L3)

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

PO2: Review(L2)

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

PO3: Develop (L3)

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

PO4: Analyze(L4)

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

PO11: Thumb rule

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

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

Action Verb: Analyze(L4)

PO1: Apply(L3)

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

PO2: Review (L2)

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

PO3: Develop (L3)

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

PO4: Analyze (L4)

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

PO11: Thumb rule

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

I YEAR

II SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20AES0301	ENGINEERING GRAPHICS	1	0	4	3

Course Outcomes: After studying the course, students 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.

Course Outcomes	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

CORRELATION OF COS WITH THE POS & PSOS

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

CO-PO MAPPING JUSTIFICATION:

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	Apply (L3) Develop (L3) Thumb Rule	3 3 1
2	15	20	2	Understand	L2	PO1 PO3 PO10	Apply (L3) Develop (L3) Thumb Rule	2 2 1
3	15	20	2	Analyze	L4	PO1 PO3 PO10	Apply (L3) Develop (L3) Thumb Rule	3 3 1
4	15	20	2	Analyze	L4	PO1 PO3 PO10	Apply (L3) Develop (L3) Thumb Rule	3 3 1
5	12	16	2	Apply	L3	PO1 PO3 PO10	Apply (L3) Develop (L3) Thumb Rule	3 3 1
	75	100						

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)

I YEAR

II SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20AES0204	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING LAB	0	0	3	1.5

Course Outcomes: After studying the course, students 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: Analyze the V-I Characteristics of PN and Zener diodes.
- CO5: Evaluate the parameters of rectifiers without & with filters
- CO6: Evaluate the parameters of BJT and FET from their characteristics

Course Outcomes	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	Basic operation of electrical power generation and transmission systems			L2
CO4	Analyze	the V-I Characteristics of PN and Zener diodes			L4
CO5	Evaluate	the parameters of rectifiers without & with filters			L5
CO6	Evaluate	the parameters of BJT and FET from their characteristics			L5

PART A

List of Experiments:

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

List of Experiments:

1. PN Junction Diode Characteristics. (CO4)
2. Zener Diode Characteristics. (CO4)
3. Rectifiers (With and Without Filter). (CO5)
4. BJT Characteristics (CB Configuration). (CO6)
5. BJT Characteristics (CE Configuration). (CO6)
6. FET Characteristics (CS Configuration). (CO6)

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

CO	CO		Program Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO5)	Level of Correlation
	Verb	BTL			
1	Apply	L3	PO1	PO1: Apply(L3)	3
			PO2	PO2: Analyze(L4)	2
			PO6	PO6: Thumb Rule	1
2	Analyze	L4	PO1	PO1: Apply(L3)	3
			PO2	PO2: Analyze(L4)	3
			PO6	PO6: Thumb Rule	1
3	Understand	L2	PO1	PO1: Apply(L3)	2
			PO2	PO2: Analyze(L4)	1
			PO6	PO6: Thumb Rule	1
4	Analyze	L4	PO1	PO1: Apply (L3)	3
			PO2	PO2: Review (L2)	3
5	Evaluate	L5	PO1	PO1: Apply (L3)	3
			PO2	PO2: Review (L2)	3
			P04	P04: Analyze(L4)	3
6	Evaluate	L5	PO1	PO1: Apply (L3)	3
			PO2	PO2: Review (L2)	3
			P04	P04: Analyze(L4)	3

JUSTIFICATION:

CO1: Apply the Kirchoff'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).

I YEAR

II SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20ABS9908	ENGINEERING PHYSICS LAB	0	0	3	1.5

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

CO1: Analyze the properties of LASER and optical fibers.

CO2: Analyze the mechanical behavior of a given material using dynamic methods.

CO3: Evaluate the basic parameters of a given semiconductor material.

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

CO5: Apply the concept of sensors to solve engineering problems.

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Analyze	The properties of LASER and optical fibers.			L4
CO2	Analyze	The mechanical behavior of a given material	Using dynamic methods.		L4
CO3	Evaluate	The basic parameters of a given semiconductor material.			L5
CO4	Analyze	The basic properties of dielectric and magnetic behavior of the given material.			L4
CO5	Apply	The concepts of sensors		To solve engineering problems.	L3

List of Experiments:

1. Determination of wavelength of LASER light using diffraction grating (CO1).
2. Determination of particle size using LASER (CO1).
3. Hall effect-Determination of Hall voltage and Hall coefficient of a given semiconductor (CO3).
4. Determination of Magnetic field along the axis of a circular coil carrying current (CO4).
5. Determination of Rigidity modulus of a wire-Torsional pendulum (CO2).
6. Study the variation of B versus H by magnetizing the magnetic material (B-H curve) (CO4).
7. Determination of numerical aperture of a given optical fiber and angle of acceptance (CO1).
8. Study the variation of pressure using Strain Guage sensor (CO5).
9. Study the variation of temperature using Strain Guage sensor (CO5).
10. Determination of dielectric constant of dielectric material using charging and discharging of capacitor (CO4).
11. Determination of spring constant using Coupled Oscillator (CO2).
12. Determination of ultrasonic velocity in liquid using Acoustic grating (CO2).
13. Measurement of magnetic susceptibility by Gouy's method (CO4).
14. Study the variation of pressure using optical fiber sensors (CO5).
15. Study the variation of temperature using optical fiber sensors (CO5).

REFERENCES:

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.
3. <https://archive.nptel.ac.in/courses/112/106/112106227>

CORRELATION OF COS WITH THE POS & PSOS

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

CO-PO MAPPING JUSTIFICATION:

CO	CO					Program Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation
	Lesson Plan (Hrs)	%	Correlation	Verb	BTL			
1	9	23	3	Analyze	L4	PO1	Apply (L3)	3
						PO4	Analyze (L4)	3
2	6	15	2	Analyze	L4	PO1	Apply (L3)	3
						PO4	Analyze (L4)	3
3	6	15	2	Evaluate	L5	PO1	Apply (L3)	3
						PO4	Analyze (L4)	3
4	9	23	3	Analyze	L4	PO1	Apply (L3)	3
						PO4	Analyze (L4)	3
5	6	15	2	Apply	L3	PO1	Apply (L3)	3
						PO4	Analyze (L4)	2

JUSTIFICATION:

CO1: Analyze the properties of LASER and optical fibers.

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: Analyze the mechanical behavior of a given material using dynamic methods.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

PO4 Verb: Analyze (L4)

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

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

CO3: Evaluate the basic parameters of a given semiconductor material.

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 is greater than PO4 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: Apply the concepts of sensors to solve engineering problems.

Action Verb: Apply (L3)

PO1 Verbs: Apply (L3)

PO4 Verb: Analyze (L4)

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

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

I YEAR

II SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20AES0510	BASICS OF PYTHON PROGRAMMING LAB	0	0	3	1.5

Course Outcomes: After studying the course, students 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

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

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Analyze	the basic concepts of Python Programming			L4
CO2	Apply	the loops and conditional statements of python	using IDLE and programs.		L3
CO3	Analyze	the compound data using Lists, Tuples and dictionaries	using functions.		L4
CO4	Apply	the development applications	using python datatypes	to read and write data from files	L3
CO5	Design	the solutions	using OOPs concepts.	for real world problems in python	L6

List of Experiments

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

2. Write a function that draws a grid like the following:(**CO1**)

```

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

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

```

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

4. Using turtles concept draw a wheel of your choice (**CO1**)

5. Write a program that draws Archimedean Spiral (**CO1**)

6. The letters of the alphabet can be constructed from a moderate number of basic elements, like vertical and horizontal lines and a few curves. Design an alphabet that can be drawn with a minimal number of basic elements and then write functions that draw the letters. The alphabet can belong to any

Natural language excluding English. You should consider at least Ten letters of the alphabet. (CO1)

7. The time module provides a function, also named time that returns the current Greenwich Mean Time in “the epoch”, which is an arbitrary time used as a reference point. On UNIX systems, the epoch is 1 January 1970.

```
>>> import time
>>> time.time()
1437746094.5735958
```

Write a script that reads the current time and converts it to a time of day in hours, minutes, and seconds, plus the number of days since the epoch. (CO1)

8. Given $n+r+1 \leq 2r$. n is the input and r is to be determined. Write a program which computes minimum value of r that satisfies the above (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 letter (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)
- Updating elements of a list
 - Concatenation of list’s
 - Check for member in the list
 - Insert into the list
 - Sum the elements of the list
 - Push and pop element of list
 - Sorting of list
 - Finding biggest and smallest elements in the list
 - Finding common elements in the list
17. Write a program to count the number of vowels in a word. (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. Use object 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)

REFERENCE BOOKS:

1. Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers, “How to Think Like a Computer Scientist: Learning with Python 3”, 3rd edition,
Available at <http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf>
2. Paul Barry, “Head First Python a Brain Friendly Guide” 2nd Edition, O’Reilly, 2016

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

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

JUSTIFICATION:

CO1: Analyze the basic concepts of Python Programming

Action Verb: Analyze (L4)

PO1 Verb: Apply(L3)

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

PO2 Verb: Analyze(L4)

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

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

Action Verb: Apply (L3)

PO1 Verb: Apply(L3)

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

PO2 Verb: Analyze(L4)

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

PO11: Thumb rule

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

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

Action Verb: Analyze(L4)

PO1: Apply(L3)

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

PO2: Analyze (L4)

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

PO3: Design (L6)

CO3 Action verb is less than PO3 verb by one level. Therefore, the correlation is medium (2)

PO4: Design (L6)

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

PO9: Thumb rule

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

PO11: Thumb rule

Construct real time applications using functions can be lifelong 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)

PO11: Thumb rule

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

I YEAR

II SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20AMC9902	CONSTITUTION OF INDIA	2	0	0	0

Course Outcomes: After studying the course, students 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: Remember the basic features of Indian Constitution

CO4: Understand the Powers and functions of Governor, President, and Judiciary.

CO5: Understand the functions of local administration bodies.

Course Outcomes	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: 1

History of Making of the Indian Constitution - History Drafting Committee, (Composition & Working)

UNIT: 2

Philosophy of the Indian Constitution - Preamble Salient Features

UNIT: 3

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:4

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:5

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.

TEXT BOOKS:

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.

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

CO	CO					Program Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation
	Lesson Plan (Hrs)	%	Correlation	Verb	BTL			
1	4	14	2	Understand	L2	PO6 PO11	Thumb Rule Thumb Rule	2 2
2	4	14	1	Remember	L1	PO6 PO7	Thumb Rule Thumb Rule	1 1
3	8	26	2	Understand	L2	PO8 PO11	Thumb Rule Thumb Rule	2 2
4	8	26	2	Understand	L2	PO6 PO11	Thumb Rule Thumb Rule	2 2
5	6	20	2	Understand	L2	PO6 PO11	Thumb Rule Thumb Rule	2 2

JUSTIFICATION STATEMENTS:

CO1: Understand the historical background of the Constitution making and its importance for building a democratic India.

Action Verb: Understand (L2)

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

CO2: Remember the basic features of Indian Constitution

Action Verb: Remember (L1)

CO2 Action Verb is Remember of BTL 1. Using Thumb rule, L1 correlates PO6 to PO11 as low (1).

CO3: Understand the fundamental rights and duties for becoming a good citizen of India.

Action Verb: Understand (L2)

CO3 Action Verb is Understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

CO4: Understand the Powers and functions of Governor, President, and Judiciary.

Action Verb: Understand (L2)

CO4 Action Verb is Understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

CO5: Understand the functions of local administration bodies.

Action Verb: Understand (L2)

CO5 Action Verb is Understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)

CIVIL ENGINEERING

AK20 REGULATION

(Effective for the student admitted from the AY 2022-23 & LE from 2023-24)

Semester III (Second year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)			
				L	T/CLC	P		C	CIE	SEE	Total
1	Basic Science courses	20ABS9913	Probability & Statistics, Partial differential equations	2	1	0	3	30	70	100	
2	Professional core course	20APC0101	Mechanics of Materials	2	1	0	3	30	70	100	
3	Professional core course	20APC0102	Surveying	2	1	0	3	30	70	100	
4	Professional core course	20APC0103	Fluid Mechanics	2	1	0	3	30	70	100	
5	Humanities and social science	20AHSMB01	Managerial Economics and Financial Analysis	2	1	0	3	30	70	100	
6	Professional core courses (LAB)	20APC0104	Strength of Materials Lab	0	0	3	1.5	30	70	100	
7	Professional core courses (LAB)	20APC0105	Surveying Lab	0	0	3	1.5	30	70	100	
8	Professional core courses (LAB)	20APC0106	Fluid Mechanics Lab	0	0	3	1.5	30	70	100	
9	Skill Oriented Course*	20APC0107	Basics of CAD	0	1	2	2	100	-	100	
10	Mandatory course (AICTE suggested)	20AMC9903	Environmental Studies	2	1	0	0	30	-	30	
Total credits							21.5	370	560	930	

IIYEAR		I SEMESTER			
Subject Code	Subject Name	L	T/CLC	P	CREDITS
20ABS9913	PROBABILITY AND STATISTICS, PARTIAL DIFFERENTIAL EQUATIONS	2	1	0	3

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

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

CO2: Analyze the fundamental laws of probability and its applications.

CO3: Apply the formulation of null hypothesis to large samples.

CO4: Apply the techniques for testing of hypothesis for small samples.

CO5: Analyze the applications of partial differential equations in Cartesian coordinates.

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the discrete and continuous data	through statistical methods.		L2
CO2	Analyze	the fundamental laws of probability and its applications.			L4
CO3	Apply	the formulation of null hypothesis	to large samples		L3
CO4	Apply	the techniques for testing of hypothesis for small samples.	for small samples		L3
CO5	Analyze	the applications of partial differential equations	in cartesian coordinates		L4

UNIT 1: DESCRIPTIVE STATISTICS:

Measures of Central tendency, Measures of Variability (spread or variance), correlation, correlation coefficient, rank correlation, regression coefficients, method of least squares, regression lines.

UNIT 2: PROBABILITY

Probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability distribution: Binomial - Poisson approximation to the binomial distribution and normal distribution-their properties.

UNIT 3: TESTING OF HYPOTHESIS

Formulation of null hypothesis, critical regions, level of significance. Large sample tests: test for single proportion, difference of proportions, test for single mean and difference of means.

UNIT 4: SMALL SAMPLE TESTS

Student t-distribution (single mean, two means and paired t-test), Testing of equality of variances (F-test), χ^2 - test for goodness of fit.

UNIT 5: APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Method of separation of variables, solution of 1D-wave, 1D-heat and 2D-Laplace's equation in Cartesian coordinates.

TEXT BOOKS

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43/e, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006.

REFERENCES

1. S.Chand ,Engineering Mathematics-II byDr.T.K.V.Iyengar, Dr.B.Krishna Gandhi, S.Ranganatham, Dr.M.V.S.S.N.Prasad
2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9/e, Wiley India, 2009.
3. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India,1995.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

CO	CO					Program Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation
	Lesson Plan (Hrs)	%	Correlation	Verb	BTL			
1	14	19.71	2	Understand	L2	PO2	Analyze (L4)	1
2	17	23.94	3	Analyze	L4	PO2	Analyze (L4)	3
3	14	21.9	2	Apply	L3	PO1	Apply (L3)	3
4	16	22.53	3	Apply	L3	PO1	Apply (L3)	3
5	10	14.08	2	Analyze	L4	PO2	Analyze (L4)	3

JUSTIFICATION:

CO1: Understand the discrete and continuous data through 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 fundamental laws of probability 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: Apply the formulation of null hypothesis to large samples.

Action Verb: Apply (L3)

PO1 Verb: Apply (L3)

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

CO4: Apply the techniques for testing of hypothesis for small samples.

Action Verb: Apply (L3)

PO1 Verb: Apply (L3)

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

CO5: Analyze the applications of partial differential equations in Cartesian coordinates.

Action Verb: Analyze (L4)

PO2 Verb: Analyze (L4)

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

II YEAR

I SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20APC0101	MECHANICS OF MATERIALS	2	1	0	3

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

CO1: Understand the system of forces and free body diagrams on rigid bodies.

CO2: Apply the concepts of centroid and moment of inertia for different cross-sections

CO3: Understand the theory of elastic properties on varying deformable bodies

CO4: Analyze the concepts of shear force and bending moment for different load conditions.

CO5: Analyze the displacements of simple beams using slope deflection methods

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the system of forces on		rigid bodies.	L2
CO2	Apply	concepts of centroid and moment of inertia		different cross-sections	L3
CO3	Understand	theory of elastic properties		varying deformable bodies	L2
CO4	Analyze	concepts of shear force and bending moment	different loads conditions		L4
CO5	Analyze	the displacements of simple beams	using slope deflection methods		L4

UNIT – I INTRODUCTION TO MECHANICS:

Basic Concepts, system of Forces Coplanar Concurrent Forces - Components in Space Resultant -Moment of Forces and its Application - Couples and Resultant of Force Systems. Equilibrium of system of Forces: Free body diagrams and Equations of Equilibrium of Coplanar Systems, support reactions for simply supported beam.

UNIT – II CENTROID AND CENTER OF GRAVITY:

Introduction – Centroids of rectangular, triangular, circular, I, L and T sections.

AREA MOMENT OF INERTIA:

Introduction – Definition of Moment of Inertia of rectangular, triangular, circular, I, L and T sections - Radius of gyration, perpendicular axis theorem and parallel axis theorem.

UNIT – III SIMPLE STRESSES AND STRAINS:

Types of stresses and strains – Hooke’s law – Stress – strain diagram for mild steel – working stress – Factor of safety – lateral strain, Poisson’s ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of Varying section – Composite bars – Temperature stresses.

UNIT – IV SHEAR FORCE AND BENDING MOMENT:

Definition of beam – types of beams – Concept of Shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and over hanging beams subjected to point loads, uniformly distributed load, uniformly varying loads and combination of these loads – point of contra flexure – Relation between S.F, B.M and rate of loading at section of a beam.

UNIT – V DEFLECTION OF BEAMS:

Uniform bending – slope, deflection and radius of curvature - Determination of slope and deflection for cantilever and simply supported beams under point loads and U.D.L. -Mohr’s theorems –Moment area method –Conjugate beam method.

TEXT BOOKS

1. R.K Bansal, Engineering Mechanics, Lakshmi Publications 2015.
2. R. K. Bansal, Strength of Materials, Lakshmi Publications House Pvt. Ltd 2018.
3. R. Subramanian, Strength of Materials, Oxford University Press 2013.

REFERENCES

1. S.S. Bhavakatti, Engineering Mechanics, New Age Publishers 2015.

CORRELATION OF COS WITH THE POS & PSOS

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

CO-PO MAPPING JUSTIFICATION

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	12/80	15	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
2	17/80	21	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
3	12/80	15	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
4	19/80	24	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	3 3 3 3
5	20/80	25	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	3 3 3 3

JUSTIFICATION STATEMENTS:

CO1: Understand the system of forces and free body diagrams on rigid bodies.

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO1 Action Verb is of BTL 2. Using Thumb rule, L4 correlates PO7 as moderate (3).

CO2: Apply the concepts of centroid and moment of inertia for different cross-sections.

Action Verb: Apply (L3)

PO1: Apply(L3)

CO2 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO2: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

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

CO3: Understand the theory of elastic properties on varying deformable bodies.

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO3 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO3 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO4: Analyze the concepts of shear force and bending moment for different load conditions.

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO5: Analyze the displacements of simple beams using slope deflection methods

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

CO5 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as moderate (3).

II YEAR

I SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20APC0102	SURVEYING	2	1	0	3

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

CO1: Understand the basics of linear and angular measurements

CO2: Apply the concepts of leveling, contouring and Theodolite survey in field works

CO3: Apply the techniques of computing of Areas and Volumes in earthworks

CO4: Analyze the simple horizontal circular curves for buildings and highway culverts

CO5: Understand the EDM, Total Station and DGPS in the survey systems.

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the concepts of linear and angular measurements			L2
CO2	Apply	the concepts of leveling, contouring and Theodolite survey		In field works	L3
CO3	Apply	the techniques of computing Areas and Volumes		In earthworks	L3
CO4	Analyze	the simple horizontal circular curves		for buildings and highway culverts	L4
CO5	Understand	the EDM, Total Station and DGPS	in the survey system		L2

UNIT – I BASICS OF SURVEYING:

Definition, principles and classification of surveying - Principles of chain survey –Types of chains - Tape corrections – types of Ranging - Construction and working of prismatic compass – Types of bearing - Declination, local attraction.

UNIT – II LEVELLING:

Basics definitions, types of levels and levelling staves, temporary adjustments, methods of levelling, booking and Determination of levels- HI Method-Rise and Fall method.

CONTOURING: Characteristics and uses of Contours - methods of contour surveying, interpolation and sketching of Contours.

THEODOLITE SURVEYING:

Measurement of horizontal and vertical angles-reiteration and repetition methods.

UNIT – III COMPUTATION OF AREAS AND VOLUMES:

Areas - Determination of areas consisting of irregular boundary and regular boundary - Volume- trapezoidal and prismoidal formula-Determination of volume of earth work in cutting and embankments.

UNIT – IV CURVES:

Types of curves and their necessity, elements of simple circular curve, setting out of simple horizontal circular curves-problems.

CONSTRUCTION SURVEYS: Introduction-setting out of buildings-highways culverts.

UNIT – V MODERN FIELD SURVEY SYSTEMS:

EDM and Total Station: Measurement principle of EDM - EDM instrument characteristics - Accuracy in EDM - Total station – Introduction – Advantages - Types and applications of total station - Field procedure.

Differential Global Positioning System (DGPS): Introduction - Working principle - DGPS receivers - Applications of DGPS.

TEXT BOOKS

1. Arora, K.R. I, Surveying, Vol-I, II and II, Standard Book House, 2015.

2. C. Venkatramaiah, Text Book of Surveying, Universities Press Pvt Ltd, Hyderabad. Revised Edition 2011.
3. B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Surveying (Vol – 1,2&3), by – Laxmi Publications (P) Ltd., New Delhi.
4. N.N. Basak, Surveying and Levelling-Tata McGraw-Hill Education, 2017.

REFERENCES

1. Manoj K., Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011.
2. Madhu N., Sathikumar, R. and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
3. Chandra A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
4. Anji Reddy M., Remote sensing and Geographical information system, B.S. Publications, 2001.

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	11/70	15	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
2	15/70	21	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
3	15/70	21	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
4	17/70	24	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	2 3 3 3
5	12/70	15	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2

JUSTIFICATION STATEMENTS:

CO1: Understand the basics of linear and angular measurements.

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO2: Apply the concepts of leveling, contouring and Theodolite survey in field works

Action Verb: Apply (L3)

PO1: Apply(L3)

CO2 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO2: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

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

CO3: Apply the techniques of computing of Areas and Volumes in earthworks

Action Verb: Apply (L3)

PO1: Apply(L3)

CO3 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO3: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

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

CO4: Analyze the simple horizontal circular curves for buildings and highway culverts

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO5: Understand the EDM, Total Station and DGPS in the survey systems.

Action Verb: Understand (L2)

PO1: Apply(L3)

CO5 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

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

CO5 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)

CIVIL ENGINEERING

AK20 REGULATION

(Effective for the student admitted from the AY 2022-23 & LE from 2023-24)

II YEAR

I SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20APC0103	FLUID MECHANICS	2	1	0	3

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

CO1: Understand the basic characteristics and behavior of fluids

CO2: Apply the laws of fluid statics and concepts of Buoyancy

CO3: Apply the law of conservation of mass to differentiate type of flow in a pipe

CO4: Analyze the discharge of fluid flow in pipes using law of conservation of energy

CO5: Analyze the energy losses and flow characteristics through closed conduits

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	basic characteristics and behavior of fluids			L2
CO2	Apply	the laws of fluid statics and concepts of buoyancy			L3
CO3	Apply	the law of conservation of mass and differentiate type of flow in a pipe			L3
CO4	Analyze	the discharge of fluid flow in pipes using law of conservation of energy			L4
CO5	Analyze	the energy losses and flow characteristics	through Closed Conduits		L4

UNIT – I BASIC CONCEPTS AND DEFINITIONS:

Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Newton law of viscosity, Kinematic and dynamic viscosity; variation of viscosity with temperature, vapor pressure, surface tension, capillarity, Bulk modulus of elasticity, compressibility.

UNIT – II FLUID STATICS

Fluid Pressure: Pressure at a point, Pascal’s law, and pressure variation with temperature. Piezometer, U-Tube Manometer, Single Column Manometer, U Tube Differential Manometer. Pressure gauges, Hydrostatic pressure force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

UNIT – III FLUID KINEMATICS:

Classification of fluid flow : steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two and three dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One, two and three -dimensional continuity equations in Cartesian coordinates.

UNIT – IV FLUID DYNAMICS:

Surface and body forces; Equations of motion - Euler’s equation; Bernoulli’s equation – derivation; Energy Principle; Practical applications of Bernoulli’s equation: Venturimeter, orifice meter; Momentum principle; Forces exerted by fluid flow on pipe bend; Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number.

UNIT -V ANALYSIS OF PIPE FLOW:

Energy losses in pipelines; Friction factor for pipe flow, Darcy – Weisbach equation; Minor losses in pipelines; Hydraulic Grade Line and Total Energy Line; Concept of equivalent length- Pipes in series and parallel.

TEXT BOOKS

1. R. K. Bansal, A text of Fluid mechanics and hydraulic machines, Laxmi Publications (P) Ltd., New Delhi 2012.

2. K. Subrahmanya, Theory and Applications of Fluid Mechanics, Tata McGraw Hill 2014.

REFERENCES

1. N. Narayana Pillai, Principles of Fluid Mechanics and Fluid Machines, Universities Press Pvt Ltd, Hyderabad. 3rd Edition 2009.

2. P. M. Modi and S. M. Seth, Hydraulics and Fluid Mechanics, Standard Book House

3. C. S. P. Ojha, R. Berndtsson and P. N. Chadramouli, Fluid Mechanics and Machinery, Oxford University Press, 2010.

4. K. Subramanya, Open Channel flow, Tata Mc.Grawhill Publishers, 2014.

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO1)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	12/78	15	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
2	15/78	20	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
3	15/78	20	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
4	18/78	23	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	3 3 3 3
5	18/78	23	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	3 3 3 3

JUSTIFICATION STATEMENTS:

CO1: Understand the basic characteristics and behavior of fluids

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO2: Apply the laws of fluid statics and concepts of Buoyancy

Action Verb: Apply (L3)

PO1: Apply(L3)

CO2 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO2: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

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

CO3: Apply the law of conservation of mass to differentiate type of flow in a pipe

Action Verb: Apply (L3)

PO1: Apply(L3)

CO3 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO3: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

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

CO4: Analyze the discharge of fluid flow in pipes using law of conservation of energy

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO5: Analyze the energy losses and flow characteristics through closed conduits

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

CO5 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as moderate (3).

II YEAR

I SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20AHSMB01	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS	2	1	0	3

Course Outcomes: After studying the course, students 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.

Course Outcomes	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, meaning, 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 HI 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.

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

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	Analyze	1
CO3	22%	Analyze	PO1	Apply	3
CO4	16%	Evaluate	PO2	Analyze	3
CO5	22%	Analyze	PO2	Analyze	3

Justification Statements:

CO1: Understand the fundamentals of Managerial economics and demand concept.

Action Verb: Understand (L2)

PO1 Verb: Apply (L3)

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

CO2: Understand the Concept of Production and cost analysis.

Action Verb: Understand (L2)

PO2: Analyze (L4)

CO2 Action verb is less than PO1 verb by two levels. Therefore, the correlation is low (1)

CO3: Analyze the price output in various markets.

Action Verb: Analyze (L4)

PO1: Apply (L3)

CO3 Action verb is more than PO1 verb by one level. Therefore, the correlation is high (3)

CO4: Evaluate the capital budgeting techniques.

Action Verb : Evaluate (L5)

PO2: Analyze

CO3 Action verb is more than PO1 verb by one level. Therefore, the correlation is high (3)

CO5: Analyze 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)

II Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APC0104	STRENGTH OF MATERIALS LAB	0	0	3	1.5

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

CO1: Apply the engineering principles to analyze the support reactions and bending behavior of beams under different support conditions

CO2: Analyze the relationship between material elastic properties and the performance of mechanical components.

CO3: Analyze the behavior of steel under impact load and couple acting on it.

CO4: Analyze the load-deflection behavior of open-coiled and close-coiled springs under compression

CO5: Evaluate the compressive strength and failure modes of wood and concrete specimens

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Apply	engineering principles to analyze the support reactions and bending behavior	under different loading conditions	of beams	L3
CO2	Analyze	the relationship between material properties		the performance of mechanical components	L4
CO3	Analyze	the behavior of steel	Under impact load and couple acting on it.		L4
CO4	Analyze	the load-deflection behavior of open-coiled and close-coiled springs	under compression		L4
CO5	Evaluate	the compressive strength and failure modes		of wood and concrete Specimen	L5

LABORATORY EXPERIMENTS:

1. Support reactions test on simply supported beam CO1
2. Bell Crank Lever test CO2
3. Tension test CO2
4. Bending test on (Steel/Wood) Cantilever beam. CO1
5. Bending test on simply supported beam. CO1
6. Torsion test. CO3
7. Hardness test. CO1, CO2
8. Compression test on Open coiled springs
9. Compression test on Closely coiled springs
10. Compression test on wood/ concrete CO5
11. Izod / Charpy Impact test on metals CO3
12. Shear test on metals CO2
13. Continuous beam – deflection test CO1

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes		Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	CO's Action Verb	BTL			
1	Apply	L3	PO1	Apply (L3)	3
			PO2	Analyze (L4)	2
			PO6	Thumb Rule	2
2	Analyze	L4	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
3	Analyze	L3	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analysis (L4)	3
			PO6	Thumb Rule	3
4	Analyze	L4	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analysis (L4)	3
			PO6	Thumb Rule	3
5	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analysis (L4)	3
			PO6	Thumb Rule	3
			PO11	Thumb Rule	3

JUSTIFICATION STATEMENTS:

CO1: Apply the engineering principles to analyze the support reactions and bending behavior of beams under different support conditions

Action Verb: Apply (L3)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO1 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

CO2: Analyze the relationship between material elastic properties and the performance of mechanical components.

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO3: Analyze the behavior of steel under impact load and couple acting on it.

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO4: Analyze the load-deflection behavior of open-coiled and close-coiled springs under compression

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO5: Evaluate the compressive strength and failure modes of wood and concrete specimens.

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO5: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO5 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO5 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO4: Design

CO5 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

PO11: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO11 as High (3)

II Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APC0105	SURVEYING LAB	0	0	3	1.5

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

CO1: Apply the triangulation method to measure the area of a given boundary.

CO2: Apply the traversing method to measure the area of a given boundary.

CO3: Analyze the elevations on the surface of the ground by levelling methods.

CO4: Analyze the height, horizontal and vertical angles by theodolite on earth surface.

CO5: Evaluate the elevations, depressions and distance on the ground surface for preparation of maps.

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Apply	triangulation method		to measure the area of a given boundary	L3
CO2	Apply	Traversing method		to measure the area of a given boundary	L3
CO3	Analyze	the elevations on the surface of the ground	levelling methods		L3
CO4	Analyze	the height, horizontal and vertical angles	by theodolite	on earth surface	L4
CO5	Evaluate	the elevations, depressions and distance on the ground surface		preparation of maps.	L5

LIST OF FIELD WORKS:

1. Chain Survey: Finding the area of a given boundary CO1
2. Plane table survey: Finding the area of a given boundary CO1
3. Compass Survey: Determining the Horizontal Angles and Area CO2
4. Fly levelling: Height of the instrument method and rise and fall method. CO3
5. Measurement of Horizontal and vertical angle by Theodolite CO4
6. Determination of height of building using Theodolite CO4
7. Total Station: Determination of Remote height and distance. CO5
8. Total Station: Determination of area. CO5
9. Total Station: Preparation of contour maps for small area CO5
10. Stake out using total station CO5

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes		Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	CO's Action Verb	BTL			
1	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
2	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	3 3 3 3
4	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	3 3 3 3
5	Evaluate	L5	PO1 PO2 PO4 PO6 PO11	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule Thumb Rule	3 3 3 3 3

JUSTIFICATION STATEMENTS:

CO1: Apply the triangulation method to measure the area of a given boundary.

Action Verb: Apply (L3)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO1 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

CO2: Apply the traversing method to measure the area of a given boundary.

Action Verb: Apply (L3)

PO1: Apply(L3)

CO2 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO2: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

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

CO3: Analyze the elevations on the surface of the ground by levelling methods

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO4: Analyze the height, horizontal and vertical angles by theodolite on earth surface.

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO5: Evaluate the elevations, depressions and distance on the ground surface for preparation of maps.

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO5: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO5 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO5 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO4: Design

CO5 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

PO11: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO11 as High (3)

II Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APC0106	FLUID MECHANICS LAB	0	0	3	1.5

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

CO1: Analyze the behavior of fluid flow in pipes by Bernoulli's equation.

CO2: Evaluate the rate of flow through the closed conduits

CO3: Analyze the Coefficient of discharge for small orifice and external mouthpiece

CO4: Evaluate the performance of contracted rectangular notch and triangular notch

CO5: Analyze the frictional losses in various cross sections of pipe by varying pressure

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Analyze	the behavior of fluid flow in pipes	by Bernoulli's equation.		L4
CO2	Evaluate	the rate of flow		through the closed conduits	L5
CO3	Analyze	coefficient of discharge	for small orifice and external mouthpiece		L4
CO4	Evaluate	the performance of contracted rectangular notch and triangular notch			L5
CO5	Analyze	frictional losses in various cross sections of pipe	by varying pressure		L4

LABORATORY EXPERIMENTS

1. Verification of Bernoulli's equation. CO1
2. Calibration of Venturimeter CO2
3. Calibration of Orifice meter CO2
4. Determination of Coefficient of discharge for a small orifice by constant head method. CO3
5. Determination of Coefficient of discharge for an external mouth piece by variable head method. CO3
6. Calibration of contracted Rectangular Notch CO4
7. Calibration of contracted Triangular Notch CO4
8. Determination of friction factor CO5

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes		Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	CO's Action Verb	BTL			
1	Analyze	L4	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
2	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analysis (L4)	3
			PO6	Thumb Rule	3
			PO11	Thumb Rule	3
3	Analyze	L4	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
4	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
			PO11	Thumb Rule	3
5	Analyze	L4	PO1	Apply (L3)	2
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3

JUSTIFICATION STATEMENTS:

CO1: Analyze the behavior of fluid flow in pipes by Bernoulli's equation.

Action Verb: Analyze (L4)

PO1: Apply(L3)

CO1 Action verb is greater than PO1 verb. Therefore, the correlation is moderate

(2). PO2: Analyze (L4)

CO1 Action verb is equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

CO1 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as High (3)

CO2: Evaluate the rate of flow through the closed conduits.

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO2: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO2 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO2 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO4: Design

CO2 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

PO11: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO11 as High (3)

CO3: Analyze the Coefficient of discharge for small orifice and external mouthpiece.

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO4: Evaluate the performance of contracted rectangular notch and triangular notch.

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO4: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO4 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO4: Design

CO4 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

PO11: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO11 as High (3)

CO5: Analyze the frictional losses in various cross sections of pipe by varying pressure.

Action Verb: Analyze (L4)

PO1: Apply(L3)

CO5 Action verb is greater than PO1 verb. Therefore, the correlation is moderate (2). PO2: Analyze (L4)

CO5 Action verb is equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

CO5 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as High (3)

II Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APC0107	BASICS OF CAD	0	1	2	2

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

CO1: Understand the tools of CAD Software

CO2: Understand of concept of co-ordinate methods.

CO3: Understand the isometric views

CO4: Understand the isometric views for brick wall

Course Outcomes	Action Verb	Knowledge Statement	Criteria	Blooms Level
CO1	Understand	The tools of	CAD Software	L2
CO2	Understand	Concept of Coordinate methods		L2
CO3	Understand	The isometric views		L2
CO4	Understand	The isometric views	For brick wall	L2

LIST OF EXPERIMENTS

1. INTRODUCTION TO COMPUTER AIDED DESIGN
2. ABSOLUTE CO ORDINATE METHOD
3. RELATIVE CO ORDINATE METHOD
4. POLAR CO ORDINATE METHOD
5. CO-ORDINATE METHOD
6. ISOMETRIC VIEW -1
7. ISOMETRIC VIEW -2
8. ISOMETRIC VIEW -3
9. ISOMETRIC VIEW OF ONE BRICK WALL ENGLISH BOND
10. ISOMETRIC VIEW OF ONE BRICK WALL FLEMISH BOND

MAPPING OF COS TO POS AND PSOS

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes		Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	CO's Action Verb	BTL			
1	Understand	L2	PO1 PO5	Apply (L3) Apply (L3)	2 2
2	Understand	L2	PO1 PO5	Apply (L3) Apply (L3)	2 2
3	Understand	L2	PO1 PO5	Apply (L3) Apply (L3)	2 2
5	Understand	L2	PO1 PO5	Apply (L3) Apply (L3)	2 2

JUSTIFICATION STATEMENTS:

CO1: Understand the tools of CAD Software.

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO5: Apply(L3)

CO1 Action Verb is less than PO5 verb by one level; Therefore, correlation is moderate (2).

CO2: Understand of concept of co-ordinate methods.

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO5: Apply(L3)

CO2 Action Verb is less than PO5 verb by one level; Therefore, correlation is moderate (2).

CO3: Understand the isometric views.

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO5: Apply(L3)

CO3 Action Verb is less than PO5 verb by one level; Therefore, correlation is moderate (2).

CO4: Understand the isometric views for brick wall

Action Verb: Apply (L3)

Action Verb: Understand (L2)

PO1: Apply(L3)

CO4 Action verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO5: Apply(L3)

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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)

CIVIL ENGINEERING

AK20 REGULATION

(Effective for the student admitted from the AY 2022-23 & LE from 2023-24)

II Year

I Semester

Subject code	SUBJECT NAME	L	T/CLC	P	Credits
20AMC9903	ENVIRONMENTAL STUDIES	2	1	0	0

Course Outcomes: After studying the course, students 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

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	Multidisciplinary nature of environmental studies and various renewable and nonrenewable resources			L2
CO2	Understand	Ecosystem and biodiversity to solve complex environmental problems			L2
CO3	Apply	Various types of pollution and solid waste management and related preventive measures			L3
CO4	Apply	Rainwater harvesting, watershed management, ozone layer depletion and wasteland reclamation			L3
CO5	Understand	Population explosion			L2

UNIT – I

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

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-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man – wildlife conflicts – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III

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

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

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.

TEXT BOOKS:

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.

REFERENCES:

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 COS TO POS AND PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	10	12	23	3	Understand	L2	PO6, PO7	2 2
2	15	15	28	3	Understand	L2	PO7	2
3	8	8	15	2	Apply	L3	PO6 PO7	2 2
4	9	10	19	2	Apply	L3	PO6, PO7	2 2
5	8	8	15	2	Understand	L2	PO7	2
	50	53	100					

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)

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CIVIL ENGINEERING

AK20 REGULATION

(Effective for the student admitted from the AY 2022-23 & LE from 2023-24)

Semester IV (Second year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T/CLC	P		C	CIE	SEE
1	Basic Science courses	20ABS9922	Mathematical Modelling and optimization techniques	2	1	0	3	30	70	100
2	Professional core course	20APC0108	Strength of Materials	2	1	0	3	30	70	100
3	Professional core course	20APC0109	Hydraulic Engineering	2	1	0	3	30	70	100
4	Professional core course	20APC0110	Structural Analysis-I	2	1	0	3	30	70	100
5	Professional core course	20APC0111	Concrete Technology	2	1	0	3	30	70	100
6	Humanity Science Courses	20AHS9905	Universal Human Values	2	1	0	3	30	70	100
7	Professional core courses (LAB)	20APC0112	Hydraulic Machinery Lab	0	0	3	1.5	30	70	100
8	Professional core courses (LAB)	20APC0113	Concrete Technology Lab	0	0	3	1.5	30	70	100
9	Professional core courses (LAB)	20APC0114	Computer-aided Civil Engineering Drawing Lab	0	0	3	1.5	30	70	100
10	Skill Oriented Course*	20APC0115	Land survey with 2D drafting /Soft Skills	0	1	2	2	100	-	100
Total credits							24.5	370	630	1000
<p>Community Service Project (Mandatory) for 6 weeks duration during summer vacation. (To visit the selected community to conduct survey (Socio-economic & domain survey) and conduct sensitization/awareness program/activities at the end of IV- semester before commencement of V-semester and complete immersion programme also during V-Semester and submit report in V - semester. Assessment will be done at the end of V-Semester)</p>										
Honors/ Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)				3	1	0	4	30	70	100

II YEAR

II SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20ABS9922	MATHEMATICAL MODELING AND OPTIMIZATION TECHNIQUES	2	1	0	3

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

- CO1:** Analyze the classifications and stages of mathematical modeling.
- CO2:** Apply the techniques to build different mathematical models.
- CO3:** Evaluate the linear programming problems by various computational methods.
- CO4:** Analyze the best solution of assignment and transportation problems.
- CO5:** Apply the techniques to solve problems related to Game theory.

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Analyze	the classifications and stages of mathematical modeling			L4
CO2	Apply	techniques to build different mathematical models			L3
CO3	Evaluate	the linear programming problems	by various computational methods		L5
CO4	Analyze	the best solution of assignment and transportation problems			L4
CO5	Apply	the techniques to solve problems related to Game theory			L3

UNIT I: INTRODUCTION TO MODELLING, BUILDING MODELS

What is mathematical modelling? What objectives can modelling achieve? Classifications of models Stages of modelling. Systems analysis- Making assumptions- Flow diagrams- Choosing mathematical equations.

UNIT II: STUDYING MODELS

Equations from the literature- Analogies from physics-Data exploration, Dimensionless form - Asymptotic behaviour- Sensitivity analysis - Modelling model output

UNIT III: LINEAR PROGRAMMING PROBLEMS(LPP)

Linear programming problems (LPP)-Graphical method -Simplex method -Big M Method-Dual simplex method.

UNIT IV: TRANSPORTATION & ASSIGNMENT PROBLEM

Formulation of transportation model, Basic feasible solution using different methods, Optimality Methods, Unbalanced transportation problem, Degeneracy in transportation problems, Applications of Transportation problems. Assignment Problem: Formulation, unbalanced assignment problem, Travelling salesman problem.

UNIT V: GAME THEORY

Formulation of games, Two person-Zero sum game, Mini max and Max min Principle, games with and

without saddle point, Rules of dominance, Solving a 2x2 game using graphical method.

TEXT BOOKS:

1. Mathematical Modeling: by MajidJaberi-Douraki and Seyed M. Moghadas
2. Operations Research , S.D. Sharma.

REFERENCES:

1. Operations Research, An Introduction, Hamdy A. Taha, Pearson publishers.

Online Learning Resources:

https://people.maths.bris.ac.uk/~madjl/course_text.pdf

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

CO	CO					Program Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation
	Lesson Plan (Hrs)	%	Correlation	Verb	BTL			
1	11	14	2	Analyze	L4	PO2	Analyze(L4)	3
2	17	22	3	Apply	L3	PO1	Apply (L3)	3
3	16	21	3	Evaluate	L5	PO2	Analyze (L4)	3
4	16	21	3	Analyze	L4	PO2	Analyze (L4)	3
5	16	21	3	Apply	L3	PO1	Apply(L3)	3

JUSTIFICATION STATEMENTS:

CO1: Analyze the classifications and stages of mathematical modeling.

Action Verb: Analyze (L4)

PO2 Verb: **Analyze (L4)**

CO1 Action Verb is equal to PO2 verb; Therefore, correlation is moderate (2).

CO2: Apply the techniques to build different mathematical models.

Action Verb: Apply (L3)

PO1 Verb: **Apply (L3)**

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

CO3: Evaluate linear programming problems by various computational methods.

Action Verb: Evaluate(L5)

PO2 Verb: **Analyze (L4)**

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

CO4: Analyze the best solution of assignment and transportation problems.

Action Verb: Analyze (L4)

PO2 Verb: **Analyze (L4)**

CO4 Action Verb level is low to PO2 verb by two levels; Therefore, correlation is moderate (2).

CO5: Apply the techniques to solve problems related to Game theory.

Action Verb: Apply (L3)

PO1 Verb: Apply (L3)

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

II YEAR

II SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20APC0108	STRENGTH OF MATERIALS	2	1	0	3

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

CO1: Apply the simple bending theory for standard cross-sectional beams

CO2: Analyze the shear stress in beams and combined direct and bending stresses in columns under the eccentric loading

CO3: Apply the Euler's and Rankine's formula theory to find critical load for different end conditions

CO4: Analyze the torsion and power transmission through circular shafts

CO5: Apply the theory of principal stresses and theories of failure in structural members

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Apply	the simple bending theory		for standard cross-sectional beams	L3
CO2	Analyze	the shear stress & combined direct, direct stresses	eccentric loading	beams & columns	L4
CO3	Apply	the critical load for different end conditions	Euler's and Rankine's formula theory		L3
CO4	Analyze	the torsion and power transmission	through circular shafts		L4
CO5	Apply	the theory of principal stresses and theories of failure	in structural members		L3

UNIT – I

Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/Y = E/R$ – Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel Sections – Design of simple beam sections.

UNIT – II SHEAR STRESSES

Derivation of formula-Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T and angle sections. Combined bending and shear.

COMBINED DIRECT AND BENDING STRESSES: Introduction-eccentric loading – columns with eccentric loading – symmetrical columns with eccentric loading about one axis –about two axes – Unsymmetrical columns with eccentric loading – limit of eccentricity.

UNIT – III COLUMNS AND STRUTS

Introduction – classification of columns – Axially loaded compression members – Euler's crippling load theory – derivation of Euler's critical load formulae for various end conditions – Equivalent length – Slenderness ratio – Euler's critical stress – Limitations of Euler's theory – Rankine – Gordon formula.

UNIT – IV TORSION

Theory of pure torsion – Assumptions and Derivation of Torsion formula for circular shaft – Torsional moment of resistance – Polar section modulus – power transmission through shafts – Combined bending and torsion.

UNIT – V COMPOUND STRESSES AND STRAINS

Two-dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of

stress, and its applications. Two-dimensional stress-strain system, principal strains and principal axis of strain, circle of strain.

THEORIES OF FAILURES: Various Theories of failures like Maximum Principal stress theory – Maximum Principal strain theory – Maximum shear stress theory – Maximum strain energy theory – Maximum shear strain energy theory

TEXT BOOKS:

1. R.K Bansal, Engineering Mechanics, Lakshmi Publications,2015.
2. R. K. Bansal, Strength of Materials, Lakshmi Publications House Pvt. Ltd,2015.
3. R. Subramanian, Strength of Materials, Oxford University Press,2016.

REFERENCES:

1. S.S. Bhavakatti, Engineering Mechanics, New Age Publishers.
2. S. Timoshenko, D.H. Young and J.V. Rao, Engineering Mechanics, Tata McGraw-Hill Company.
3. Sadhu Singh, Strength of Materials, Khanna Publishers 11th edition 2015.

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s):Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	16/80	20	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
2	16/80	20	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	3 3 3 3
3	16/80	20	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
4	16/80	20	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	3 3 3 3
5	16/80	20	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2

JUSTIFICATION STATEMENTS:

CO1: Apply the simple bending theory for standard cross-sectional beams.

Action Verb: Apply (L3)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO1 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

CO2: Analyze the shear stress in beams and combined direct and bending stresses in columns under the eccentric loading

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO3: Apply the Euler's and Rankine's formula theory to find critical load for different end conditions.

Action Verb: Apply (L3)

PO1: Apply(L3)

CO3 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO3: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

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

CO4: Analyze the torsion and power transmission through circular shafts.

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO5: Apply the theory of principal stresses and theories of failure in structural members.

Action Verb: Apply (L3)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO5: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO5 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

II YEAR

II SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20APC0109	HYDRAULIC ENGINEERING	2	1	0	3

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

- CO1: Apply the Laminar and Turbulent flow concept in pipes
- CO2: Analyze the uniform flows in open-channel flow systems.
- CO3: Analyze the non-uniform flows in open-channel flow systems
- CO4: Evaluate the performance of impact of jets on plates and its application in different turbines.
- CO5: Analyze the performance of Centrifugal pumps

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Apply	the laminar and turbulent concept	in pipes		L2
CO2	Analyze	the uniform flows	in open-channel flow systems		L4
CO3	Analyze	the non-uniform flows	in open-channel flow systems		L4
CO4	Evaluate	the performance of impact of jets	on plates & turbines		L5
CO5	Analyze	the performance of centrifugal pumps			L4

UNIT – I LAMINAR & TURBULENT FLOW IN PIPES

Laminar Flow- Laminar flow through: circular pipes. Stoke’s law, Measurement of viscosity. Turbulent Flow-Reynolds experiment, Transition from laminar to turbulent flow. Definition of turbulence, scale and intensity, Causes of turbulence, instability

UNIT – II UNIFORM FLOW IN OPEN CHANNELS

Open Channel Flow-Comparison between open channel flow and pipe flow, classification of open channels, classification of open channel flow, Velocity Distribution of channel section. Uniform Flow-Continuity Equation, Energy Equation and Momentum Equation, Chezy’s formula, Manning’s formula. Computation of Uniform flow.

UNIT – III NON-UNIFORM FLOW IN OPEN CHANNELS

Specific energy, critical flow, discharge curve, Specific force, Specific depth, and Critical depth. Measurement of Discharge and Velocity. Gradually Varied Flow- Dynamic Equation of Gradually Varied Flow. Hydraulic Jump and classification.

UNIT – IV IMPACT OF JETS

Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes – velocity triangles at inlet and outlet - Work done and efficiency.

HYDRAULIC TURBINES: Classification of turbines; pelton wheel and its design. Francis turbine and its design – efficiency - Draft tube: theory - characteristic curves of hydraulic turbines.

UNIT -V CENTRIFUGAL PUMPS

Working principles of a centrifugal pump, work done by impeller; heads, losses and efficiencies; minimum starting speed; Priming; specific speed; net positive suction head (NPSH); Performance and characteristic curves; Cavitation effects; Dimensional analysis and hydraulic similitude.

TEXT BOOKS:

1. P. M. Modi and S. M. Seth, Hydraulics and Fluid Mechanics, Standard Book House ,2015.
2. D. S. Kumar Fluid Mechanics & Fluid Power Engineering, Kataria& Sons 2014.

REFERENCES:

1. Rajput, Fluid mechanics and fluid machines, S. Chand & Co
2. K. Subramanya, Open channel Flow, Tata McGraw Hill.
3. Srinivasan, Open channel flow by, Oxford University Press
4. Banga& Sharma, Hydraulic Machines, Khanna Publishers.

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	11/82	13	2	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
2	17/82	21	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	2 3 3 3
3	17/82	21	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	2 3 3 3
4	19/82	23	3	Evaluate	L5	PO1 PO2 PO3 PO4 PO6 PO11	Apply (L3) Analyze (L4) Design (L6) Analysis (L4) Thumb Rule Thumb Rule	2 2 2 2 3 3
5	18/82	22	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	2 3 3 3

JUSTIFICATION STATEMENTS:

CO1: Apply the Laminar and Turbulent flow concept in pipes

Action Verb: Apply (L3)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO1 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

CO2: Analyze the uniform flows in open-channel flow systems.

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO3: Analyze the non-uniform flows in open-channel flow systems

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO4: Evaluate the performance of impact of jets on plates and its application in different turbines.

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO4: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO4 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO4: Design

CO4 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

PO11: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO11 as High (3)

CO5: Analyze the performance of Centrifugal pumps

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

CO5 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as moderate (3).

II YEAR

II SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20APC0110	STRUCTURAL ANALYSIS - I	2	1	0	3

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

- CO1:** Analyze the fixed beam with yielding of supports
- CO2:** Analyze the beams using slope deflection method
- CO3:** Analyze the beams using moment distribution methods
- CO4:** Apply the energy theorems for analysis of indeterminate structures
- CO5:** Analyze the determinate and indeterminate trusses using Castigliano's theorems

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Analyze	the yielding of supports		fixed beam	L4
CO2	Analyze	the beams	using slope deflection method		L4
CO3	Analyze	the beams	using moment distribution methods		L4
CO4	Apply	the energy theorems		for analysis of indeterminate structures	L3
CO5	Analyze	the determinate and indeterminate trusses	using Castigliano's theorems		L4

UNIT – I FIXED BEAMS

Indeterminate Structural Analysis – Determination of static and kinematic indeterminacies- Analysis of fixed beams - uniformly distributed load, central point load, eccentric point load, number of point loads, uniformly varying load and combination of loads – Shear force and Bending moment diagrams – effect of sinking of support, effect of rotation of a support.

UNIT – II SLOPE-DEFLECTION METHOD

Introduction- derivation of slope deflection equation- application to continuous beams with and without settlement of supports.

UNIT – III MOMENT DISTRIBUTION METHOD

Introduction to moment distribution method- application to continuous beams with and without settlement of supports.

UNIT – IV ENERGY THEOREMS

Strain energy – Resilience – Gradual, Sudden and impact loadings – simple applications. Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear force – Castigliano's first theorem -Deflections of simple beams (Determinate beams).

UNIT – V ANALYSIS OF DETERMINATE AND INDETERMINATE TRUSSES

Analysis of Determinate trusses by method of joints - Analysis of Indeterminate trusses with single degree internal and external indeterminacy – Castigliano's theorems.

TEXT BOOKS:

1. S.S. Bhavikatti, “Structural Analysis”, Volume 1 and 2, Vikas Publishing House, Pvt. Ltd.
2. S. Ramamurtham, “Theory of Structures”, DhanpatRai Publishing Company (p) Ltd, 2009
3. C. S. Reddy, “Basic Structural Analysis”, Tata McGraw Hill

REFERENCES:

1. Timoshenko & Young, “Theory of Structures”, Tata McGraw Hill
2. S. B. Junarkar, “Structural Mechanics” Vol I & II, Charotar Publishers
3. C. K. Wang, “Intermediate Structural Analysis”, McGraw Hill

MAPPING OF COS TO POS AND PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	16/80	20	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	3 3 3 3
2	16/80	20	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	3 3 3 3
3	16/80	20	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	3 3 3 3
4	16/80	20	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
5	16/80	20	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	3 3 3 3

JUSTIFICATION STATEMENTS:

CO1: Analyze the fixed beam with yielding of supports.

Action Verb: Analyze (L4)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action verb is equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

CO1 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as moderate (3).

CO2: Analyze the beams using slope deflection method.

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO3: Analyze the beams using moment distribution methods.

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO4: Apply the energy theorems for analysis of indeterminate structures.

Action Verb: Apply (L3)

PO1: Apply(L3)

CO4 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO4: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO4 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

CO5: Analyze the determinate and indeterminate trusses using Castigliano's theorems.

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

CO5 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as moderate (3).

II YEAR

II SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20APC0111	CONCRETE TECHNOLOGY	2	1	0	3

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

- CO1: Understand the properties of cement and behavior of admixtures
- CO2: Understand the properties of aggregates and manufacturing process of concrete
- CO3: Understand the properties of fresh and hardened concrete
- CO4: Understand NDT testing techniques and engineering properties of concrete
- CO5: Design concrete mix proportioning for economical and durable concrete based on IS standards

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	properties & behavior		of cement & admixtures	L2
CO2	Understand	properties and manufacturing process		of aggregates & concrete	L2
CO3	Understand	properties of fresh and hardened		concrete	L2
CO4	Understand	NDT testing techniques and engineering properties		of concrete	L2
CO5	Design	mix proportioning for economical and durable concrete	based on is standards		L6

UNIT – I CEMENT & ADMIXTURES

Portland cement – Chemical composition - Properties of Bogue’s compounds – Hydration, Setting of cement – Tests on physical properties – Different grades of cement. Admixtures: Types of admixtures – mineral and chemical admixtures.

UNIT – II AGGREGATES, WATER & MANUFACTURE OF CONCRETE

Classification of aggregate – Particle shape & texture, properties of aggregate – Specific gravity, Bulk density, adsorption & moisture content of aggregate – Bulking of sand – Deleterious substance in aggregate - Alkali aggregate reaction – Sieve analysis – Fineness modulus – Grading of Aggregates - Quality of mixing water – Steps in manufacture of concrete – Curing.

UNIT – III FRESH CONCRETE

Workability – Factors affecting workability – Measurement of workability by slump test, compaction factor test and Vee-Bee test – Segregation & bleeding

HARDENED CONCRETE: Water / Cement ratio – Abram’s Law – Compression test – Flexure test – Splitting test - Factors affecting strength – Relation between compression and tensile strength

UNIT – IV NON-DESTRUCTIVE TESTING

Non-destructive testing methods - UPV and Rebound Hammer tests.

ELASTICITY, CREEP & SHRINKAGE: – Static Modulus of elasticity – Poisson’s ratio – Creep of concrete – Factors influencing creep – Relation between creep & time – Shrinkage – types of shrinkage.

UNIT – V MIX DESIGN

Factors in the choice of mix proportions – Quality Control of concrete – Proportioning of concrete mixes by various methods – BIS method of mix design.

DURABILITY OF CONCRETE: Durability concept - Permeability of concrete - Methods to increasing durability of concrete

TEXT BOOKS

1. Concrete Technology by M.S. Shetty. – S. Chand & Co.; 2004
2. Concrete Technology by A.R. Santhakumar, 2nd Edition, Oxford university Press, New Delhi
3. Concrete Technology by M. L. Gambhir. – Tata Mc. Graw Hill Publishers, New Delhi

REFERENCES

1. Properties of Concrete by A. M. Neville – Low priced Edition – 4th edition
2. Concrete: Micro structure, Properties and Materials – P.K. Mehta and J.M. Monteiro, Mc-Graw Hill Publishers

IS CODES: IS 383, IS 516, IS 10262 – 2019

MAPPING OF COS TO POS AND PSOS

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	9/60	15	2	Understand	L2	PO1 PO2 PO7	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
2	11/60	18	2	Understand	L2	PO1 PO2 PO7	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
3	11/60	18	2	Understand	L2	PO1 PO2 PO7	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
4	10/60	17	2	Understand	L2	PO1 PO2 PO7	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
5	19/60	32	3	Design	L6	PO1 PO2 PO3 PO4 PO6	Apply (L3) Analyze (L4) Thumb Rule Analyze (L4) Thumb Rule	2 2 3 2 3

JUSTIFICATION STATEMENTS:

CO1: Understand the properties of cement and behavior of admixtures

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO2: Understand the properties of fresh and hardened concrete

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO2 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO3: Understand the properties of fresh and hardened concrete

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO3 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO3 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO4: Understand NDT testing techniques and engineering properties of concrete.

Action Verb: Understand (L2)

PO1: Apply(L3)

CO4 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO4 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO5: Design concrete mix proportioning for economical and durable concrete based on IS standards

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO5: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

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

PO3: Design

CO5 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO5 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

II YEAR

II SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20AHS9905	UNIVERSAL HUMAN VALUES	2	1	0	3

Course Outcomes: After studying the course, students 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.

Course Outcomes	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 ecofriendly 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: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantik, 1999.
2. A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"
5. E. F. Schumacher. "Small is Beautiful"
6. Slow is Beautiful – Cecile Andrews

MAPPING OF COS TO POS AND PSOS

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

CO-PO MAPPING JUSTIFICATION:

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, PO11		2,2
2	8	22.2	3	Analyze	4	PO7, PO8		3,3
3	7	19.4	2	Apply	3	PO6, PO7, PO8		2,2,2
4	8	22.2	3	Evaluate	5	PO6, PO7, PO8, PO11		3,3,3,3
5	7	19.4	2	Apply	3	PO6, PO7, PO8, PO11		2,2,2,2

JUSTIFICATION:

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

Action Verb: Understand (L2)

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

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

Action Verb: Analyze (L4)

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

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

Action Verb: Apply (L3)

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

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

Action Verb: Evaluate (L5)

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

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

Action Verb: Apply (L3)

CO5 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).

II Year

II Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APC0112	HYDRAULIC MACHINERY LAB	0	0	3	1.5

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

CO1 Analyze the phenomenon of a hydraulic jump in open channel flow

CO2 Analyze the impact force exerted by a jet on vanes vertically and inclined.

CO3 Evaluate the performance characteristics of Pelton wheel and Francis turbines

CO4 Evaluate the performance of centrifugal and reciprocating pumps by varying pressure

CO5 Analyze the minor losses in pipe flow systems by determining the coefficient of loss for various pipe fittings.

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Analyze	phenomenon of a hydraulic jump	in open channel flow		L4
CO2	Analyze	the impact force exerted by a jet on vanes	vertically and inclined		L4
CO3	Evaluate	the performance characteristics of Pelton wheel and Francis turbines			L5
CO4	Evaluate	the performance of centrifugal and reciprocating pumps	by varying pressure		L5
CO5	Analyze	the minor losses in pipe flow systems	by determining the coefficient of loss	for various pipe fittings.	L4

LABORATORY EXPERIMENTS

1. Study of Hydraulic jump CO1
2. Impact of jet on vanes CO2
3. Performance test on Pelton wheel turbine. CO3
4. Performance test on Francis turbine.CO3
5. Efficiency test on single stage centrifugal pump. CO4
6. Efficiency test on Multi stage centrifugal pump. CO4
7. Efficiency test on reciprocating pump. CO4
8. Determination of Coefficient of loss of head in minor losses (Pipe fittings) CO5

MAPPING OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes		Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	CO's Action Verb	BTL			
1	Analyze	L4	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
2	Analyze	L4	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
3	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
			PO11	Thumb Rule	3
4	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
			PO11	Thumb Rule	3
5	Analyze	L4	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3

JUSTIFICATION STATEMENTS:

CO1: Analyze the phenomenon of a hydraulic jump in open channel flow

Action Verb: Analyze (L4)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action verb is equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

CO1 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as moderate (3).

CO2: Analyze the impact force exerted by a jet on vanes vertically and inclined

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO3: Evaluate the performance characteristics of Pelton wheel and Francis turbines

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO3: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO3 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO3 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO4: Design

CO3 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

PO11: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO11 as High (3)

CO4: Evaluate the performance of centrifugal and reciprocating pumps by varying pressure

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO4: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO4 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO4: Design

CO4 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

PO11: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO11 as High (3)

CO5: Analyze the minor losses in pipe flow systems by determining the coefficient of loss for various pipe fittings.

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

CO5 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as moderate (3).

II Year

II Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APC0113	CONCRETE TECHNOLOGY LAB	0	0	3	1.5

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

CO1: Evaluate the quality and suitability of cement for concrete production

CO2: Analyze the compressive strength of cement mortar by standardized testing procedures

CO3: Analyze the fresh and hardened properties of concrete

CO4: Evaluate the quality and suitability of aggregates for concrete production

CO5: Apply the principles of Non-Destructive Testing (NDT) methods for assessment of structural members

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Evaluate	the quality and suitability of cement	for concrete production		L5
CO2	Analyze	compressive strength of cement mortar		by standardized testing procedures	L4
CO3	Analyze	the fresh and hardened properties of concrete			L4
CO4	Evaluate	the quality and suitability of aggregates	for concrete production		L5
CO5	Apply	the principles of non-destructive testing (ndt) methods	for assessment of structural members		L3

LABORATORY EXPERIMENTS

1. Normal Consistency and fineness of cement. CO1
2. Initial setting time and final setting time of cement CO1.
3. Specific gravity and soundness of cement. CO1
4. Compressive strength of cement mortar. CO2
5. Workability test on concrete by compaction factor, slump and Vee-bee. CO3
6. Compressive strength, Tensile strength and Young's modulus of concrete. CO2
7. Specific Gravity and Water Absorption of Coarse aggregate. CO4
8. Bulking of Fine aggregate. CO4
9. Specific Gravity and Water Absorption of fine aggregate. CO4
10. Grain size distribution of coarse aggregate and fine aggregate CO4
11. Non-Destructive testing on concrete (for demonstration) CO5

MAPPING OF COS TO POS AND PSOS

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes		Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	CO's Action Verb	BTL			
1	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analysis (L4)	3
			PO6	Thumb Rule	3
			PO11	Thumb Rule	3
2	Analyze	L4	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analysis (L4)	3
			PO6	Thumb Rule	3
3	Analyze	L4	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analysis (L4)	3
			PO6	Thumb Rule	3
4	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analysis (L4)	3
			PO6	Thumb Rule	3
			PO11	Thumb Rule	3
5	Apply	L3	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analysis (L4)	3
			PO6	Thumb Rule	3

JUSTIFICATION STATEMENTS:

CO1: Evaluate the quality and suitability of cement for concrete production

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO1: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO1 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

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

PO4: Design

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

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

PO11: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO11 as High (3)

CO2: Analyze the compressive strength of cement mortar by standardized testing procedures

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO3: Analyze the fresh and hardened properties of concrete

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO4: Evaluate the quality and suitability of aggregates for concrete production

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO4: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO4 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO4: Design

CO4 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

PO11: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO11 as High (3)

CO5: Apply the principles of Non-Destructive Testing (NDT) methods for assessment of structural members

Action Verb: Apply (L3)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO5: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO5 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

II Year

II Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APC0114	COMPUTER-AIDED CIVIL ENGINEERING DRAWING LAB	0	0	3	1.5

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

CO1: Apply the fundamental CAD concepts and commands to practice the exercises.

CO2: Create the single and multi-storey buildings based on the NBC and BIS guidelines.

CO3: Evaluate the sectional and elevation views of the building based on the NBC and BIS guidelines

CO4: Evaluate the detailing of building components based on NBC and BIS guidelines.

CO5: Evaluate the building component roof trusses using CAD software

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Apply	the fundamental CAD concepts and CAD commands to practice the exercises.			L3
CO2	Create	the single and multi-storey buildings	based on the NBC and BIS guidelines		L6
CO3	Evaluate	the sectional and elevation views of the building	based on the NBC and BIS guidelines		L5
CO4	Evaluate	the detailing of building components	based on the NBC and BIS guidelines		L5
CO5	Evaluate	the building component roof trusses	using CAD software		L5

LIST OF THE EXPERIMENTS

1. Introduction to computer aided drafting and Practice exercises on CAD Commands- CO1
2. Drawing of plans for Single storey buildings-CO2
3. Drawing of plans for Multi storey buildings-CO2
4. Development of sections and elevations for Single storey buildings-CO3
5. Development of sections and elevations for Multi storey buildings-CO3
6. Detailing of building components like doors, windows-CO4
7. Development of building components roof trusses-CO5

MAPPING OF COS TO POS AND PSOS

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes		Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	CO's Action Verb	BTL			
1	Apply	L3	PO1	Apply (L3)	3
			PO2	Analyze (L4)	2
			PO4	Analyze (L4)	2
			PO5	Create(L6)	1
			PO6	Thumb Rule	2
2	Create	L6	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO5	Create(L6)	3
			PO6	Thumb Rule	3
3	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO5	Create(L6)	2
			PO6	Thumb Rule	3
4	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO5	Create(L6)	2
			PO6	Thumb Rule	3
5	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO5	Create(L6)	2
			PO6	Thumb Rule	3

JUSTIFICATION STATEMENTS:

CO1: Apply the fundamental CAD concepts and commands to practice the exercises.

Action Verb: Apply (L3)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO1 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

CO2: Create the single and multi-storey buildings based on the NBC and BIS guidelines.

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO2: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO2 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO2 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO2 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

CO3: Evaluate the sectional and elevation views of the building based on the NBC and BIS guidelines

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO3: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO3 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO3 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO4: Design

CO3 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

CO4: Evaluate the detailing of building components based on NBC and BIS guidelines.

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO4: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO4 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO4: Design

CO4 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

CO5: Evaluate the building component roof trusses using CAD software.

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO5: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO5 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO5 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO4: Design

CO5 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

II Year

II Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APC0115	LAND SURVEY WITH 2D DRAFTING	0	1	2	2

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

CO1: Apply the basic concepts of total station to find area and Difference in level.

CO2: Understand basic concepts of Global positioning system.

CO3: Understand the basic concepts of Land surveying.

CO4: Apply the basic concepts of Auto Cad to find Area of a given boundary.

CO5: Apply the basic concepts of Auto Cad to find draw a site plan

Course Outcomes	Action Verb	Knowledge Statement	Criteria	Blooms Level
CO1	Apply	Using total station basic operations	to measure the area of a given boundary and difference in level	L3
CO2	Understand	GPS concepts and working principles	to identify the location of relative stations	L2
CO3	Understand	Land survey methods	Types and concepts of Land surveying	L2
CO4	Apply	Area measurement	Measurement of area	L3
CO5	Apply	Site plan concepts	Preparation site plan for construction	L3

LIST OF EXPERIMENTS

1. Total Station: Determination of Area, Contour maps, leveling and Setting out of curves.
2. Demonstration on GPS (Global Positioning System)
3. Introduction to Land Surveying
4. Drawing of Irregular Plan in Auto Cad Software
5. Determination of Area of given Plans in Auto Cad software (Boundary Survey)
6. Drawing of site plan in Auto Cad Software (Construction Survey)

MAPPING OF COS TO POS AND PSOS

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes		Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	CO's Action Verb	BTL			
1	Apply	L3	PO1	Apply (L3)	3
			PO2	Analyze (L4)	2
			PO6	Thumb Rule	2
2	Understand	L2	PO1	Understand (L2)	2
			PO2	Apply (L3)	1
3	Understand	L2	PO1	Understand (L2)	3
			PO2	Apply (L3)	3
4	Apply	L3	PO1	Apply (L3)	3
			PO2	Analyze (L4)	2
			PO6	Thumb Rule	3
5	Apply	L3	PO1	Apply (L3)	3
			PO2	Analyze (L4)	2

JUSTIFICATION STATEMENTS:

CO1: Apply the basic concepts of total station to find area and Difference in level.

Action Verb: Apply (L3)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO1 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

CO2: Understand basic concepts of Global positioning system.

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO2 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO3: Understand the basic concepts of Land surveying.

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO3 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO3 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO4: Apply the basic concepts of Auto Cad to find Area of a given boundary

Action Verb: Apply (L3)

PO1: Apply(L3)

CO4 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO4: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO4 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

CO5: Apply the basic concepts of Auto Cad to find draw a site plan

Action Verb: Apply (L3)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO5: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO5 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)

CIVIL ENGINEERING

AK20 REGULATION

(Effective for the student admitted from the AY 2022-23 & LE from 2023-24)

Semester V (third year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T/CLC	P		C	CIE	SEE
1	Professional core course	20APC0116	Soil Mechanics	2	1	0	3	30	70	100
2	Professional core course	20APC0117	Building Technology	2	1	0	3	30	70	100
3	Professional core course	20APC0118	Engineering Geology	2	1	0	3	30	70	100
4	Open Elective course / Job Oriented Elective	20APE0417	Sensor Networks	2	1	0	3	30	70	100
		20APC0323	Operations Research							
		20AOE0302	Management Science							
5	Professional Elective courses	20APE0101	Structural Analysis-II	2	1	0	3	30	70	100
		20APE0102	Water Harvesting and Conservation							
		20APE0103	Cost Effective Housing Techniques							
6	Professional core courses (LAB)	20APC0119	Soil Mechanics Lab	0	0	3	1.5	30	70	100
7	Professional core courses (LAB)	20APC0120	Engineering Geology Lab	0	0	3	1.5	30	70	100
8	Skill Oriented Course*	20APC0121	Building planning & Drawing Lab	0	1	2	2	100	-	100
9	Mandatory course (AICTE suggested)	20AMC9904	Professional Ethics and Human Values	2	1	0	0	30	-	30
10	CSP	20CSP0101	Community service project	0	0	0	1.5	100	-	100
Total credits							21.5	440	490	930
Honors/ Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)				3	1	0	4	30	70	100
S. No	Professional Electives*		Open Electives*							
1	Air Pollution and Control		An introduction to Artificial intelligence							
2	Basic construction materials		Industrial Safety Engineering							
3	Pavement Materials		Leadership and Team Effectiveness							
4	Energy Efficiency, Acoustics and Day lighting in Building		Education for Sustainable Development							
5	Remote Sensing Essentials		Organizational Behavior							
6	Ground Improvement		Environment and Development							
7	Availability And Management Of Groundwater Resources		Indian Art: Materials, Techniques And Artistic Practices							
8	Integrated Waste Management For A Smart City		Human Resource Development							
9	Sustainable Transportation Systems		Entrepreneurship							
10	Bridge Engineering		Geographic Information System							
11	Municipal Solid Waste Management		Patent Law for Engineers and Scientists							
12	Admixtures And Special Concretes		Training and Development							
13	Characterization of Construction Materials		Talent Acquisition and Management							
14	Soil Structure Interaction		Principles of Management							
15	Water Supply Engineering		E-Business							

III Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APC0116	SOIL MECHANICS	2	1	0	3

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

- CO1:** Understand the soil formation and index properties of soil
- CO2:** Apply the permeability and effective stress principles in soils
- CO3:** Apply the analytical methods in stress distribution and principles of soil compaction
- CO4:** Analyze the compressibility characteristics and settlements of soil
- CO5:** Evaluate the shear strength parameters for analyzing soil behavior.

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	Formation and index properties		soil	L2
CO2	Apply	Permeability and effective stress		soil	L3
CO3	Apply	Stress distribution and principles of soil compaction	Analytical methods	soil	L3
CO4	Analyze	Compressibility		soil	L4
CO5	Evaluate	the shear strength parameters for analyzing		soil behavior	L5

UNIT – I

INTRODUCTION: Soil formation– Mass, volume relationships–moisture content – Specific Gravity-Field density by core cutter and sand replacement methods-Relative density.

INDEX PROPERTIES OF SOILS: Grain size analysis – consistency limits and indices – I.S. Classification of soils.

UNIT –II

PERMEABILITY: Soil water – capillary rise – flow of water through soils – Darcy’s law- permeability – Factors affecting permeability – laboratory determination of coefficient of permeability-layered permeability.

EFFECTIVE STRESS: Total, neutral and effective stresses – principle of effective stress - quick sand condition — Flow-nets: Characteristics and Uses.

UNIT –III

STRESS DISTRIBUTION IN SOILS: Boussinesq’s and Westergaard’s theories for point load, uniformly loaded pressure bulb and Newmark’s influence chart.

COMPACTION: Mechanism of compaction – factors affecting compaction – effects of compaction on soil properties – Field compaction Equipment – compaction quality control.

UNIT – IV

CONSOLIDATION: Types of compressibility – Immediate Settlement, primary consolidation and secondary consolidation - stress history of clay; e-p and e-log(p) curves – normally consolidated soil, over consolidated soil and under consolidated soil – coefficient of consolidation: square root time and logarithm of time fitting methods.

UNIT - V

SHEAR STRENGTH OF SOILS: Importance of shear strength – Mohr’s– Coulomb Failure theories – Direct shear test, Un-confined compressive strength and vane shear test– strength tests based on drainage conditions – critical void ratio.

TEXT BOOKS:

1. Soil Mechanics and Foundation Engg. By K.R. Arora, Standard Publishers and Distributors, Delhi.
2. Basic and Applied Soil Mechanics by GopalRanjan& ASR Rao, New age International Pvt Ltd

3. Soil Mechanics and Foundation by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt. Ltd., New Delhi
4. Soil Mechanics and Foundation Engg. By K.R. Arora, Standard Publishers and Distributors, Delhi.
5. Geotechnical Engineering by C. Venkataramiah, New age International Pvt. Ltd, (2002).

REFERENCE BOOKS:

1. Soil Mechanics and Foundation Engineering by VNS Murthy, CBS Publishers and Distributors.
2. Principals of Geotechnical Engineering by Braja M. Das, Cengage Learning Publishers.
3. Geotechnical Engineering Principles and Practices by Cuduto, PHI International.
4. Geotechnical Engineering by ManojDutta&Gulati S.K – Tata McGraw-Hill Publishers New Delhi.

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	10/80	13	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
2	17/80	21	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
3	17/80	21	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
4	18/80	22	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	2 3 3 3
5	18/80	23	3	Evaluate	L5	PO1 PO2 PO4 PO6 PO11	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule Thumb Rule	2 3 3 3 3

JUSTIFICATION STATEMENTS:

CO1: Understand the soil formation and index properties of soil

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO2: Apply the permeability and effective stress principles in soils

Action Verb: Apply (L3)

PO1: Apply(L3)

CO2 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO2: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

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

CO3: Apply the analytical methods in stress distribution and principles of soil compaction

Action Verb: Apply (L3)

PO1: Apply(L3)

CO3 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO3: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

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

CO4: Analyze the compressibility characteristics and settlements of soil

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO5: Evaluate the shear strength parameters for analyzing soil behavior.

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO5: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO5 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO5 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO4: Design

CO5 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

PO11: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO11 as High (3)

III Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APC0117	BUILDING TECHNOLOGY	2	1	0	3

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

CO1: Understand the properties of basic building materials

CO2: Understand the types and applications of advanced building material.

CO3: Understand the construction techniques for different building components

CO4: Understand the principles of building planning and plumbing services

CO5: Apply bye laws & regulation in residential building planning

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	Properties of basic building materials			L2
CO2	Understand	Types and Applications of advanced building material			L2
CO3	Understand	Construction techniques for different building components			L2
CO4	Understand	Principles of building planning and plumbing services			L2
CO5	Apply	Bye laws & regulation		Residential building planning	L3

UNIT I BASIC BUILDING MATERIALS

BRICKS: Composition of good brick earth – Methods of manufacturing of bricks– comparison between clamp burning and kiln burning – Testing of bricks.

WOOD: Seasoning of timber – Defects in timber.

OTHER MATERIALS: Properties and uses of glass, plastics, steel, aluminum, bitumen.

UNIT – II ADVANCED BUILDING MATERIALS

NANO MATERIALS: Introduction – Types and its applications.

SMART MATERIALS: Introduction - Types of smart materials and its applications.

MODERN BUILDING MATERIALS: Building products made of gypsum and their uses- GFRG.

UNIT – III BUILDING CONSTRUCTION

MASONRY: Bonds in brick masonry – Cavity& Partition walls.

FLOORS: Different types of floors – concrete, mosaic, terrazzo, tiled floors.

STAIRS: Terminology – Types of stairs.

SURFACE FINISHES: Plastering – Pointing – White washing, distempering and Painting – Damp proofing - Form work and scaffolding.

UNIT – IV BUILDING SERVICES

PLUMBING SERVICES: Different types of pipes – Pipe fitting.

PRINCIPLES OF BUILDING PLANNING: Introduction – Selection of site – Aspect, prospect, roominess, grouping, circulation, privacy, sanitation, elegance, economy, flexibility and practical considerations. Lighting and ventilation requirements.

UNIT – V BUILDING BYE-LAWS AND REGULATION

Introduction – Objectives of building bye-laws – Principles underlying building bye-laws – Terminology – Floor area ratio (FAR), Floor space index (FSI) – Classification of buildings – Open space requirements –

Built up area limitations – Height of the buildings – Wall thickness

PLANNING OF RESIDENTIAL BUILDINGS: Introduction – Minimum standards for various parts of the buildings – Bed room – Kitchen – Dining room – Bath room – Water closet.

TEXT BOOKS:

1. Dr. N. Kumara Swamy & A. Kameswara Rao, Building Planning & Drawing, Charotar Publishers, Anand.
2. Dr. B.C. Punmia [2008], Building construction, Laxmi Publications (P) Ltd., New Delhi
3. Gurucharan Singh and Jagdish Singh [2009], Building Planning Designing and scheduling, Standard publishers Distributors

REFERENCES:

1. S.K. Duggal [2012], Building materials, New Age international (P) Ltd., New Delhi.
2. Bureau of Indian Standards, National Building Code of India – 2005, New Delhi.
3. M. Chakraborty, Civil Engineering Drawing, Third Edition, Bhakti Vedanta Book Trust.
4. S.C. Rangwala [2009], Civil Engineering Drawing, Charotar Publishing House

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	11/60	19	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Understand (L2)	2 2 2
2	11/60	19	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Understand (L2)	2 2 2
3	11/60	19	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Understand (L2)	2 2 2
4	11/60	19	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Understand (L2)	2 2 2
5	16/60	24	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Apply (L3)	3 2 2

JUSTIFICATION STATEMENTS:

CO1: Understand the properties of basic building materials

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO1 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO7 as moderate (2).

CO2: Understand the types and applications of advanced building material.

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO2 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO2 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO7 as moderate (2).

CO3: Understand the construction techniques for different building components

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO3 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO3 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO7 as moderate (2).

CO4: Understand the principles of building planning and plumbing services

Action Verb: Understand (L2)

PO1: Apply(L3)

CO4 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO4 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO7 as moderate (2).

CO5: Apply bye laws & regulation in residential building planning

Action Verb: Apply (L3)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO5: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO5 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

III Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APC0118	ENGINEERING GEOLOGY	2	1	0	3

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

CO1: Understand the formation of minerals and its uses in construction

CO2: Understand the classification and properties of rocks

CO3: Understand the geological strata of rocks

CO4: Understand the geological strata for construction of dams and reservoirs

CO5: Understand the concept of RS&GIS

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	formation of minerals and its uses		construction	L2
CO2	Understand	classification and properties		Rocks	L2
CO3	Understand	geological strata		Rocks	L2
CO4	Understand	geological strata for construction		dams and reservoirs	L2
CO5	Understand	Concept of RS&GIS			L2

UNIT – I INTRODUCTION

Application of Earth Science in Civil Engineering Practices, Understanding the earth, internal structure and composition. Weathering, erosion and denudations process on earth material and natural agencies, Geological work of wind, river underground water and glaciers Mineralogy: Mineral properties, composition and their use in the manufacture of construction materials – Quartz Group; Feldspar Group; Kaolin; Asbestos; Carbonate Group; Gypsum; Mica Group; Ore minerals - Iron ores; pyrite; Chlorite

UNIT – II PETROLOGY

Definition of rock - Rock forming processes - Geological classification of rocks - Dykes and sills, common structures and textures - Megascopic study, Chemical and Mineralogical Composition of rock (Granite, Gabbro, Dolerite, Basalt, Pegmatite, Laterite, Conglomerate, Sand Stone, Shale, Limestone, Tuff, Felsite, Gneiss, Schist, Quartzite, Breccia, Marble, Porphyries, Charnockite and Slate).

UNIT – III STRUCTURAL GEOLOGY

Out crop, strike and dip study of common geological structures associating with the rocks such as folds, faults unconformities, and joints – their important types. Their importance insitu and drift soils, common types of soils, their origin and occurrence in India

UNIT –IV GEOMORPHOLOGY, HYDROGEOLOGY AND SEISMOLOGY

Ground water, Water table - ground water exploration. site selection for dams and tunnels – analysis of failures in dams and tunnels - Seismic zones of India - Earth quakes, their causes and effects. Seismic waves, Richter scale. Landslides - causes and effects; Tsunami –causes and effects.

UNIT – V - REMOTE SENSING

Basic concepts and foundation of remote sensing – elements involved in remote sensing, electromagnetic spectrum, remote sensing terminology and units.

GEOGRAPHIC INFORMATION SYSTEM: Introduction, GIS definition and terminology, GIS categories, components of GIS, fundamental operations of GIS.

TEXT BOOKS:

1. Engineering Geology by N. Chennkesavulu, Mc-Millan, India Ltd. 2005
2. Engineering Geology by Vasudev Kanthi, Universities Press, Hyderabad.
3. Remote Sensing and GIS by B. Bhatta, Oxford University Press, New Delhi

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	12/6	20	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
2	12/60	20	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
3	12/60	20	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
4	12/60	20	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
5	12/60	20	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2

JUSTIFICATION STATEMENTS:

CO1: Understand the formation of minerals and its uses in construction

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO2: Understand the classification and properties of rocks

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO2 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).
CO2 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO3: Understand the geological strata of rocks

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO3 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO3 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO4: Understand the geological strata for construction of dams and reservoirs

Action Verb: Understand (L2)

PO1: Apply(L3)

CO4 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO4 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO5: Understand the concept of RS&GIS

Action Verb: Understand (L2)

PO1: Apply(L3)

CO5 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

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

CO5 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

III YEAR

I SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20APE0417	SENSOR NETWORKS	2	1	0	3

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

CO1: Understand the concepts of Converters and Sensor data acquisition systems

CO2: Understand the concepts of Sensor Measurements for Structural Monitoring

CO3: Apply the concepts of commonly used sensing technologies and algorithms

CO4: Analyze the concepts of piezoelectric transducers for assessing and monitoring infrastructures

CO5: Analyze the concepts of Fiber optic sensors for assessing and monitoring infrastructures

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the concepts of Converters and Sensor data acquisition systems			L2
CO2	Understand	the concepts of Sensor Measurements for		Structural Monitoring	L2
CO3	Apply	The concepts of commonly used sensing technologies and algorithms			L3
CO4	Analyze	the concepts of piezoelectric transducers for		assessing and monitoring infrastructures	L4
CO5	Analyze	the concepts of Fiber optic sensors for		assessing and monitoring infrastructures	L4

UNIT-1 SENSOR DATA ACQUISITION SYSTEMS AND ARCHITECTURES

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 R- 2R DAC, Data acquisition systems-Analog Systems-Digital Systems

UNIT-II SENSORS AND SENSING TECHNOLOGY FOR STRUCTURAL MONITORING

Introduction, Sensor Types, Sensor Measurements in Structural Monitoring- Structural Responses- Environmental Quantities- Operational Quantities- Typical Quantities for Bridge Monitoring- Fibre Optic Sensors- Classification of Fibre Optic Sensors- Typical Fibre Optic Sensors in SHM- Fibre Optic Sensors for Structural Monitoring- Wireless Sensors- Components of Wireless Sensors- Field Deployment in Civil Infrastructure-Case Study

UNIT-III COMMONLY USED SENSORS FOR CIVIL INFRASTRUCTURES AND THEIR ASSOCIATED ALGORITHMS

Introduction, commonly used sensing technologies- Displacement-Strain-Acceleration-Environment-Prevalence of commonly used sensors in SHM systems- Associated algorithms- Displacement sensors- Strain gages- Accelerometers- Environmental measurements- Examples of continuous monitoring systems

UNIT-III PIEZOELECTRIC TRANSDUCERS FOR ASSESSING AND MONITORING CIVIL INFRASTRUCTURES

Introduction, Principle of piezoelectricity, Piezoelectric materials and the fabrication of piezoelectric transducers, Piezoelectric transducers for SHM applications, Bonding effects, Limitations of piezoelectric transducers, SHM techniques using piezoelectric transducers

UNIT-V FIBER OPTIC SENSORS FOR ASSESSING AND MONITORING CIVIL INFRASTRUCTURES

Introduction, Optical fiber concepts, Sensing mechanisms, Sensor packaging, Cables, connectors, and

splicing, Common optical fiber sensors- Coherent interferometers, Low-coherence interferometers, Fiber Bragg gratings, Brillouin and Raman scattering distributed sensors

TEXT BOOKS:

1. “Sensor Technologies for Civil Infrastructures”, Volume 1 Sensing Hardware and Data Collection Methods for Performance Assessment Woodhead Publishing in Civil and Structural Engineering Ming L. Wang Jerome P. Lynch Hardcover ISBN: 9780857094322
2. “Wireless Sensor Networks for Civil Infrastructure Monitoring: A Best Practice Guide” ICE Publishing David Rodenas-Herráiz, Kenichi Soga, Paul R A Fidler and Nicholas de Battista

REFERENCES:

1. Ghatak A and Thyagarajan K. (1998) Introduction to Fiber Optics; Cambridge University Press: Cambridge, UK.
2. Barthorpe, R.J. and Worden, K. (2009) Sensor Placement Optimization. Encyclopaedia of Structural Health Monitoring, Boller, Chang and Fujino (ed.), John Wiley & Sons, Chichester, UK.

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

CO	CO					Program Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation
	Lesson Plan (Hrs)	%	Correlation	Verb	BTL			
1	14	18	2	Understand	L2	PO1, PO2, PO3	Apply Identify Develop	2 2 2
2	17	22	3	Understand	L2	PO1, PO2, PO3	Apply Identify Develop	2 2 2
3	16	20	2	Apply	L3	PO1, PO2, PO3, PO5	Apply Identify Develop Apply	3 2 3 3
4	14	18	2	Analyze	L4	PO1, PO2, PO3, PO4, PO5, PO6, PO11	Apply Identify Develop Analyze Apply Thumb Rule Thumb Rule	3 3 3 2 3 2 1
5	16	20	2	Analyze	L4	PO1, PO2, PO3, PO4, PO5, PO6, PO11	Apply Identify Develop Analyze Apply Thumb Rule Thumb Rule	3 3 3 2 3 2 1

JUSTIFICATION:

CO1: Understand the concepts of Converters and Sensor data acquisition systems

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 Verb: Identify(L3)

CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3 Verb: Develop (L3)

CO1 Action Verb is less than PO3 verb by one level; Therefore, correlation is Moderate (2).

CO2: Understand the concepts of Sensor Measurements for Structural Monitoring

Action Verb: Understand (L2)

PO1 Verbs: Apply (L3)

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

PO2 Verb: Review (L2)

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

PO3 Verb: Develop (L3)

CO2 Action Verb is less than PO3 verb by one level; Therefore, correlation is Moderate (2).

CO3: Apply the concepts of commonly used sensing technologies and algorithms

Action Verb: Apply (L3)

PO1 Verbs: Apply (L3)

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

PO2 Verb: Analyze(L4)

CO3 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3 Verb: Develop (L3)

CO3 Action Verb is equal to PO3 verb; Therefore, correlation is high (3).

PO5 verb: Apply (L3)

CO3 Action verb is equal to PO5 verb therefore the correlation is high (3).

CO4: Analyze the concepts of piezoelectric transducers for assessing and monitoring infrastructures

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

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

PO2 Verb: Identify(L3)

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

PO3 Verb: Develop (L3)

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

PO4 Verb: Analyze (L4)

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

PO5 verb: Apply (L3)

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

PO6: CO4 using thumb rule Correlates PO6 as moderate (2).

PO11: CO4 using thumb rule Correlates PO11 as low (1).

CO5: Analyze the concepts of Fiber optic sensors for assessing and monitoring infrastructures

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

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

PO2 Verb: Identify(L3)

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

PO3 Verb: Develop (L3)

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

PO4 Verb: Analyze (L4)

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

PO5 verb: Apply (L3)

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

PO6: CO5 using thumb rule Correlates PO6 as moderate (2).

PO11: CO5 using thumb rule Correlates PO11 as low (1).

III YEAR

I SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20APC0323	OPERATIONS RESEARCH	2	1	0	3

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

- CO1:** Apply the knowledge of operations research in solving linear programming problems
- CO2:** Apply the mathematical procedure for solving the transportation and assignment models related to real world problems
- CO3:** Evaluate the decisions to replace the items that deteriorate with time and to solve the game theory models
- CO4:** Analyze the available resources based on the priority in solving the sequencing problems
- CO5:** Analyze the simulation tools to develop the queuing and other relevant models

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Apply	the knowledge of operations		research in solving linear programming problems	L3
CO2	Apply	the mathematical procedure for solving the transportation and assignment models		related to real world problems	L3
CO3	Evaluate	the decisions to replace the items that deteriorates with time and		to solve the game theory models	L5
CO4	Analyze	the available resources based on the priority		in solving sequencing problems	L4
CO5	Analyze	the simulation tools to develop the queuing and other relevant models			L3

UNIT I

Introduction to OR and Linear Programming-1 OR definition– Classification of Models –Types of Operations Research models; Linear Programming- Problem Formulation, Graphical Method, Simplex Method, Two–Phase Simplex Method, Big-M Method Special Cases of LP- Degeneracy, Infeasibility and Multiple Optimal Solutions.

UNIT II Linear programming-2: Transportation Problem – Formulation; Different Methods of Obtaining Initial Basic Feasible Solution- North-West Corner Rule, Least Cost Method, Vogel’s Approximation Method; Optimality Testing. Special Cases -Unbalanced Transportation Problem, Degenerate Problem; Assignment Problem – Formulation; Optimal Solution -Traveling Salesman problem.

UNIT III Game Theory: Introduction – Minimax (Maximin) Criterion and Optimal Strategy, Saddle Point, Solution of Games with Pure Strategy –Games with Mixed Strategies– Dominance Principle–Graphical Method, Algebraic methods, sub matrices method.

UNIT IV

Queuing Theory: Introduction –Terminology, Service Channel, Arrival Pattern, Population, Departure Pattern (Service Pattern), Queue Discipline Single Channel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non-finite queue length; Multichannel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non-finite queue length. Sequencing - Assumptions-n-jobs-2 Machines model, n-jobs-3-machines models & n jobs – m Machines models.

UNIT V Dynamic Programming: Introduction – Bellman’s Principle of Optimality – Applications of Dynamic Programming- Capital Budgeting Problem – Shortest Path Problem – Solution of Linear Programming Problem by DP. Replacement Models: Introduction –Types of Replacement Problem,

Determination of Economic Life of an Asset, and Simple Probabilistic Model for Items which completely fail-Individual Replacement Model, Group Replacement Model.

TEXT BOOKS:

1. Operations Research, Dr. C.Nadhamuni Reddy & Sri Gopal Krishna, Kurnool Publishers
2. Operation Research, J.K.Sharma,MacMilan, 5th edition, 2013.
3. Introduction to Operations Research, H.A.Taha, PHI, 9th edition, 2013

REFERENCE BOOKS:

1. Operations Research, A.M.Natarajan, P.Balasubramani,A. Tamilarasi,Pearson Education, 8th edition, 2011
2. Operations Research by R Panneerselvam, PHI, 2nd edition, 2012.
3. Operations Research, Wagner, PHI Publications , 2nd edition.
4. Operations Research, S.R.Yadav, A.K.Malik, Oxford, 2015

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

CO	CO					Program Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation
	Lesson Plan (Hrs)	%	Correlation	Verb	BTL			
1	9	15	L2	Apply	L3	PO1 PO2 PO3	Apply (L3) Formulate (L3) Develop (L3)	3 3 3
2	19	31	L3	Apply	L3	PO1 PO2 PO3	Apply (L3) Identify (L3) Develop (L3)	3 3 3
3	14	23	L3	Evaluate	L5	PO1 PO2 PO3 PO4	Apply (L3) Identify (L3) Develop (L3) Design (L6)	3 3 3 1
4	8	13	L2	Analyze	L4	PO1 PO2	Apply (L3) Identify (L3)	3 3
5	10	16	L2	Analyze	L4	PO2 PO3 PO5	Apply (L3) Develop (L3) Apply (L3)	3 3 3

JUSTIFICATION STATEMENTS:

CO1: Apply the knowledge of operations research in solving linear programming problems 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:

Formulate (L3)

CO1 Action verb is same level as PO2 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 transportation and assignment models related to real world problems.

Action Verb: Apply (L3) PO1

Verb: **Apply (L3)**

CO2: Action verb is same level as PO1 verb. Therefore, the correlation is high (3) PO2 Verb:

Develop (L3)

CO2: Action verb is same level as PO2 verb. Therefore, the correlation is high (3) PO3 Verb:

Apply (L3)

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

CO3: Evaluate the decisions to replace the items that deteriorate with time and to solve the game theory models.

Action Verb: Evaluate (L5) PO1

Verb: **Apply (L3)**

CO3: Action verb is same (greater) level as PO1 verb. Therefore, the correlation is high (3). PO2 Verb:

Identify (L3)

CO3: Action verb is same (greater) level as PO2 verb. Therefore, the correlation is high (3). PO3 Verb:

Develop (L3)

CO3: Action verb is same (greater) level as PO3 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:**

Analyze the available resources based on the priority in solving the sequencing problems. 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:

Identify (L3)

CO4: Action verb is same level as PO2 verb. Therefore, the correlation is high (3) **CO5:**

Analyze the simulation tools to develop the queuing and other relevant models Action Verb:

Analyze (L4)

PO2 Verb: **Apply (L3)**

CO5: Action verb is same level as PO2 verb. Therefore, the correlation is high (3). PO3

Verb: **Develop (L3)**

CO5: Action verb is same level as PO3 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).

III YEAR

I SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20AOE0302	MANAGEMENT SCIENCE	2	1	0	3

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

CO1: Understand the management principles to take the decisions in all levels for productivity

CO2: Analyze 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

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the management principles to take the decisions in all levels for productivity			L2
CO2	Analyze	the available facilities for location of the industrial plant and also deal the ergonomics to improve the efficiency and safety			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			L3
CO4	Understand	the materials requirement to minimize the inventory costs and to maximize the profit			L2
CO5	Apply	the knowledge of the human resources principles in motivating the workers in the industry			L3

UNIT I INTRODUCTION TO MANAGEMENT:

Management - Concept - Nature - Functions – Levels - Evolution of Management Thought - Taylor’s Scientific Theory - Henry Fayol’s principles - Elton Mayo’s Human relations - Leadership styles - Autocratic leadership - Democratic & Free rein leadership.

Organizational Designs: Line organization - Line & Staff Organization – Functional Organization – Matrix Organization - Project Organization - Committee form of Organization.

UNIT II

OPERATIONS MANAGEMENT: Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study.

MATERIAL MANAGEMENT - Objectives – Inventory classification - Inventory Techniques - EOQ-ABC Analysis

MARKETING MANAGEMENT: concept - meaning - nature- functions of marketing – marketing mix - channels of distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

UNIT III HUMAN RESOURCES MANAGEMENT (HRM):

HRM - Definition and Meaning - Managerial and Operative functions - Evolution of HRM – Job Analysis & Job Evaluation - Human Resource Planning (HRP) Process/Procedure- Employee Recruitment Process - Employee Selection Process and Tests in Employee Selection – Employee Training and Development - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

UNIT IV

STRATEGIC MANAGEMENT: Definition & Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process – Environmental Scanning - SWOT Analysis

PROJECT MANAGEMENT - Network Analysis - Programme Evaluation and Review Technique (PERT) – Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

UNIT V CONTEMPORARY MANAGEMENT

The concept of Management Information System (MIS) - Materials Requirement Planning (MRP) – Customer Relations Management (CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management (SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re- engineering and Bench Marking - Balanced Score Card.

TEXTBOOKS:

1. A.R Aryasri, “Management Science”, TMH, 2013
2. Stoner, Freeman, Gilbert, Management, Pearson Education, New Delhi, 2012.

REFERENCES:

1. Koontz & Wehrich, “Essentials of Management”, 6th edition, TMH, 2005.
2. Thomas N.Duening & John M.Ivancevich, “Management Principles and Guidelines”, Biztantra.
3. Kanishka Bedi, “Production and Operations Management”, Oxford University Press, 2004.

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

CO	CO					Program Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation
	Lesson Plan (Hrs)	%	Correlation	Verb	BTL			
1	-	-	-	Understand	L2	PO1 PO4	Apply (L3) Design (L6)	2 1
2	-	-	-	Analyze	L4	PO1 PO4 PO5	Apply (L3) Analyze (L4) Apply (L3)	3 3 3
3	-	-	-	Apply	L3	PO1 PO2 PO4	Apply (L3) Identify (L3) Design (L6)	3 3 1
4	-	-	-	Understand	L2	PO1 PO2 PO4	Apply (L3) Identify (L3) Interpret (L2)	2 2 2
5	-	-	-	Apply	L3	PO1 PO2	Apply (L3) Identify (L3)	3 3

JUSTIFICATION STATEMENTS:

CO1: Understand the management principles to take the decisions in all levels for productivity

Action Verb: Understand (L2)

PO1 Verb: Apply (L3)

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

PO4 Verb: Design (L6)

CO1 Action verb is same (lower) level as PO4 verb. Therefore, the correlation is low (1).

CO2: Analyze the available facilities for location of the industrial plant and also deal the ergonomics to improve the efficiency and safety.

Action Verb: Analyze (L4)

PO1 Verb: Apply (L3)

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

PO4 Verb: Analyze (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).

III Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APE0101	STRUCTURAL ANALYSIS-II	2	1	0	3

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

- CO1:** Analyze the three hinged arches for different loading conditions
- CO2:** Analyze the frames using slope deflection and moment distribution method
- CO3:** Analyze the beams and frames using Kani's method
- CO4:** Analyze the beams using flexibility & stiffness method
- CO5:** Apply the plastic analysis concept on beams

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Analyze	Three hinged arches	Different loading conditions		L4
CO2	Analyze	End moments of Frames		slope deflection and moment distribution method	L4
CO3	Analyze	End moments of beams and frames		Kani's method	L4
CO4	Analyze	End moments of beams		flexibility & stiffness method	L4
CO5	Apply	Plastic analysis concept		Beams	L3

UNIT – I

ARCHES: Three hinged arches, Elastic theory of arches – Eddy's theorem – Determination of horizontal thrust, bending moment, normal thrust and radial shear – effect of temperature.

UNIT – II

SLOPE-DEFLECTION & MOMENT DISTRIBUTION METHOD: Analysis of single bay, single storey, portal frame including side sway– Stiffness and carry over factors – Distribution factors – Analysis of single storey portal frames – including Sway.

UNIT - III

KANI'S METHOD: Analysis of continuous beams – including settlement of supports and single bay, single storey portal frames with side sway by Kani's method.

UNIT –IV

FLEXIBILITY & STIFFNESS METHODS: Flexibility methods, Introduction, application to continuous beams including support settlements-Introduction to stiffness method and its application to continuous beams including support settlements.

UNIT – V

PLASTIC ANALYSIS: Introduction – Idealized stress – Strain diagram – shape factors for various sections –Moment curvature relationship – ultimate moment – Plastic hinge – lower and upper bound theorems – ultimate strength of fixed and continuous beams.

TEXT BOOKS:

1. S.S. Bhavikatti, "Structural Analysis", Volume 1 and 2, Vikas Publishing House, Pvt. Ltd.
2. S. Ramamurtham, "Theory of Structures", DhanpatRai Publishing Company (p) Ltd, 2009

3. C. S. Reddy, “Basic Structural Analysis”, Tata McGraw Hill

REFERENCES:

1. Timoshenko & Young, “Theory of Structures”, Tata McGraw Hill
2. S. B. Junarkar, “Structural Mechanics” Vol I & II, Charotar Publishers
3. C. K. Wang, “Intermediate Structural Analysis”, McGraw Hill

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	17/85	20	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	2 3 3 3
2	17/85	20	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	2 3 3 3
3	17/85	20	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	2 3 3 3
4	17/85	20	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	2 3 3 3
5	17/85	20	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2

JUSTIFICATION STATEMENTS:

CO1: Analyze the three hinged arches for different loading conditions.

Action Verb: Analyze (L4)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action verb is equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

CO1 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as moderate (3).

CO2: Analyze the frames using slope deflection and moment distribution method

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO3: Analyze the beams and frames using Kani's method

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO4: Analyze the beams using flexibility & stiffness method

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO5: Apply the plastic analysis concept on beams

Action Verb: Apply (L3)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO5: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO5 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

III Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APE0102	WATER HARVESTING AND CONSERVATION	2	1	0	3

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

CO1: Understand the movement of ground water in fissures and cracks

CO2: Understand the water conservation methods

CO3: Understand the techniques of reclamation and reuse of waste water

CO4: Understand the sustainable practices of watershed management

CO5: Understand the principles of conservation of water and soil

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	Movement of ground water		Fissures and Cracks	L2
CO2	Understand	Water conservation methods			L2
CO3	Understand	Techniques of reclamation and Reuse		Waste water	L2
CO4	Understand	Sustainable practices of watershed management			L2
CO5	Understand	Principles of conservation		Water and Soil	L2

UNIT – I ORIGIN, OCCURRENCE & MOVEMENT OF GROUNDWATER

Introduction-sources of ground water – Hydro geological Cycle – Infiltration – natural openings in rocks – zones of aeration, saturation and water table – classification of ground water – laboratory and field methods of sampling ground water- aquifers – aquifuges aquicludes – aquitards – ill effects due to lowering of water table -Artificial recharge.

UNIT – II WATER HARVESTING

Principles of water harvesting-methods of rainwater harvesting-design of rainwater harvesting structures-Purification Techniques for direct use- Harvesting of surface runoff-onsite detention basin - ponds - types - Recycling of harvested water

UNIT – III WATER RECOVERY AND REUSE

Perspective on recycle and reuse-factors affecting the development of water reclamation and reuse criteria- elements/components of water reclamation and reuse criteria / guidelines sewage irrigation-Waste water reclamation-waste water recharge for reuse – Treatment Requirements for Water Reuse-methods.

UNIT – IV SUSTAINABLE WATERSHED APPROACH & WATERSHED MANAGEMENT PRACTICES

Concept Of Watershed- Introduction To Watershed Management-Integrated water resources management- natural resources management-agricultural practices-integrated farming-Conjunctive use of water resources-Community Participation-Watershed Management Practices in Arid and Semiarid Regions-Case studies-short term and long term strategic planning.

UNIT – V SOIL AND WATER CONSERVATION

Scope of soil and water conservation-Mechanics and types of erosion-their causes-Soil erosion control measures - bank protection-vegetative barriers-contour bund- contour trenches contour stone walls-contour ditches-terraces-outlets and grassed waterways-Gully control structures - temporary and permanent - design of permanent soil conservation structures-Design of farm ponds and percolation ponds.

TEXT BOOKS:

1. Watershed Management by Murty, J.V.S, New Age Intl., New Delhi .
2. Water Resources Conservation and Management by Chatterjee, S. N.,Atlantic Publishers.
3. Ground Water by S.Ramakrishnan, SCITECH Publishers.

REFERENCE BOOKS:

Advances in Soil and Water Conservation by Pierce, F.J. and Frye, W. W. (1998):, Ann Arbor Press, Michigan

MAPPING OF COS TO POS AND PSOS

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	12/60	20	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
2	12/60	20	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
3	12/60	20	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
4	12/60	20	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
5	12/60	20	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2

JUSTIFICATION STATEMENTS:

CO1: Understand the movement of ground water in fissures and cracks

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO2: Understand the water conservation methods

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO2 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO3: Understand the techniques of reclamation and reuse of waste water

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO3 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO3 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO4: Understand the sustainable practices of watershed management

Action Verb: Understand (L2)

PO1: Apply(L3)

CO4 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO4 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO5: Understand the principles of conservation of water and soil

Action Verb: Understand (L2)

PO1: Apply(L3)

CO5 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

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

CO5 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

III Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APE0103	COST EFFECTIVE HOUSING TECHNIQUES	2	1	0	3

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

CO1: Apply the concept of housing technique

CO2: Understand housing programs and projects

CO3: Understand development and adoption of low-cost housing technology

CO4: Understand low-cost housing in rural areas

CO5: Understand housing in disaster prone areas

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Apply	Concept of housing technique			L3
CO2	Understand	Housing programs and projects			L2
CO3	Understand	Development and adoption of low-cost housing technology			L2
CO4	Understand	Low-cost housing in rural areas			L2
CO5	Understand	housing in disaster prone areas			L2

UNIT – I INTRODUCTION TO HOUSING

Definition of Basic Terms – House, Home, Household, Apartments, Multi storied Buildings, Special Buildings, Objectives and Strategies of National Housing Policies including Slum Housing Policy, Principle of Sustainable Housing – Integrated approach on arriving holding capacity and density norms - All basic infrastructure consideration - Institutions for Housing at National, State and Local levels.

UNIT – II HOUSING PROGRAMMES

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighbourhoods - Plotted land development programs, Open Development Plots, Apartments, Gated communities, Townships, Rental Housing, Co-operative Housing, Slum Housing Programmes – Slum improvement – Slum redevelopment and Relocation – Use of GIS and MIS in Slum Housing Projects,, Role of Public housing agencies, and Private sector in supply , quality, infrastructure and pricing – Role of Non- Government Organizations in slum housing.

UNIT – III DEVELOPMENT AND ADOPTION OF LOW COST HOUSING TECHNOLOGY

Introduction - Adoption of innovative cost effective construction techniques - Adoption of precast elements - Adopting of total prefabrication of mass housing in India- General remarks on pre cast roofing/flooring systems -Economical wall system - Single Brick thick loading bearing wall - 19cm thick load bearing masonry walls - Half brick thick load bearing wall – Fly ash gypsum thick for masonry - Stone Block masonry - Adoption of precast R.C. plank and join system for roof/floor in the building

UNIT – IV ALTERNATIVE BUILDING MATERIALS FOR LOW COST HOUSING AND INFRASTRUCTURE SERVICES IN RURAL HOUSES

Introduction - Substitute for scarce materials – Ferrocement - Gypsum boards - Timber substitutions – Industrial wastes - Agricultural wastes - Low cost Infrastructure services: Introduce - Present status – Technological options - Low cost sanitation - Domestic wall - Water supply, energy. Rural Housing:

Introduction traditional practice of rural housing continuous - Mud Housing technology-Mud roofs - Characteristics of mud – Fire treatment for thatch roof - Soil stabilization - Rural Housing program

UNIT – V HOUSING IN DISASTER PRONE AREAS

Introduction – Earthquake - Damages to houses - Traditional prone areas - Type of Damages and Railways of non-engineered buildings - Repair and restore action of earthquake Damaged non-engineered buildings recommendations for future constructions. Requirements of structural safety of thin pre-cast roofing units against Earthquake forces -Status of R& D in earthquake strengthening measures - Floods, cyclone, future safety

TEXT BOOKS

1. Hand book of Low Cost Housing by A.K.Lal – New Age International publishers.
2. Low Cost Housing – G.C. Mathur, IBH Publishers.
3. Housing in India by Francis Cherunilam and Odeyar D Heggade, Himalaya Publishing House, Bombay, 1997.

REFERENCES

1. Disaster Management by Rajib Shaw, Universities Press, India.
 2. Disaster Science and Management by Tushar Bhattacharya, TMH Publications.
- Building Materials For Low –Income Houses – International Council For Building Research Studies And Documentation.
4. Modern Trends In Housing In Developing Countries – A.G. MadhavaRao, D.S. Ramachandra Murthy & G.Annamalai.
 5. Properties of Concrete – Neville A.M. Pitman Publishing Limited, London.
 6. Light Weight Concrete, Academic Kiado, Rudhai.G – Publishing home of Hungarian Academy of Sciences 1963.

MAPPING OF COS TO POS AND PSOS

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	17/65	24	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
2	12/65	19	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
3	12/65	19	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
4	12/65	19	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
5	12/65	19	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2

JUSTIFICATION STATEMENTS:

CO1: Apply the concept of housing technique

Action Verb: Apply (L3)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO1 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

CO2: Understand housing programs and projects

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO2 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO3: Understand development and adoption of low-cost housing technology

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO3 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO3 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO4: Understand low-cost housing in rural areas

Action Verb: Understand (L2)

PO1: Apply(L3)

CO4 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO4 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO5: Understand housing in disaster prone areas

Action Verb: Understand (L2)

PO1: Apply(L3)

CO5 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

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

CO5 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

III Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APC0119	SOIL MECHANICS LAB	0	0	3	1.5

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

CO1: Analyze the classification of soils based on Atterberg Limits and sieve analysis

CO2: Evaluate the field density of soil using core cutter and sand replacement methods

CO3: Evaluate the suitability of a soil for foundations and pavements application

CO4: Evaluate key engineering properties of soils such as strength, compressibility and permeability

CO5: Analyze the swelling potential of soils and assess their suitability for foundation applications.

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Analyze	The classification of soils	Based on Atterberg Limits and sieve analysis		L4
CO2	Evaluate	The field density of soil	using core cutter and sand replacement methods		L5
CO3	Evaluate	The suitability of a soil		for foundations and pavements application	L5
CO4	Evaluate	The key engineering properties of soils		strength, compressibility, and permeability	L5
CO5	Analyze	The swelling potential of soils and assess their suitability		For foundation applications.	L4

LIST OF EXPERIMENTS

1. Determination of Atterberg Limits (Liquid Limit, Plastic Limit, and shrinkage limit)-CO1
2. a) Determination of Field density by core cutter method and
b) Determination of Field density by sand replacement method-CO2
3. Determination of Specific gravity of soil-CO3
4. Determination of Grain size distribution by dry sieve analysis-CO3
5. Determination of Coefficient of Permeability of soil by constant and variable head test methods- CO3
6. Determination of OMC & MDD by Standard Proctor's Compaction Test-CO4
7. Determination of California Bearing ratio test-CO4
8. Determination of Unconfined compression test-CO4
9. Determination of Cohesion and internal friction by Direct shear test-CO4
10. Determination of Free swell index (FSI) test-CO5

REFERENCES:

Measurement of Engineering Properties of Soils by. E. Saibaba Reddy & K. Rama Sastri, New Age International

MAPPING OF COS TO POS AND PSOS

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes		Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	CO's Action Verb	BTL			
1	Analyze	L4	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
2	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
3	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
4	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
5	Analyze	L4	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3

JUSTIFICATION STATEMENTS:

CO1: Analyze the classification of soils based on Atterberg Limits and sieve analysis.

Action Verb: Analyze (L4)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action verb is equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

CO1 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as moderate (3).

CO2: Evaluate the field density of soil using core cutter and sand replacement methods

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO2: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO2 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO2 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO4: Design

CO2 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

CO3: Evaluate the suitability of a soil for foundations and pavements application

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO3: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO3 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO3 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO4: Design

CO3 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

CO4: Evaluate key engineering properties of soils such as strength, compressibility and permeability

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO4: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO4 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO4: Design

CO4 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

CO5: Analyze the swelling potential of soils and assess their suitability for foundation applications.

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

CO5 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as moderate (3).

III Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APC0120	ENGINEERING GEOLOGY LAB	0	0	3	1.5

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

CO1: Apply the physical properties of minerals to real world scenarios

CO2: Analyze the physical properties of rock samples from the field

CO3: Evaluate the accuracy and limitations of geological maps based on the data used for their formation

CO4: Analyze basic strike problems using geological maps and sections

CO5: Analyze basic dip problems using geological maps and sections

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Apply	the physical properties of minerals	of minerals	real world scenarios	L3
CO2	Analyze	the physical properties of rocks		from the field	L4
CO3	Evaluate	accuracy and limitations of geological maps	based on the data used for their formation		L5
CO4	Analyze	basic strike problem		using geological maps and sections	L4
CO5	Analyze	basic dip problems		using geological maps and sections	L4

LIST OF EXPERIMENTS

1. Description and identification of six minerals-CO1
2. Description and identification of six (including igneous, sedimentary and metamorphic rocks)- CO2
- 3 Interpretation of geological map along with a geological section-CO3
4. Simple strike and dip problems-CO4, CO5

MAPPING OF COS TO POS AND PSOS:

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

CO-PO MAPPING JUSTIFICATION

Unit No	Course Outcomes		Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	CO's Action Verb	BTL			
1	Apply	L3	PO1	Apply (L3)	3
			PO2	Analyze (L4)	2
			PO4	Analyze (L4)	2
			PO6	Thumb Rule	2
2	Analyze	L4	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
3	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
4	Analyze	L4	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
5	Analyze	L4	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3

JUSTIFICATION STATEMENTS:

CO1: Apply the physical properties of minerals to real world scenarios

Action Verb: Apply (L3)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO1 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

CO2: Analyze the physical properties of rock samples from the field

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO3: Evaluate the accuracy and limitations of geological maps based on the data used for their formation

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO3: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO3 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO3 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO4: Design

CO3 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

CO4: Analyze basic strike problems using geological maps and sections

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO5: Analyze basic dip problems using geological maps and sections

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

CO5 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as moderate (3).

III Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APC0121	BUILDING PLANNING & DRAWING LAB	0	1	2	2

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

CO1: Understand the fundamental building design principles and relevant building codes

CO2: Create the 3D-Single storey building based on the NBC and BIS guidelines

CO3: Create the 3D-Multi storey building based on the NBC and BIS guidelines

CO4: Evaluate the detailing of beams and columns in CAD software as per IS code guide lines

CO5: Evaluate the detailing of slabs in CAD software as per IS code guide lines

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	The fundamental building design principles and relevant building codes			L2
CO2	Create	The 3D-Single storey building	based on the NBC and BIS guidelines		L6
CO3	Create	The 3D-Multi storey building	based on the NBC and BIS guidelines		L6
CO4	Evaluate	The detailing of beams and columns	CAD software	as per IS code guide lines	L5
CO5	Evaluate	The detailing of slabs	CAD software	as per IS code guide lines	L5

LIST OF EXPERIMENTS:

1. General building requirements-CO1
2. 3D-Single storey Residential building- CO2
3. 3D-Two storey educational building- CO2
4. Reinforcement Drawing: Typical Beams- CO4
5. Reinforcement Drawing: Typical Columns- CO4
6. Reinforcement Drawing: Typical Slabs- CO5

MAPPING OF COS TO POS AND PSOS

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes		Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	CO's Action Verb	BTL			
1	Understand	L2	PO1	Apply (L3)	2
			PO2	Analyze (L4)	1
			PO6	Thumb Rule	2
2	Create	L6	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO5	Create(L6)	3
			PO6	Thumb Rule	3
3	Create	L6	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO5	Create(L6)	3
			PO6	Thumb Rule	3
4	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
5	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3

JUSTIFICATION STATEMENTS:

CO1: Understand the fundamental building design principles and relevant building codes

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO2: Create the 3D-Single storey building based on the NBC and BIS guidelines

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO2: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO2 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO2 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO2 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

CO3: Create the 3D-Multi storey building based on the NBC and BIS guidelines

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO3: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO3 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO3 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO3 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

CO4: Evaluate the detailing of beams and columns in CAD software as per IS code guide lines

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO4: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO4 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO4: Design

CO4 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

CO5: Evaluate the detailing of slabs in CAD software as per IS code guide lines

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO5: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO5 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO5 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO4: Design

CO5 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

III Year

I Semester

Subject Code	Subject Name	L	T/CLC	P	Credits
20AMC9904	PROFESSIONAL ETHICS AND HUMAN VALUES	2	1	0	0

Course Outcomes: After studying the course, students 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

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

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 (AkhandSamaj), Universal Order (SarvabhaumVyawastha) - from family to world family!

UNIT - III

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

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

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.

TEXT BOOKS:

- 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.

REFERENCES:

1. Prof. K. V. SubbaRaju, 2013, Success Secrets for Engineering Students, Smart Student Publications, 3rd Edition.
2. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
3. Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, 4e, Cengage learning, 2015.
4. Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008.

CORRELATION OF COS WITH THE POS & PSOS:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1											2		
2							2	2					
3						2		2	2				
4						2	2	2	2				
5							2				2		

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 PO11)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	8	27	2	Understand	L2	PO11	Thumb Rule	2
2	8	26	2	Understand	L2	PO7 PO8	Thumb Rule Thumb Rule	2 2
3	4	13	2	Understand	L2	PO6, PO8 PO9	Thumb Rule Thumb Rule	2 2 2
4	5	17	2	Understand	L2	PO6 PO7 PO8 PO9	Thumb Rule Thumb Rule Thumb Rule Thumb Rule	2 2 2 2
5	5	17	2	Understand	L2	PO7 PO11	Thumb Rule Thumb Rule	2 2

JUSTIFICATION STATEMENTS:

CO1: Understand sustained happiness through identifying the essentials of human values and skills.

Action Verb: Understand (L2)

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

CO2: Understand the importance of Values and Ethics in their personal lives and professional careers.

Action Verb: Understand (L2)

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

CO3: Understand the rights and responsibilities as an employee, team member and a global citizen.

Action Verb: Understand (L2)

CO3 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

CO4: Understand the importance of trust, mutually satisfying human behavior and enriching interaction with nature.

Action Verb: Understand (L2)

CO4 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

CO5: Understand appropriate technologies and management patterns to create harmony in professional and personal life.

Action Verb: Understand (L2)

CO5 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

CO5 Action Verb is understand of BTL 2. Using action verb apply, L2 correlates PO5 as low (1).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)

CIVIL ENGINEERING

AK20 REGULATION

(Effective for the student admitted from the AY 2022-23 & LE from 2023-24)

Semester VI (third year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T/CLC	P		C	CIE	SEE
1	Professional core course	20APC0122	Environmental Engineering	2	1	0	3	30	70	100
2	Professional core course	20APC0123	Highway Engineering	2	1	0	3	30	70	100
3	Professional core course	20APC0124	Foundation Engineering	2	1	0	3	30	70	100
4	Professional Elective courses	20AMOC0102	Rural Water Resources Management	2	1	0	3	25	75	100
			Intelligent Transport System							
			Remote Sensing and GIS							
5	Professional core courses (LAB)	20APC0125	STAAD Lab	0	0	3	1.5	30	70	100
6	Professional core courses (LAB)	20APC0126	Environmental Engineering lab	0	0	3	1.5	30	70	100
7	Professional core courses (LAB)	20APC0127	Highway Engineering Lab	0	0	3	1.5	30	70	100
8	Skill Oriented Course*	20AHE9902	Principal of Effective Public Speaking	0	1	2	2	100	-	100
9	Mandatory course (AICTE suggested)	20AMC9901	Biology for Engineers	2	1	0	0	30	-	30
Total credits							18.5	335	495	830
Honors/ Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)				3	1	0	4	30	70	100
Industrial/ Research Internship (Mandatory) 2 Months during summer vacation										

III Year

II Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APC0122	ENVIRONMENTAL ENGINEERING	2	1	0	3

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

- CO1:** Analyze the quality of water and forecast the water demand
- CO2:** Analyze the water treatment techniques and its distribution process
- CO3:** Analyze the characteristics of waste water
- CO4:** Design of oxidation pond for waste water
- CO5:** Design of sludge digestion tanks

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Analyze	Quality of water and forecast the water demand			L4
CO2	Analyze	Water treatment techniques and its distribution process			L4
CO3	Analyze	Characteristics		Waste Water	L4
CO4	Design	Oxidation Pond		Waste Water	L6
CO5	Design	Sludge digestion tanks			L6

UNIT – I INTRODUCTION:

Importance and Necessity of Protected Water Supply systems, Objectives of Protected water supply system, Flow chart of public water supply system, Role of Environmental Engineer.

WATER DEMAND AND QUANTITY STUDIES: Estimation of water demand for a town or city, Types of water demands, Per capita Demand, Factors affecting the Per Capita Demand, Variations in the Demand, Design Period, Factors affecting the Design period, Population Studies, Population Forecasting Studies.

QUALITY AND ANALYSIS OF WATER: Characteristics of water – Physical, Chemical and Biological. Analysis of Water – Physical, Chemical and Biological Impurities in water, Water borne diseases Drinking water quality standards.

UNIT – II WATER TREATMENT:

Layout and general outline of water treatment units. Screening. Sedimentation -types of sedimentation tanks - design elements. Coagulation – coagulants – feeding arrangements –flocculation. Filtration – Classification of filters – working of slow and rapid gravity filters – design of filters –troubles in operation comparison of filters. Disinfection – theory of chlorination – chlorine demand, other disinfection practices – Miscellaneous treatment methods

WATER DISTRIBUTION: Distribution systems – Requirements, Layout of Water distribution systems - Design procedures- Hardy Cross and equivalent pipe methods.

UNIT – III INTRODUCTION TO SANITATION:

Systems of sanitation – relative merits & demerits – collection and conveyance of waste water – sewerage – classification of sewerage systems- types of sewers, design of sewers, cleaning and ventilation of sewers. Engineered systems for solid waste management (reuse/ recycle energy recovery, treatment and disposal).

WASTE WATER COLLECTION AND CHARACTERISTICS: characteristics of sewage – cycles of decay–decomposition of sewage, examination of sewage – B.O.D. – C.O.D. equations.

UNIT IV WASTE WATER TREATMENT

Layout and general outline of various units in a waste water treatment plant – Screens – grit chambers – skimming tanks – sedimentation tanks – biological treatment – trickling filters – standard and high rate – Construction and design of Oxidation ponds.

UNIT – V SLUDGE TREATMENT:

Sludge digestion – design of Digestion tank – septic tanks and Imhoff Tanks working principles and design – soak

pits.

TEXT BOOKS

1. Water supply and sanitary Engineering by G.S. Birdi, Dhanpat Rai& Sons Publishers.
2. Water Supply Engineering, Vol. 1, waste water Engineering, Vol. II, B.C. Punmia, Ashok Jain & Arun Jain, Laxmi Publications Pvt.Ltd, New Delhi
3. Environmental Engineering by Peavy, TMH Publishers

REFERENCES

1. Environmental Science and Engineering by J.G. Henry and G.W. Heinke – Person Education.
2. Waste water treatment- concepts and design approach by G.L. Karia and R.A. Christian, Prentice Hall of India

MAPPING OF COS TO POS AND PSOS

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	16/80	20	3	Analyze	L4	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO4	Analyze (L4)	3
						PO6	Thumb Rule	3
2	16/80	20	3	Analyze	L4	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO4	Analyze (L4)	3
						PO6	Thumb Rule	3
3	16/80	20	3	Analyze	L4	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO4	Analyze (L4)	3
						PO6	Thumb Rule	3
4	16/80	20	3	Design	L6	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO3	Design (L6)	3
						PO4	Analysis (L4)	3
						PO6	Thumb Rule	3
5	16/80	20	3	Design	L6	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO3	Design (L6)	3
						PO4	Analysis (L4)	3
						PO6	Thumb Rule	3

JUSTIFICATION STATEMENTS:

CO1: Analyze the quality of water and forecast the water demand

Action Verb: Analyze (L4)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action verb is equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

CO1 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as moderate (3).

CO2: Analyze the water treatment techniques and its distribution process

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO3: Analyze the characteristics of waste water

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO4: Design of oxidation pond for waste water

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO4: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO4 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO4 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

CO5: Design of sludge digestion tanks

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO5: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO5 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO5 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO5 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

III Year

II Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APC0123	HIGHWAY ENGINEERING	2	1	0	3

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

- CO1:** Understand planning and alignment of highway.
- CO2:** Apply concept of the geometric design for highway.
- CO3:** Understand concept of traffic Engineering and its regulations.
- CO4:** Understand the design principles of intersections.
- CO5:** Design of pavements as per IRC standards.

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	Planning and alignment		Highway	L2
CO2	Apply	Concept of the geometric design		Highway	L3
CO3	Understand	Concept of traffic Engineering and its regulations.			L2
CO4	Understand	Principles of intersections in lands		Using traffic volumes	L2
CO5	Design	Pavements	IRC standards		L6

UNIT – I HIGHWAY DEVELOPMENT AND PLANNING: Highway development in India – Necessity for highway planning – Different Road development plans – Classification of roads – Road network patterns – Highway alignment – Factors affecting alignment – Engineering surveys – Drawings and reports.

UNIT-II HIGHWAY GEOMETRIC DESIGN: Importance of geometric design – Design controls and criteria – Highway cross section elements – Sight distance elements – Stopping sight distance, Overtaking sight distance and intermediate sight distance – Design of horizontal alignment – Design of super elevation and extra widening – Design of transition curves – Design of vertical alignment – Gradients – Vertical curves.

UNIT-III TRAFFIC ENGINEERING & REGULATIONS : Basic Parameters of Traffic-Volume, Speed and Density - Traffic Volume Studies - Data Collection and Presentation - Speed studies - Data Collection and Presentation - Parking Studies – On street & Off street Parking - Road Accidents - Causes and Preventive Measures - Accident Data Recording – Condition Diagram and Collision Diagrams - Traffic Signs – Types and Specifications – Road Markings - Need for Road Markings-Types of Road Markings - Design of Traffic Signals – Webster Method

UNIT-IV INTERSECTION DESIGN: Conflicts at intersections – Channelization: Objectives – Traffic islands and design criteria – Types of at grade intersections – Types of grade separated intersections – Rotary intersection– Concept of rotary and design criteria – Advantages and disadvantages of rotary intersection.

UNIT-V

PAVEMENT DESIGN: Types of pavements – Difference between flexible and rigid pavements – Pavement components – Sub grade, Sub base, Base and wearing course – Functions of pavement components – Design factors – Flexible pavement design methods – G.I method, CBR method, (as per IRC 37-2012) – Design of rigid pavements – Critical load positions – Westergaard’s stress equations.\ (as per IRC 58-2002).

TEXT BOOKS:

1. Highway Engineering – S.K.Khanna & C.E.G.Justo, Nemchand & Bros., 7th edition (2000).
2. Traffic Engineering & Transportation Planning – Dr.L.R.Kadyali, Khanna Publications – 6th Edition – 1997.

REFERENCES:

1. Principles of Traffic and Highway Engineering – Garber & Hoel, Cengage Learning.
2. Principles and Practices of Highway Engineering – Dr.L.R.Kadiyali and Dr.N.BLal - Khanna Publications.
3. Highway Engineering – S.P.Bindra, Dhanpat Rai & Sons. – 4th Edition (1981)

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	11/64	17	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
2	14/64	22	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
3	11/64	17	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
4	12/64	19	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
5	16/64	25	3	Design	L6	PO1 PO2 PO3 PO4 PO6	Apply (L3) Analyze (L4) Design (L6) Analysis (L4) Thumb Rule	3 3 3 3 3

JUSTIFICATION STATEMENTS:

CO1: Understand planning and alignment of highway.

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO2: Apply concept of the geometric design for highway.

Action Verb: Apply (L3)

PO1: Apply(L3)

CO2 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO2: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

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

CO3: Understand concept of traffic Engineering and its regulations.

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO3 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO3 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO4: Understand the design principles of intersections.

Action Verb: Understand (L2)

PO1: Apply(L3)

CO4 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO4 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO5: Design of pavements as per IRC standards.

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO5: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO5 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO5 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO5 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

III Year

II Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APC0124	FOUNDATION ENGINEERING	2	1	0	3

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

CO1: Understand the principles and methods of Soil Exploration

CO2: Apply various analytical methods to assess slop stability

CO3: Apply classical earth pressure theories to check the stability of retaining walls

CO4: Apply standard methods for bearing capacity and settlement analysis of shallow foundations

CO5: Evaluate pile capacity and settlement of pile group

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	Principles and methods		Soil Exploration	L2
CO2	Apply	Analytical methods to assess slop stability			L3
CO3	Apply	Classical earth pressure theories to check the stability		Retaining walls	L3
CO4	Apply	Bearing capacity and settlement analysis	Standard methods	Shallow foundations	L3
CO5	Apply	Pile capacity and settlement analysis			L3

UNIT – I SOIL EXPLORATION:

Need – methods of soil exploration – boring and sampling methods – penetration tests – plate load test– planning of soil exploration programme, -preparation of soil investigation report.

UNIT – II SLOPE STABILITY:

Infinite and finite earth slopes – types of failures – factor of safety of infinite slopes – stability analysis by Swedish slip circle method, method of slices– Taylor’s Stability Number.

UNIT – III EARTH PRESSURE THEORIES:

Active, Passive and at rest soil pressures Rankine’s theory of earth pressure in cohesive and non-cohesive soils – Earth pressures in layered soils -Coulomb’s earth pressure theory. Culmann’s and Rebhann Graphical method for active case.

RETAINING WALLS: Types of retaining walls – stability of cantilever retaining walls.

UNIT – IV SHALLOW FOUNDATION

Types - choice of foundation – location and depth - safe bearing capacity – shear criteria – Terzaghi’s method of bearing capacity- settlement criteria –plate load test – allowable settlements of structures.

UNIT - V PILE FOUNDATION

Types of piles – load carrying capacity of piles based on static pile formulae – dynamic pile formulae – pile load tests - load carrying capacity of pile groups in sands and clays – Settlement of pile groups – negative skin friction.

TEXT BOOKS:

1. Soil Mechanics and Foundation Engg. By K.R. Arora, Standard Publishers and Distributors, Delhi.
2. Basic and Applied Soil Mechanics by GopalRanjan& ASR Rao, New age International Pvt Ltd.
3. Soil Mechanics and Foundation by by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt. Ltd., New Delhi
4. Soil Mechanics and Foundation Engg. By K.R. Arora, Standard Publishers and Distributors, Delhi.

5. Geotechnical Engineering by C. Venkataramiah, New age International Pvt. Ltd, (2002).

REFERENCE BOOKS:

1. Soil Mechanics and Foundation Engineering by VNS Murthy, CBS Publishers and Distributors.
2. Principals of Geotechnical Engineering by Braja M. Das, Cengage Learning Publishers.
3. Geotechnical Engineering Principles and Practices by Cuduto, PHI International.
4. Geotechnical Engineering by Manoj Dutta & Gulati S.K – Tata McGraw-Hill Publishers New Delhi.

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	12/76	16	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
2	16/76	21	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
3	16/76	21	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
4	16/76	21	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
5	16/76	21	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2

JUSTIFICATION STATEMENTS:

CO1: Understand the principles and methods of Soil Exploration

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO2: Apply various analytical methods to assess slop stability

Action Verb: Apply (L3)

PO1: Apply(L3)

CO2 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO2: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

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

CO3: Apply classical earth pressure theories to check the stability of retaining walls

Action Verb: Apply (L3)

PO1: Apply(L3)

CO3 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO3: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

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

CO4: Apply standard methods for bearing capacity and settlement analysis of shallow foundations

Action Verb: Apply (L3)

PO1: Apply(L3)

CO4 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO4: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO4 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

CO5: Evaluate pile capacity and settlement of pile group

Action Verb: Apply (L3)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO5: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO5 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

III Year

II Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20AMOC0102	RURAL WATER RESOURCE MANAGEMENT	2	1	0	3

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

CO1: Understand the concept of hydrological cycle and its parameters

CO2: Analyze the ground water resources and significance of its components

CO3: Design the water mass balance equation on surface water hydrology

CO4: Understand the rural water management issues and data challenges

CO5: Design the remote sensing data for rural water resources

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	The concept of hydrological cycle and its parameters			L2
CO2	Analyze	The ground water resources and significance of its components			L4
CO3	Design	The water mass balance equation		On surface water hydrology	L6
CO4	Understand	The rural water management issues and data challenges			L2
CO5	Design	The remote sensing data		For rural water resources	L6

Course layout

Week 1: Importance of water resource management in India and Introduction to Hydrological Cycle and representations – CO1

Week 2: Key Hydrological Parameters 1 – CO1

Week 3: Key Hydrological Parameters 2 – CO1

Week 4: Introduction to Groundwater hydrology - CO2

Week 5: Groundwater components – CO2

Week 6: Surface water hydrology – CO3

Week 7: Water Mass Balance Equation – CO3

Week 8: Rural water management issues, data challenges and observation records. – CO4

Week 9: Rural water resource management infrastructure (engineered) – CO4

Week 10: Rural water resource management infrastructure (nature based) – CO4

Week 11: Rural hydrological databases for India – CO4

Week 12: Remote Sensing data bases for Rural water resources – CO5

REFERENCES:

- Freeze P.A., Cherry J. 1979 Groundwater. Prentice-Hall
- Ward, R.C and Robinson. M. 1967. Principles of Hydrology. Tata McGraw Hill
- Dingman, S.L. and Dingman, S.L. 2015. Physical hydrology (Vol. 575). Upper Saddle River, NJ: Prentice Hall.
- Viessman, W., Lewis, G.L. and Knapp, J.W. 2003. Introduction to hydrology (No. GB 661.2. V53 1972.). Upper Saddle River, NJ: Prentice Hall.
- Fetter, C.W. 2018. Applied hydrogeology. Waveland Press.

III Year

II Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20AMOC0102	INTELLIGENT TRANSPORTATION SYSTEMS	2	1	0	3

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

CO1: Apply the sensor techniques in capturing the data by using GIS

CO2: Understand the tele communication usage in road networks

CO3: Apply the various ITS methodologies in the transportation

CO4: Understand the user needs and services in traffic and travel management

CO5: Understand the significance of ITS under Indian conditions

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Apply	the sensor techniques in capturing the data	by using GIS		L3
CO2	Understand	the tele communication usage		in road networks	L2
CO3	Apply	the various its methodologies		in the transportation	L3
CO4	Understand	the user needs and services of traffic management		in traffic and travel management	L2
CO5	Understand	the significance of its	Indian conditions		L2

UNIT – I INTRODUCTION: Objectives- Advantages - Data Collection Techniques - Detectors – Automatic Vehicle Location- Automatic Vehicle Identification - Geographical Information Systems - Video Data Collection.

UNIT – II TELECOMMUNICATIONS IN ITS: Importance of telecommunications in the ITS system - Information Management - Traffic Management Centers (TMC) - Vehicle–Road side communication – Vehicle Positioning System.

UNIT – III ITS FUNCTIONAL AREAS: Advanced Traffic Management Systems (ATMS) - Advanced Traveler Information Systems (ATIS) - Commercial Vehicle Operations (CVO) - Advanced Vehicle Control Systems (AVCS) -Advanced Public Transportation Systems (APTS) – Advanced Rural Transportation Systems (ARTS).

UNIT – IV ITS USER NEEDS AND SERVICES: Travel and Traffic management - Public Transportation Management -Electronic Payment - Commercial Vehicle Operations – Emergency Management - Advanced Vehicle safety systems - Information Management.

UNIT – V AUTOMATED HIGHWAY SYSTEMS: Vehicles in Platoons – Integration of Automated Highway Systems – ITS Programs in the World – Overview of ITS implementations in developed countries - Case studies.

TEXT BOOKS

1. ITS Hand Book 2000: Recommendations for World Road Association (PIARC), Kan Paul Chen, John Miles.

2. Sussman, J. M., *Perspective on ITS*, Artech House Publishers, 2005.
 3. National ITS Architecture Documentation, US Department of Transportation, 2007 (CDROM).

REFERENCE BOOKS

1. Chowdhary, M.A. and A Sadek, *Fundamentals of Intelligent Transportation systems planning*, Artech House Inc., US, 2003.

MAPPING OF COS TO POS AND PSOS

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	12/59	20	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
2	11/59	19	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
3	14/59	23	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
4	11/59	19	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
5	11/59	19	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2

JUSTIFICATION STATEMENTS:

CO1: Apply the sensor techniques in capturing the data by using GIS

Action Verb: Apply (L3)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO1 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

CO2: Understand the tele communication usage in road networks

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO2 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO3: Apply the various ITS methodologies in the transportation

Action Verb: Apply (L3)

PO1: Apply(L3)

CO3 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO3: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

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

CO4: Understand the user needs and services in traffic and travel management

Action Verb: Understand (L2)

PO1: Apply(L3)

CO4 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO4 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO5: Understand the significance of ITS under Indian conditions

Action Verb: Understand (L2)

PO1: Apply(L3)

CO5 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

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

CO5 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

III Year

II Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20AMOC0102	REMOTE SENSING AND GIS	2	1	0	3

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

- CO1:** Understand principles of aerial photography
- CO2:** Understand the concept of remote sensing
- CO3:** Understand the concept of geographic information system
- CO4:** Analyze the GIS spatial data
- CO5:** Apply the concepts of GIS in water resources

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	Principles of aerial photography			L2
CO2	Understand	Concept of remote sensing			L2
CO3	Understand	Concept of geographic information system			L2
CO4	Analyze	GIS spatial data			L4
CO5	Apply	Concepts of GIS		Water Resources	L3

UNIT – I INTRODUCTION TO PHOTOGRAMMETRY:

Principles & types of aerial photograph, geometry of vertical aerial photograph, Scale & Height measurement on single vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of stereoscopy, fiducially points, parallax measurement using fiducially line.

UNIT – II REMOTE SENSING:

Basic concepts and foundation of remote sensing – elements involved in remote sensing, electromagnetic spectrum, remote sensing terminology and units. Energy resources, energy interactions with earth surface features and atmosphere, resolution, sensors and satellite visual interpretation techniques, basic elements, converging evidence, interpretation for terrain evaluation, spectral properties of water bodies, introduction to digital data analysis.

UNIT – III GEOGRAPHIC INFORMATION SYSTEM:

Introduction, GIS definition and terminology, GIS categories, components of GIS, fundamental operations of GIS, A theoretical framework for GIS.

TYPES OF DATA REPRESENTATION: Data collection and input overview, data input and output. Keyboard entry and coordinate geometry procedure, manual digitizing and scanning, Raster GIS, Vector GIS – File management, Spatial data – Layer based GIS, Feature based GIS mapping.

UNIT – IV GIS SPATIAL ANALYSIS:

Computational Analysis Methods (CAM), Visual Analysis Methods (VAM), Data storage-vector data storage, attribute data storage, overview of the data manipulation and analysis. Integrated analysis of the spatial and attribute data.

UNIT – V WATER RESOURCES APPLICATIONS:

Land use/Land cover in water resources, Surface water mapping and inventory -Watershed management for sustainable development and Watershed characteristics - Reservoir sedimentation, Fluvial Geomorphology - Ground Water Targeting, Identification of sites for artificial Recharge structures - Inland water quality survey and management, water depth estimation and bathymetry.

TEXT BOOKS

- 1 Remote Sensing and GIS by B.Bhatta, Oxford University Press, New Delhi.
- 2 Fundamentals of remote sensing by Gorge Joseph, Universities press, Hyderabad

REFERENCES

1. Advanced Surveying: Total Station GIS and Remote Sensing – Sathesh Gopi – Pearson Publication.
2. Remote Sensing and its applications by LRA Narayana University Press 1999.
3. Basics of Remote sensing & GIS by S.Kumar, Laxmi Publications.
4. Remote sensing and GIS by M.AnjiReddy, B.S.Publiications, New Delhi.
5. GIS by Kang – Tsung Chang, TMH Publications & Co.,

MAPPING OF COS TO POS AND PSOS

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	12/66	18	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
2	12/66	18	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
3	12/66	18	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
4	16/66	24	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	3 3 3 3
5	14/66	22	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2

JUSTIFICATION STATEMENTS:

CO1: Understand principles of aerial photography

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)

CIVIL ENGINEERING

AK20 REGULATION

(Effective for the students admitted from the AY 2022-23 & LE from 2023-24)

III Year

II Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APC0125	STAAD LAB	0	0	3	1.5

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

CO1: Analyze the 2-D and 3-D Frames subjected to various loads

CO2: Analyze the Steel Tabular Truss subjected to various loads

CO3: Evaluate the retaining wall and simple tower subjected to various loads

CO4: Evaluate the one way and two-way slabs subjected to various loads

CO5: Analyze the columns subjected to various loads

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Analyze	2-D and 3-D Frames	subjected to various loads		L4
CO2	Analyze	Steel Tabular Truss	subjected to various loads		L4
CO3	Evaluate	Retaining walls and Simple tower	subjected to various loads		L5
CO4	Evaluate	one way and two way slabs	subjected to various loads		L5
CO5	Analyze	Columns	subjected to various loads		L4

SOFTWARE:

1. STAAD PRO or Equivalent

EXERCISIES:

1. 2-D Frame Analysis and Design-CO1
2. Steel Tabular Truss Analysis and Design-CO2
3. 3-D Frame Analysis and Design- CO1
4. Retaining Wall Analysis and Design- CO3
5. Simple tower Analysis and Design- CO3
6. One Way Slab Analysis & Design- CO4
7. Two Way Slab Analysis & Design- CO4
8. column Analysis & Design- CO5

TEXT BOOK:

1. computer Aided Design Lab Manual by Dr.M.N.SeshaPrakash And Dr.C.S.Suresh

CO-PO MAPPING JUSTIFICATION:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes		Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	CO's Action Verb	BTL			
1	Analyze	L4	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
2	Analyze	L4	PO1	Apply (L3)	2
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
3	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO3	Design(L6)	2
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
4	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO3	Design(L6)	2
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
5	Analyze	L4	PO1	Apply (L3)	2
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3

JUSTIFICATION STATEMENTS:

CO1: Analyze the 2-D and 3-D Frames subjected to various loads

Action Verb: Analyze (L4)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action verb is equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

CO1 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as moderate (3).

CO2: Analyze the Steel Tabular Truss subjected to various loads

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO3: Evaluate the retaining wall and simple tower subjected to various loads

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO3: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO3 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO3 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO4: Design

CO3 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

CO4: Evaluate the one way and two-way slabs subjected to various loads

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO4: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO4 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO4: Design

CO4 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

CO5: Analyze the columns subjected to various loads

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

CO5 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as moderate (3).

III Year

II Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APC0126	ENVIRONMENTAL ENGINEERING LAB	0	0	3	1.5

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

CO1: Evaluate the physical characteristics of water

CO2: Evaluate the chemical characteristics of water

CO3: Evaluate the biological characteristics of water

CO4: Analyze the optimum dosage of coagulant

CO5: Evaluate the quality of surface and ground water

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Evaluate	the physical characteristics		of water	L5
CO2	Evaluate	the chemical Characteristics		of water	L5
CO3	Evaluate	the biological Characteristics		of water	L5
CO4	Analyze	the optimum dosage		of coagulant	L4
CO5	Evaluate	the quality		of surface and ground water	L5

LIST OF EXPERIMENTS

1. Determination of pH and Turbidity-CO5
2. Determination of Conductivity and Total dissolved solids-CO1
3. Determination of Alkalinity/Acidity-CO5
4. Determination of Chlorides- CO5
5. Determination and Estimation of total solids, organic solids and inorganic solids- CO3
6. Determination of iron- CO2
7. Determination of Dissolved Oxygen- CO3
8. Determination of Nitrogen- CO2
9. Determination of total Phosphorous- CO2
10. Determination of B.O.D- CO2
11. Determination of C.O.D- CO2
12. Determination of Optimum coagulant dose- CO4
13. Determination of Chlorine demand- CO4
14. Presumptive coliform test- CO3

NOTE: At least 8 of the above experiments are to be conducted.

MAPPING OF COS TO POS AND PSOS

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes		Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	CO's Action Verb	BTL			
1	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO3	Design (L6)	3
			PO4	Analysis (L4)	3
			PO6	Thumb Rule	3
2	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO3	Design (L6)	3
			PO4	Analysis (L4)	3
			PO6	Thumb Rule	3
3	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO3	Design (L6)	3
			PO4	Analysis (L4)	3
			PO6	Thumb Rule	3
4	Analyze	L4	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
5	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO3	Design (L6)	3
			PO4	Analysis (L4)	3
			PO6	Thumb Rule	3

JUSTIFICATION STATEMENTS:

CO1: Evaluate the physical characteristics of water

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

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

PO4: Design

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

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

CO2: Evaluate the chemical characteristics of water

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

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

PO4: Design

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

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

CO3: Evaluate the biological characteristics of water

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

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

PO4: Design

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

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

CO4: Analyze the optimum dosage of coagulant

Action Verb: Analyze (L4)

PO1: Apply(L3)

CO Action verb is greater than PO1 verb. Therefore, the correlation is moderate (2)

PO2: Analyze (L4)

CO Action verb is equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

CO Action Verb is equal to PO4; Therefore, correlation is high (3)

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

CO5: Evaluate the quality of surface and ground water

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

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

PO4: Design

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

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

CO2: Understand the concept of remote sensing

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO2 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO3: Understand the concept of geographic information system

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO3 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO3 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO4: Analyze the GIS spatial data

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO5: Apply the concepts of GIS in water resources

Action Verb: Apply (L3)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO5: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO5 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

III Year

II Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APC0127	HIGHWAY ENGINEERING LAB	0	0	3	1.5

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

CO1: Evaluate the quality and suitability of aggregates for highway applications

CO2: Evaluate the quality and suitability of bitumen for highway applications

CO3: Analyze traffic flow characteristics at intersections by conducting traffic volume studies

CO4: Analyze traffic flow characteristics at mid-blocks by conducting traffic volume studies

CO5: Apply relevant Indian Standard (IS) codes during laboratory testing procedures

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Evaluate	The quality and suitability		For Highway applications	L5
CO2	Evaluate	The quality and suitability of bitumen		For Highway applications	L5
CO3	Analyze	The traffic flow characteristics at intersections	by conducting traffic volume studies		L4
CO4	Analyze	The traffic flow characteristics at mid-blocks	by conducting traffic volume studies		L4
CO5	Apply	The relevant Indian Standard (IS) codes	during laboratory testing procedures		L3

LIST OF EXPERIMENTS

I. ROAD AGGREGATES: -CO1, CO5

1. Aggregate Crushing value
2. Aggregate Impact Test.
3. Specific Gravity and Water Absorption.
4. Abrasion Test.
5. Shape tests

II. BITUMINOUS MATERIALS: -CO2, CO5

1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Flash and fire point tests.

III TRAFFIC FIELD STUDIES-CO3, CO4, CO5

1. Traffic Volume Studies at Mid-block and Data Analysis
2. Traffic Volume Studies at Intersection and Data Analysis

LIST OF EQUIPMENT:

1. Apparatus for aggregate crushing test.
2. Aggregate Impact testing machine
3. Pycnometer.
4. Los angles Abrasion test machine
5. Length and elongation gauges
7. Bitumen penetration test setup.
8. Bitumen Ductility test setup.
9. Ring and ball apparatus
10. Penskey – Morten’s apparatus
11. Relevant IS Codes

MAPPING OF COS TO POS AND PSOS

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes		Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	CO's Action Verb	BTL			
1	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO3	Design (L6)	3
			PO4	Analysis (L4)	3
			PO6	Thumb Rule	3
2	Evaluate	L5	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO3	Design (L6)	3
			PO4	Analysis (L4)	3
			PO6	Thumb Rule	3
3	Analyze	L4	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
4	Analyze	L4	PO1	Apply (L3)	3
			PO2	Analyze (L4)	3
			PO4	Analyze (L4)	3
			PO6	Thumb Rule	3
5	Apply	L3	PO1	Apply (L3)	3
			PO2	Analyze (L4)	2
			PO6	Thumb Rule	2

JUSTIFICATION STATEMENTS:

CO1: Evaluate the quality and suitability of aggregates for highway applications

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

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

PO4: Design

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

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

CO2: Evaluate the quality and suitability of bitumen for highway applications

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

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

PO4: Design

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

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

CO3: Analyze traffic flow characteristics at intersections by conducting traffic volume studies

Action Verb: Analyze (L4)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO Action verb is equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

CO Action Verb is equal to PO4; Therefore, correlation is high (3)

CO Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as moderate (3).

CO4: Analyze traffic flow characteristics at mid-blocks by conducting traffic volume studies

Action Verb: Analyze (L4)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO Action verb is equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

CO Action Verb is equal to PO4; Therefore, correlation is high (3)

CO Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as moderate (3).

CO5: Apply relevant Indian Standard (IS) codes during laboratory testing procedures

Action Verb: Apply (L3)

PO1: Apply(L3)

CO Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

III Year

II Semester

Subject Code	Subject Name	L	T/CLC	P	Credits
20AHE9902	PRINCIPLES OF EFFECTIVE PUBLIC SPEAKING	0	1	2	2

Course Outcomes: After studying, the students will be able to

CO1: Apply the knowledge of principles, concepts and skills learned in speech preparation.

CO2: Analyze the techniques of knowing audiences and in refining the speech

CO3: Understand the listening skills and styles in effective listening.

CO4: Analyze the diverse methods of speech in speech composition

CO5: Apply the supporting materials and presentation aids in speech preparation.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Apply	the knowledge of principles, concepts and skills learned	in speech preparation		L3
2	Analyze	the techniques of knowing audiences and	in refining the speech		L4
3	Understand	the listening skills and styles	in effective listening		L2
4	Analyze	the diverse methods of speech	in speech composition		L4
5	Apply	the supporting materials and presentation aids	in speech preparation		L3

UNIT -1

INTRODUCTION TO PUBLIC SPEAKING:

Basic communication concepts, processes – Models of Communication, concepts and principles of public speaking - Steps and methods of speech preparation.

UNIT -2

SELECTING TOPIC AND KNOWING YOUR AUDIENCE:

Identifying sources; Tools and techniques for selecting and refining speech topics - Identifying speech purposes - Central idea statement - Audience analysis techniques.

UNIT – 3

LISTENING WITH A PURPOSE:

Effective listening, the listening process, and types of listening; Listening barriers; Identifying and improving listening styles.

UNIT - 4

SPEAKING WITH A PURPOSE:

Methods of speech preparation - Informative, persuasive, and ceremonial speeches.

UNIT -5

DELIVERING YOUR SPEECH AND USING VISUAL AIDS:

The mechanics of verbal and nonverbal communication in speech delivery - Effective delivery techniques - Incorporating presentation aids in presentation.

References:

- DeVito, J.A. (2009). The Essential Elements of Public Speaking. (3rd ed.) Boston: Pearson Education, Inc.
- Lucas, S.E. (2009). The Art of Public Speaking. (10th ed.) New York: McGraw - Hill Co.
- Zarefsky, D. (2011). Public Speaking: Strategies for Success. (6th ed. Boston: Pearson Education, Inc).

CORRELATION OF COS WITH THE POS & PSOS:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1									2				
CO 2									3				
CO 3									2				
CO 4									3				
CO 5									2				

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 PO11)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	-	-	-	Apply	L3	9	Thumb Rule	2
2	-	-	-	Analyze	L4	9	Thumb Rule	3
3	-	-	-	Understand	L2	9	Thumb Rule	2
4	-	-	-	Analyze	L4	9	Thumb Rule	3
5	-	-	-	Apply	L3	9	Thumb Rule	2

JUSTIFICATION:

CO1: Apply the knowledge of principles, concepts and skills learned in speech preparation.

Action Verb: Apply (L3)

CO1 Action Verb is Apply of BTL3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).

CO2: Analyze the techniques of knowing audiences and in refining the speech

Action Verb: Analyze (L4)

CO2 Action Verb is Analyze of BTL4. Using Thumb rule, L4 correlates PO6 to PO11 as high (3).

CO3: Understand the listening skills and styles in effective listening.

Action Verb: Apply (L3)

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

CO4: Analyze the diverse methods of speech in speech composition.

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

CO5: Apply the supporting materials and presentation aids in speech preparation.

CO5 Action Verb is Apply of BTL3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2)

III Year

II Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20AMC9901	BIOLOGY FOR ENGINEERING	2	1	0	3

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

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

CO2: Understand the role of biomolecules in industry.

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

CO4: Understand DNA technology in living organisms

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

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	Structure of cells and basics in living organisms			L2
CO2	Understand	Role of biomolecules in industry			L2
CO3	Understand	the functioning of physiology in respiratory system and digestive system			L2
CO4	Understand	DNA technology in living organisms			L2
CO5	Apply	The biological principles in different technologies for the production of medicines and pharmaceuticals			L3

UNIT I: INTRODUCTION TO BASIC BIOLOGY

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

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

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

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

UNIT V: APPLICATION OF BIOLOGY

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

REFERNCES:

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

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s):Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	10	20	2	Understand	L2	PO6	Thumb Rule	2
2	10	20	2	Understand	L2	PO6	Thumb Rule	2
3	9	18	1	Understand	L2	PO6	Thumb Rule	2
4	9	18	1	Understand	L2	PO6	Thumb Rule	2
5	10	20	2	Apply	L3	PO6	Thumb Rule	2

JUSTIFICATION:

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

Action Verb: Understand (L2)

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

CO2: Understand the role of biomolecules in industry.

Action Verb: Understand (L2)

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

CO3: Understand the functioning of physiology in respiratory system and digestive system

Action Verb: Understand (L2)

CO3 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO4: Understand DNA technology in living organisms.

Action Verb: Understand (L2)

CO4 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

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

Action Verb: Apply (L3)

CO5 Action Verb is of BTL 3. Using Thumb rule, L2 correlates PO6 as moderate (2)

Semester VII (Fourth year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T/CLC	P		C	CIE	SEE
1	Professional Elective courses	20APE0107	Estimation Costing & Valuation	2	1	0	3	30	70	100
		20APE0108	Environmental Impact Assessment and Management							
		20APE0109	Railways airport Docks and Harbours							
2	Professional Elective courses	20APE0104	Design and Drawing of Reinforced Concrete Structures	2	1	0	3	30	70	100
		20APE0111	Design and Drawing of irrigation Structures							
		20APE0112	Water shed and River management							
3	Professional Elective courses	20APE0113	Design and Drawing of Steel Structures	2	1	0	3	30	70	100
		20APE0114	Advanced Structural Design							
		20APE0115	Bridge Engineering							
4	Elective course / Job Oriented Elective	20MOC0103	Computer Networks	2	1	0	3	25	75	100
			Entrepreneurship Development							
			Intellectual Property Rights							
5	Professional Elective courses (CBCS)	20APE0116	Pre-stressed Concrete	2	1	0	3	30	70	100
		20APE0117	Ground Improvement Techniques							
		20APE0118	Repair and Rehabilitation of Structures							
6	Humanities & Social Science Elective*	20AOE9901	English For Research Paper Writing	2	1	0	3	30	70	100
		20AHE9903	Professional Communication							
7	Skill Advanced Course*	20APC0129	Structural Analysis Design software	0	1	2	2	100	-	100
Industrial/ Research Internship 2 months (Mandatory) after Third Year (to be evaluated during VII semester)				0	0	0	3	100	-	100
Total credits							23	375	425	800
Honors/ Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)				3	1	0	4	30	70	100

IV Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APE0107	ESTIMATION, COSTING AND VALUATION	2	1	0	3

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

- CO1:** Understand the different types of estimates and standard specifications
- CO2:** Analyze the estimation of different types of buildings and steps
- CO3:** Analyze the volume of earth works and quality of reinforcement
- CO4:** Understand the type of contracts and tenders
- CO5:** Evaluate the rate analysis and valuation of building items

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	Types of estimates and standard specifications			L2
CO2	Analyze	Estimations		Of different Buildings & Steps	L4
CO3	Analyze	volume of earth works and quality of reinforcement			L4
CO4	Understand	type of contracts and tenders			L2
CO5	Evaluate	rate analysis and valuation		Building Items	L5

UNIT – I

INTRODUCTION: General items of work in Building – Standard Units Principles of working out quantities for detailed and abstract estimates – Approximate method of Estimating.

STANDARDS SPECIFICATIONS: General and Detailed specifications for different items of building construction

UNIT – II

ESTIMATION OF BUILDINGS: Detailed Estimates of Buildings for single room building, double room building, hexagonal room building

STEP: Simple step, Corner step and Three sides step

UNIT – III

EARTHWORK ESTIMATION: Earthwork for roads and canals. Taking out quantities of work for different Civil Engineering Works for Roads, Canals embankments, methods of mean sectional area and mid sectional area, trapezoidal, Prismoidal formula. Calculation of quantity of earth work. Estimate of Road of 1km

REINFORCEMENT ESTIMATION: Reinforcement bar bending and bar requirement schedules for beams, column, slabs and footings

UNIT – IV CONTRACTS AND TENDERS:

Contracts – Types of contracts – Contract Documents – Conditions of contract – Types of Tenders – Requirement of Tendering.

UNIT – V

RATE ANALYSIS: Working out rate analysis for various items of work using Standard schedule of rates.

VALUATION: Purpose of valuation, types of property- Depreciation, Sinking fund, Lease hold and free hold property, obsolescence, Gross income, Outgoing and Net income, Capitalized value and year's purchase. Rental method of valuations, and typical problems.

TEXT BOOKS

1. Estimating and Costing, 27th revised edition by B.N. Dutta, UBS publishers, 2000.
2. Civil Engineering Contracts and estimations, 4th edition by B.S.Patil, Universities Press, Hyderabad.

REFERENCES

1. Engineering Construction Cost 6th edition by Peurifoy, TMH Publications
2. Estimation, Costing and Specifications by M. Chakraborti; Laxmi publications.
3. Standard Schedule of Rates and Standard Data Book by Public Works Department.
4. I. S. 1200 (Parts I to XXV – 1974/ Method of Measurement of Building and Civil Engineering works – B.I.S.)
5. National Building Code

Note : Standard schedule of rates is permitted in the examination hall.

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	12/80	15	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
2	18/80	22	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	3 3 3 3
3	18/80	23	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	2 3 3 3
4	12/80	15	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
5	20/80	25	3	Evaluate	L5	PO1 PO2 PO4 PO6 PO11	Apply (L3) Analyze (L4) Analysis (L4) Thumb Rule Thumb Rule	3 3 3 3 3

JUSTIFICATION STATEMENTS:

CO1: Understand the different types of estimates and standard specifications

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO2: Analyze the estimation of different types of buildings and steps

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO3: Analyze the volume of earth works and quality of reinforcement

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO4: Understand the type of contracts and tenders

Action Verb: Understand (L2)

PO1: Apply(L3)

CO4 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO4 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO5: Evaluate the rate analysis and valuation of building items

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO5: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO5 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO5 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO4: Design

CO5 Action verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 as High (3)

PO11: Action verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO11 as High (3)

IV Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APE0108	ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT	2	1	0	3

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

CO1: Understand the methodologies of EIA

CO2: Understand the impact of development activities and land use

CO3: Understand the risk and its impact on Vegetation and wild life

CO4: Understand the preparation of Environment Audit

CO5: Understand the various environmental acts

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	Methodologies of EIA			L2
CO2	Understand	Impact of development activities and land use			L2
CO3	Understand	Risk and its impact on Vegetation and wild life			L2
CO4	Understand	Preparation of Environment Audit			L2
CO5	Understand	Environmental acts			L2

UNIT – I CONCEPTS AND METHODOLOGIES OF EIA

Initial environmental Examination, Elements of EIA, - Factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters- Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods and cost/benefit Analysis.

UNIT – II IMPACT OF DEVELOPMENTAL ACTIVITIES AND LAND USE

Introduction and Methodology for the assessment of soil and ground water, Delineation of study area, Identification of actives. Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures. E I A in surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, Air pollution sources, Generalized approach for assessment of Air pollution Impact.

UNIT –III ASSESSMENT OF IMPACT ON VEGETATION, WILDLIFE AND RISK ASSESSMENT:

Introduction - Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation - Risk assessment and treatment of uncertainty key stages in performing an Environmental Risk Assessment-Advantages of Environmental Risk Assessment

UNIT – IV ENVIRONMENTAL AUDIT:

Introduction - Environmental Audit & Environmental legislation objectives of Environmental Audit, Types of environmental Audit, Audit protocol, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report.

UNIT – V ENVIRONMENTAL ACTS AND NOTIFICATIONS:

The Environmental protection Act, The water preservation Act, The Air (Prevention & Control of pollution Act), Wild life Act - Provisions in the EIA notification, procedure for environmental clearance, procedure

for conducting environmental impact assessment report- Evaluation of EIA report. Environmental legislation objectives, evaluation of Audit data and preparation of Audit report. Post Audit activities, Concept of ISO and ISO 14000.

TEXT BOOKS:

1. Canter Larry W., —Environmental Impact Assessment, McGraw-Hill education Edi (1996)
2. Y. Anjaneyulu, —Environmental Impact Assessment Methodologies, B. S. Publication, Hyderabad.

REFERENCES:

1. Peavy, H. S, Rowe, D. R, Tchobanoglous, —Environmental Engineering, G. Mc-Graw Hill International Editions, New York 1985
2. J. Glynn and Gary W. Hein Ke, —Environmental Science and Engineering, Prentice Hall Publishers
3. Suresh K. Dhaneja, —Environmental Science and Engineering, S.K., Katania & Sons Publication, New Delhi.
4. H. S. Bhatia, — Environmental Pollution and Controll, Galgotia Publication (P) Ltd, Delhi.

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	12/60	15	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
2	12/60	15	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
3	12/60	15	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
4	12/60	15	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
5	12/60	15	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2

JUSTIFICATION STATEMENTS:

CO1: Understand the methodologies of EIA

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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(Autonomous)

CIVIL ENGINEERING

AK20 REGULATION

(Effective for the students admitted from the AY 2022-23 & LE from 2023-24)

COI Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

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IV Year

I Semester

Subject code	Subject name	L	T/CLC	P	CREDITS
20APE0109	RAILWAYS AIRPORT DOCKS AND HARBORS	2	1	0	3

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

CO1: Understand the permanent way components and its functions in railway engineering

CO2: Understand the geometric design elements of railway track

CO3: Understand the Aircraft characteristics and their influence on various design elements of an airport

CO4: Understand the geometric design parameters of runways and taxi ways

CO5: Understand the significance and role of ports and harbors

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	Permanent way components and its functions		Railway engineering	L2
CO2	Understand	Geometric design elements		Railway track	L2
CO3	Understand	Aircraft characteristics and their influence on various		Design elements of an airport	L2
CO4	Understand	Geometric design parameters		Runways and Taxi ways	L2
CO5	Understand	Significance and role of ports and harbors			L2

UNIT – I RAILWAY ENGINEERING:

Introduction – Permanent way components – Cross section of permanent way – Functions and requirements of rails, sleepers and ballast – Types of gauges – Creep of rails – Theories related to creep – Coning of wheels – adzing of sleepers – Rail fastenings.

UNIT – II GEOMETRIC DESIGN OF RAILWAY TRACK

Gradients – Grade compensation – Cant and negative super elevation – Cant deficiency – Degree of curves – Safe speed on railway track – Points and crossings – Layout and functioning of left hand turn out and right hand turn outs – Station yards – Signaling and interlocking.

UNIT –III AIRPORT ENGINEERING

Airport site selection – Factors affecting site selection and surveys- Runway orientation – Wind rose diagram – basic runway length – Correction for runway length – Terminal area – Layout and functions – Concepts of terminal building – Simple building, Linear concept, pier concept and satellite concept – Typical layouts.

UNIT – IV GEOMETRIC DESIGN OF RUNWAYS AND TAXIWAYS

Aircraft characteristics – Influence of characteristics on airport planning and design – Geometric design elements of runway – Standards and specifications - Functions of taxiways – Taxiway geometric design – Geometric elements and standard specifications – Runway and taxiway lighting.

UNIT – V PORTS AND HARBORS

Requirements of ports and harbours – Types of ports – Classification of harbours – Docks and types of docks – Dry docks, wharves and jetties – Breakwaters: layouts of different types of harbours and docks – Dredging operations – navigation aids.

TEXT BOOKS

1. A Text Book of Railway Engineering-S.C.Saxena and S.Arora, Dhanpatrai and Sons, New Delhi.
2. SatishChandra and Agarwal, M.M. (2007) “Railway Engineering” Oxford Higher Education, University Press New Delhi.
3. Airport Planning and Design- S.K. Khanna and M.G Arora, Nemchand Bros.
4. A Text book of Transportation Engineering – S.P. Chandola – S. Chand & Co. Ltd. – (2001).
5. Railway Track Engineering by J.S. Mundry

REFERENCES

1. Highway, railway, Airport and Harbour Engineering – K.P. Subramanian, Scitech publishers.
2. Harbour, Dock and Tunnel Engineering – R. Srinivasan, Charotar Publishing House Pvt. Limited, 2009
3. Dock and Harbour Engineering – Hasmukh P Oza, Gutam H Oza, Chartor Publishers pvt ltd.

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	12/60	15	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
2	12/60	15	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
3	12/60	15	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
4	12/60	15	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
5	12/60	15	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2

JUSTIFICATION STATEMENTS:

CO1: Understand the permanent way components and its functions in railway engineering
Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO2: Understand the geometric design elements of railway track

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO2 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO3: Understand the Aircraft characteristics and their influence on various design elements of an airport

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO3 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO3 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO4: Understand the geometric design parameters of runways and taxi ways

Action Verb: Understand (L2)

PO1: Apply(L3)

CO4 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO4 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO5: Understand the significance and role of ports and harbors

Action Verb: Understand (L2)

PO1: Apply(L3)

CO5 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

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

CO5 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

IV Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APE0104	DESIGN AND DRAWING OF REINFORCED CONCRETE STRUCTURES	2	1	0	3

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

CO1: Design various types of beams using IS codes

CO2: Design the beams to meet the limit state of collapse and serviceability requirements

CO3: Design the reinforcement for slabs and staircase as per IS Codes

CO4: Design short and long columns under different bending conditions

CO5: Design Isolated square and rectangular footing

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Design	Types of beams	IS codes		L6
CO2	Design	Limit state of collapse and serviceability requirements		Beams	L6
CO3	Design	slabs and staircase	IS Codes		L6
CO4	Design	short and long columns	Different bending conditions		L6
CO5	Design	Isolated square and rectangular footing			L6

UNIT – I

INTRODUCTION: Concepts of RCC Design –Introduction to Working stress method - Limit State method – Material Stress- Strain Curves – Safety factors – Characteristic values. Stress Block parameters – IS: 456 – 2000.

Beams: Limit state analysis and design of singly reinforced, doubly reinforced, T and L beam sections.

UNIT – II

SHEAR, TORSION AND BOND: Limit state analysis and design of section for shear and torsion – concept of bond, anchorage and development length, I.S. code provisions. Design examples in simply supported and continuous beams, detailing.

Limit state design for serviceability for deflection, cracking and codal provision.

UNIT – III

Design of Two-way slabs and one way slab Using I S Coefficients. Design of Stair case – Dog legged and Open well.

UNIT –IV

Short and Long columns –axial loads, uni-axial and biaxial bending I S Code provisions.

UNIT – V

Design of Footings – Design and drawing of isolated square footing, rectangular footing

NOTE: All the designs to be taught in Limit State Method Following plates should be prepared by the students.

1. Reinforcement particulars of T-beams and L-beams.
2. Reinforcement detailing of continuous beams.
3. Reinforcement particulars of columns and footings.
4. Detailing of One way, two way and continuous slabs

TEXT BOOKS

1. Reinforced concrete design by N. Krishna Raju and R.N. Pranesh, New age International Publishers, New Delhi
2. Limit State Design of Reinforced Concrete by B.C.Punmia, Ashok Kumar Jain and Arun

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CIVIL ENGINEERING

AK20 REGULATION

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Kumar Jain, Laxmi, publications Pvt. Ltd., New Delhi

REFERENCES:

1. Limit State Design of RCC Structures – P.C.Varghese, Printice Hall of India, New Delhi
2. Structural Design and Drawing by N.KrishnaRaju, University Press, Hyderabad
3. Reinforced Concrete Design by Pillai& Menon, TMH Publishers.
4. Analysis of Skeletal Structures by Seetharamulu Kaveti, TMH publications.

Codes/Tables: IS 456-2000 and SP-16 code books to be permitted into the examinations Hall.

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	16/80	20	3	Design	L6	PO1 PO2 PO3 PO4 PO6	Apply (L3) Analyze (L4) Design (L6) Analysis (L4) Thumb Rule	3 3 3 3 3
2	16/80	20	3	Design	L6	PO1 PO2 PO3 PO4 PO6	Apply (L3) Analyze (L4) Design (L6) Analysis (L4) Thumb Rule	3 3 3 3 3
3	16/80	20	3	Design	L6	PO1 PO2 PO3 PO4 PO6	Apply (L3) Analyze (L4) Design (L6) Analysis (L4) Thumb Rule	3 3 3 3 3
4	16/80	20	3	Design	L6	PO1 PO2 PO3 PO4 PO6	Apply (L3) Analyze (L4) Design (L6) Analysis (L4) Thumb Rule	3 3 3 3 3
5	16/80	20	3	Design	L6	PO1 PO2 PO3 PO4 PO6	Apply (L3) Analyze (L4) Design (L6) Analysis (L4) Thumb Rule	3 3 3 3 3

JUSTIFICATION STATEMENTS:

CO1: Design various types of beams using IS codes
Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO1: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO1 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO1 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO1 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

CO2: Design the beams to meet the limit state of collapse and serviceability requirements

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO2: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO2 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO2 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO2 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

CO3: Design the reinforcement for slabs and staircase as per IS Codes

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO3: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO3 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO3 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO3 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

CO4: Design short and long columns under different bending conditions

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO4: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO4 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO4 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

CO5: Design Isolated square and rectangular footing

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO5: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO5 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO5 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO5 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

IV Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APE0111	DESIGN AND DRAWING OF IRRIGATION STRUCTURES	2	1	0	3

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

CO1: Design the sloping glacises profile based on energy dissipation requirements and hydraulic jump formation

CO2: Design the weir profile based on discharge capacity, energy dissipation requirements and water surface profile control

CO3: Design the sluice opening and tower head based on discharge requirements and desired flow control characteristics

CO4: Design Syphon profile considering hydraulic efficiency and syphon priming requirements

CO5: Design the regulator opening and control mechanism under desire flow regulation characteristics

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Design	Sloping glacises profile	Based on energy dissipation requirements and hydraulic jump formation		L6
CO2	Design	Weir profile	Based on discharge capacity, energy dissipation requirements and water surface profile control		L6
CO3	Design	Sluice opening and tower head	Based on discharge requirements and desired flow control characteristics		L6
CO4	Design	Syphon profile	considering hydraulic efficiency and syphon priming requirements		L6
CO5	Design	Regulator opening and control mechanism	Desire flow regulation characteristics		L6

Design and drawing of the following irrigation structures.

1. Sloping glacis weir
2. Surplus weir.
3. Tank sluice with tower head
4. Type III Syphon aqueduct.
5. Canal regulator.

TEXT BOOKS:

1. C.Satyanarayana Murthy, —Design of minor irrigation and canal structures, Wiley eastern Ltd.
2. S.K.Garg, —Irrigation engineering and Hydraulic structures Standard

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	16/80	20	3	Design	L6	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO3	Design (L6)	3
						PO4	Analysis (L4)	3
						PO6	Thumb Rule	3
2	16/80	20	3	Design	L6	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO3	Design (L6)	3
						PO4	Analysis (L4)	3
						PO6	Thumb Rule	3
3	16/80	20	3	Design	L6	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO3	Design (L6)	3
						PO4	Analysis (L4)	3
						PO6	Thumb Rule	3
4	16/80	20	3	Design	L6	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO3	Design (L6)	3
						PO4	Analysis (L4)	3
						PO6	Thumb Rule	3
5	16/80	20	3	Design	L6	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO3	Design (L6)	3
						PO4	Analysis (L4)	3
						PO6	Apply (L3)	3

JUSTIFICATION STATEMENTS:

CO1: Design the sloping glacises profile based on energy dissipation requirements and hydraulic jump formation

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO1: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO1 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO2: Understand the impact of development activities and land use

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO2 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO3: Understand the risk and its impact on Vegetation and wild life

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO3 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO3 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO4: Understand the preparation of Environment Audit

Action Verb: Understand (L2)

PO1: Apply(L3)

CO4 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO4 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO5: Understand the various environmental acts

Action Verb: Understand (L2)

PO1: Apply(L3)

CO5 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

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

CO5 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

IV Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APE0112	WATER SHED AND RIVER MANAGEMENT	2	1	0	3

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

CO1: Understand the basic principles of watershed management.

CO2: Understand the river basin management practices.

CO3: Understand better different approaches for conservation of water

CO4: Understand sustainable watershed approach for resources management, prevention of soil erosion

CO5: Understand Different methods of rainwater harvesting management systems and role of GIS.

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	Basic principles of watershed management			L2
CO2	Understand	River basin management practices			L2
CO3	Understand	different approaches for conservation of water			L2
CO4	Understand	Sustainable watershed approach		Resources management, prevention of soil erosion	L2
CO5	Understand	Different methods of rainwater harvesting management systems and role of GIS			L2

UNIT – I

Principles of Watershed Management: Basics concepts, Hydrology and water availability, Surface water, Groundwater, Conjunctive use, Human influences in the water resources system, Water demand, Integrated water resources system.

UNIT – II

River basin Watershed Management Practices in Arid and Semi-arid Regions, Watershed management through wells, Management of water supply -Case studies, short term and long-term strategic planning.

UNIT – III

Conservation of Water: Perspective on recycle and reuse, Waste water reclamation Social Aspects of Watershed Management: Community participation, Private sector participation, Institutional issues, Socio-economy, Integrated development, Water legislation and implementations, Case studies.

UNIT – IV

Sustainable Watershed Approach: Sustainable integrated watershed management, natural resources management, agricultural practices, integrated farming, Soil erosion and conservation

UNIT – V

Water Harvesting: Rainwater management -conservation, storage and effective utilisation of rainwater, Structures for rainwater harvesting, roof catchment system, check dams, aquifer storage Applications of Geographical Information System and Remote Sensing in Watershed Management, Role of Decision Support System in Watershed Management

TEXT BOOKS

1. Murthy, J.V.S., “Watershed Management in India”, Wiley Eastern, New Delhi, 1994.

REFERENCE BOOKS

1. Murty, J.V.S., “Watershed Management”, New Age Intl., New Delhi 1998.
2. Allam, G.I.Y., “Decision Support System for Integrated Watershed Management”, Colorado State University, 1994.
3. Vir Singh, R., “Watershed Planning and Management”, Yash Publishing House, Bikaner, 2000.
4. American Society of Civil Engineers, Watershed Management, American Soc. of Civil Engineers, New York, 1975

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	12/60	15	2	Understand	L2	PO1 PO2 PO7	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
2	12/60	15	2	Understand	L2	PO1 PO2 PO7	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
3	12/60	15	2	Understand	L2	PO1 PO2 PO7	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
4	12/60	15	2	Understand	L2	PO1 PO2 PO7	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
5	12/60	15	2	Understand	L2	PO1 PO2 PO7	Apply (L3) Analyze (L4) Thumb Rule	2 1 2

JUSTIFICATION STATEMENTS:

CO1: Understand the basic principles of watershed management.

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO1 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO7 as moderate (2).

CO2: Understand the river basin management practices.

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO2 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO2 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO7 as moderate (2).

CO3: Understand better different approaches for conservation of water

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO3 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO3 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO7 as moderate (2).

CO4: Understand sustainable watershed approach for resources management, prevention of soil erosion

Action Verb: Understand (L2)

PO1: Apply(L3)

CO4 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO4 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO7 as moderate (2).

CO5: Understand Different methods of rainwater harvesting management systems and role of GIS.

Action Verb: Understand (L2)

PO1: Apply(L3)

CO5 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

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

CO5 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO7 as moderate (2).

IV Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APE0113	DESIGN & DRAWING OF STEEL STRUCTURES	2	1	0	3

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

CO1: Design of bolt, welded connections and tension members

CO2: Design compression members

CO3: Design laterally supported beams

CO4: Design various components of plate girder

CO5: Design various components of gantry girder and simple roof truss

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Design	Bolted, welded connections and tension members			L6
CO2	Design	Compression members			L6
CO3	Design	Laterally supported beams			L6
CO4	Design	Various components		plate girder	L6
CO5	Design	Various components		Gantry girder and Simple roof truss	L6

UNIT – I

Materials – Making of iron and steel – types of structural steel – mechanical properties of steel – Concepts of plasticity– yield strength. Loads–and combinations loading wind loads on roof trusses, behavior of steel, local buckling. Concept of limit State Design – Different Limit States as per IS 800 - 2007 – Design Strengths- deflection limits –serviceability-Bolted connections– Welded connections– Design Strength– Efficiency of joint - Design of Tension members – Design Strength of members.

UNIT – II

Design of compression members–Buckling class–slenderness ratio/strength design –laced–battened columns –column splice – column base – slab base.

UNIT – III

Design of Beams – Plastic moment –Bending and shear strength laterally/supported beams.

UNIT – IV

Plate Girder: Design consideration–IS Code Recommendations Design of plate girder-Welded–Curtailement of flange plate’s stiffeners–splicing and connections.

UNIT – V

Gantry Girder: Gantry girder impact factors– longitudinal forces, Design of Gantry girders -Design of simple roof truss.

Note: The students should prepare the following plates.

Plate 1 Detailing of simple beams

Plate 2 Detailing of Column including lacing and battens.

Plate 3 Detailing of Column bases–slab base and gusseted base

Plate 4 Detailing of Plate girder including curtailment, splicing and stiffeners.

Plate 5 Detailing of Gantry girder and simple roof truss.

TEXT BOOKS

1. Design of Steel Structures by Dr.B.C.Punmia,A.K.Jain, Lakshmi Publications.
2. Limit State Design of Steel Structures by Subramanyam.N, Oxford University press, New Delhi
3. Limit State Design of Steel Structures by S.K. Duggal, Tata Mcgraw Hill, New Delhi.

REFERENCES

1. Fundamentals of Structural Steel Design by M.L.Gambhir, TMH publications.
2. Structural Design and Drawing by N.KrishnaRaju, University Press, Hyderabad.
3. Structural design in steel by SarwarAlamRaz, New Age International Publishers, New Delhi
4. Design of Steel Structures by Edwin Gaylord, Charles Gaylord, James Stallmeyer, Tata Mc.Graw-Hill, New Delhi.

Codes/Tables & IS Codes:

- 1) IS -800 – 2007
- 2) IS – 875 – Part III
- 3) Steel Tables.
- 4) Railway Design Standards Code.

Note: IS 800-2007 and steel tables are to be permitted into the examination hall.

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s):Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	16/80	20	3	Design	L6	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO3	Design (L6)	3
						PO4	Analysis (L4)	3
						PO6	Thumb Rule	3
2	16/80	20	3	Design	L6	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO3	Design (L6)	3
						PO4	Analysis (L4)	3
						PO6	Thumb Rule	3
3	16/80	20	3	Design	L6	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO3	Design (L6)	3
						PO4	Analysis (L4)	3
						PO6	Thumb Rule	3
4	16/80	20	3	Design	L6	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO3	Design (L6)	3
						PO4	Analysis (L4)	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)

CIVIL ENGINEERING

AK20 REGULATION

(Effective for the students admitted from the AY 2022-23 & LE from 2023-24)

						PO6	Thumb Rule	3
5	16/80	20	3	Design	L6	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO3	Design (L6)	3
						PO4	Analysis (L4)	3
						PO6	Thumb Rule	3

JUSTIFICATION STATEMENTS:

CO1: Design of bolt, welded connections and tension members

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO1: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO1 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO1 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO1 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

CO2: Design compression members

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO2: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO2 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO2 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO2 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

CO3: Design laterally supported beams

Action Verb: Create or Design (L6) PO1: Apply (L3)

CO3: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO3 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO3 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO3 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

CO4: Design various components of plate girder

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO4: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO4 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO4 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

CO5: Design various components of gantry girder and simple roof truss

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO5: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO5 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO5 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO5 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

IV Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APE0114	ADVANCED STRUCTURAL DESIGN	2	1	0	3

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

- CO1:** Design the RCC beams and slabs as per relevant codes
- CO2:** Design crack width in RCC beams and Deep Beams
- CO3:** Design reinforcement of flat slabs and flat plates
- CO4:** Design plain concrete walls and shear walls as per relevant codes
- CO5:** Design reinforced concrete members for fire resistance

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Design	RCC beams and slabs	as per relevant codes		L6
CO2	Design	Crack width		RCC beams and Deep Beams	L6
CO3	Design	Reinforcement		flat slabs and flat plates	L6
CO4	Design	plain concrete walls and shear walls	as per relevant codes		L6
CO5	Design	reinforced concrete members	for fire resistance		L6

UNIT – I DEFLECTION OF REINFORCED CONCRETE BEAMS AND SLABS

Introduction -Short-Term Deflection of Beams and Slabs -Deflection Due To - Imposed Loads - Short- Term Deflection of Beams Due to Applied Loads- Calculation of Deflection by IS 456 -Calculation of Deflection by BS 8110 - Deflection Calculation by Euro code – ACI Simplified Method- Deflection of Continuous Beams ByIS456 –Deflection of Cantilevers-Deflection of Slabs

UNIT – II ESTIMATION OF CRACK WIDTH IN REINFORCED CONCRETE MEMBERS AND DESIGN OF DEEP BEAMS:

Introduction-FactorsAffectingCrackwidthInBeams-MechanismofFlexuralCracking Calculation of Crack Widths - Simple Empirical Method - Estimation of Crackwidth In Beams by IS 456 Of BS 8110 - Shrinkage and Thermal Cracking.

DEEP BEAMS

Introduction - Minimum Thickness - Steps of Designing Deep Beams - Design by IS 456 - Design According to British Practice - ACI Procedure for Design of Deep Beams –Checking for Local Failures-Detailing of Deep Beams.

UNIT – III SHEAR IN FLAT SLABS AND FLAT PLATES

Introduction - Checking for One-Way (Wide Beam) Shear - Two-Way (Punching) Shear Permissible Punching Shear - Shear Due to Unbalanced Moment (Torsional Moments) Calculation of J Values - Strengthening of Column Areas for Moment Transfer by Torsion Which Produces Shear – Shear Reinforcement Design - Effect of Openings in Flat Slabs - Recent Revisions in ACI 318 - Shear in Two – Way Slabs with Beams.

UNIT- IV DESIGN OF PLAIN CONCRETE WALLS AND SHEAR WALLS

Introduction - Braced and Unbraced Walls - Slenderness of Walls- Eccentricities of Vertical Loads at Right

Angles to Wall -Empirical Design Method for Plane Concrete Walls Carrying Axial Load – Design of Walls for In-Plane Horizontal Forces - Rules for Detailing of Steel in **CONCRETE WALLS DESIGN OF SHEAR WALLS**

Introduction - Classification of Shear Walls – Classification According to Behaviour - Loads in Shear Walls - Design of Rectangular and Flanged Shear Walls-Derivation of Formula for Moment of Resistance of Rectangular Shear Walls

UNIT-V DESIGN OF REINFORCED CONCRETE MEMBERS FOR FIRE RESISTANCE

Introduction – ISO834Standard Heating Conditions- Grading Or Classification - Effect Of High Temperature OnSteel And Concrete - Effect of High Temperatures on Different Types of StructuralMembers - Fire Resistance by Structural Detailing from Tabulated Data – AnalyticalDetermination Of the Ultimate Bending Moment Capacity of Reinforced Concrete BeamsUnder Fire-Other Considerations

TEXT AND REFERENCE BOOKS

1. P.Purushothaman, Reinforced Concrete Structural Elements: Behaviour, Analysis And Design, Tata McGraw Hill.
2. C.E. Reynolds And J.C. Steedman, Reinforced Concrete Designers Hand Book, A View Point Publication.
3. Limit State Design Of Reinforced Concrete Structures By P.Dayaratnam, Oxford &Ibh Publishers.
4. Advanced RCC By N.KrishnaRaju, Cbs Publishers & Distributors.
- 5.ReinforcedCementConcrete Structures –Devdas Menon & Unnikrishna Pillai

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s):Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	16/80	20	3	Design	L6	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO3	Design (L6)	3
						PO4	Analysis (L4)	3
						PO6	Thumb Rule	3
2	16/80	20	3	Design	L6	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO3	Design (L6)	3
						PO4	Analysis (L4)	3
						PO6	Thumb Rule	3
3	16/80	20	3	Design	L6	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO3	Design (L6)	3
						PO4	Analysis (L4)	3
						PO6	Thumb Rule	3
4	16/80	20	3	Design	L6	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO3	Design (L6)	3
						PO4	Analysis (L4)	3
						PO6	Thumb Rule	3
5	16/80	20	3	Design	L6	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO3	Design (L6)	3
						PO4	Analysis (L4)	3
						PO6	Thumb Rule	3

JUSTIFICATION STATEMENTS:

CO1: Design the RCC beams and slabs as per relevant codes

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO1: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO1 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO1 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO1 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

CO2: Design crack width in RCC beams and Deep Beams

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO2: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO2 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO2 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO2 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

CO3: Design reinforcement of flat slabs and flat plates

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO3: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO3 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO3 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO3 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

CO4: Design plain concrete walls and shear walls as per relevant codes

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO4: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO4 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO4 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

CO5: Design reinforced concrete members for fire resistance

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO5: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO5 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO5 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO5 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

IV Year		I Semester			
Subject code	Subject Name	L	T/CLC	P	Credits
20APE0115	BRIDGE ENGINEERING	2	1	0	3

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

CO1: Design box culverts and bridge bearings as per the requirements

CO2: Design deck slab bridges as per standards

CO3: Design of T Beam bridges subjected to class AA tracked vehicle load

CO4: Design of a Deck type welded plate girder

CO5: Understand various aspects associated with design of Piers and Abutments

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Design	box culverts and bridge bearings	as per the requirements		L6
CO2	Design	deck slab bridges	as per standards		L6
CO3	Design	T Beam bridges subjected to class AA tracked vehicle load			L6
CO4	Design	Deck type welded plate girder			L6
CO5	Understand	various aspects associated with design		Piers and Abutments	L2

UNIT – I INTRODUCTION

Importance of site investigation in Bridge design. Highway Bridge loading standards. Impact factor.

Railway Bridge loading standards (B.G. ML Bridge) various loads in bridges.

BOX CULVERT: General aspects. Design loads, Design of Box culvert subjected to RC class AA tracked vehicle only.

BRIDGE BEARINGS: General features – Types of Bearings – Design principles of steel Rocker & Roller Bearings – Design of a steel Rocker Bearing – Design of Elastomeric pad Bearing.

UNIT – II DECK SLAB BRIDGE

Introduction – Effective width method of Analysis Design of deck slab bridge (Simply supported) subjected to class AA Tracked Vehicle only.

UNIT – III BEAM & SLAB BRIDGE (T-BEAM BRIDGE)

General features – Design of interior panel of slab – Pigeauds method – Design of a T-beam bridge subjected to class AA tracked vehicle only.

UNIT – IV PLATE GIRDER BRIDGE

Introduction – elements of a plate girder and their design. Design of a Deck type welded plate girder – Bridge of single line B.G.

COMPOSITE BRIDGES Introduction – Advantages – Design of Composite Bridges consisting of RCC slabs over steel girder's including shear connectors

UNIT V PIERS & ABUTMENTS

General features – Bed Block – Materials piers & Abutments Types of piers – Forces acting on piers – Stability analysis of piers – General features of Abutments – forces acting on abutments – Stability analysis of abutments – Types of wing walls – Approaches – Types of Bridge foundations (excluding Design).

TEXT BOOKS

1. Bridge Engineering by Ponnu Swamy, TATA Mcgraw Hill Company, New Delhi.

2. Design of Bridges by N.KrishnamRaju, Oxford & IBH, Publishing Company Pvt.ltd., Delhi.
3. Relevant – IRC & Railway bridge Codes.

REFERENCE

1. Design of Steel structures, by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications, New Delhi.
2. Design of Bridges Structure by D.J.Victor
3. Design of Steel structures by Ramachandra.

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	17/81	21	3	Design	L6	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO3	Design (L6)	3
						PO4	Analysis (L4)	3
						PO6	Thumb Rule	3
2	17/81	21	3	Design	L6	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO3	Design (L6)	3
						PO4	Analysis (L4)	3
						PO6	Thumb Rule	3
3	17/81	21	3	Design	L6	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO3	Design (L6)	3
						PO4	Analysis (L4)	3
						PO6	Thumb Rule	3
4	17/81	21	3	Design	L6	PO1	Apply (L3)	3
						PO2	Analyze (L4)	3
						PO3	Design (L6)	3
						PO4	Analysis (L4)	3
						PO6	Thumb Rule	3
5	13/81	16	2	Understand	L2	PO1	Apply (L3)	2
						PO2	Analyze (L4)	1
						PO7	Thumb Rule	2

JUSTIFICATION STATEMENTS:

CO1: Design box culverts and bridge bearings as per the requirements

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO1: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO1 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO1 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO1 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

CO2: Design deck slab bridges as per standards

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO2: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO2 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO2 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO2 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

CO3: Design of T Beam bridges subjected to class AA tracked vehicle load

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO3: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO3 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO3 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO3 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

CO4: Design of a Deck type welded plate girder

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO4: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO4 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO4 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO4 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

CO5: Understand various aspects associated with design of Piers and Abutments

Action Verb: Understand (L2)

PO1: Apply(L3)

CO5 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

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

CO5 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO7 as moderate (2).

IV YEAR

I SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20AMOC0103	COMPUTER NETWORKS	2	1	0	3

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

CO1: Understand 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.

Course Outcomes	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

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

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

THE NETWORK LAYER: Network layer design issues, Routing algorithms, Congestion control algorithms, Quality of service, Internetworking.

THE NETWORK LAYER IN THE INTERNET: IPV4 Addresses, IPV6, Internet Control protocol, OSPF, BGP, IP, ICMPv4, IGMP.

UNIT IV

THE TRANSPORT LAYER: The Transport Service, Elements of Transport Protocols, Congestion Control, The internet transport protocols: UDP, TCP, Performance problems in computer networks, Network performance measurement

UNIT – V

THE APPLICATION LAYER: Introduction, Client-Server Programming, WWW and HTTP, FTP, e-mail, TELNET, Secure Shell, Domain Name System, SNMP.

TEXT BOOKS:

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.

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

CO	CO					Program Outcome s (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	Correlation	Verb	BTL			
1	15	23%	3	Understand	L2	PO1	Apply(L3)	2
						PO2	Analyze (L4)	1
2	10	15%	2	Apply	L3	PO1	Apply(L3)	3
						PO2	Analyze (L4)	2
						PO6	Thumb rule	1
3	15	23%	3	Analyze	L4	PO1	Apply(L3)	3
						PO2	Analyze L4)	3
						PO4	Analyze (L4)	3
						PO5	Apply(L3)	3
						PO6	Thumb rule	1
4	11	17%	2	Analyze	L4	PO1	Apply(L3)	3
						PO2	Analyze (L4)	3
						PO4	Analyze (L4)	3
						PO5	Apply(L3)	3
5	15	23%	3	Understand	L2	PO1	Apply(L3)	2
						PO2	Analyze (L4)	1

JUSTIFICATION:

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 real time 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)

IV YEAR

I SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20AMOC0103	ENTERPRENURSHIP DEVELOPMENT	2	1	0	3

Course Outcomes: After studying the course, students 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.

Course Outcomes	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 – I 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.

REFERENCE BOOKS:

1. Vasant Desai, “Small Scale Industries and Entrepreneurship”, Himalaya Publishing 2012.
2. Rajeev Roy “Entrepreneurship”, 2nd Edition, Oxford, 2012.
3. B.Janakiram and M.Rizwanal “Entrepreneurship Development: Text & Cases”, Excel Books, 2011.
4. Stuart Read, Effectual “Entrepreneurship”, Routledge, 2013.

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No.	CO					Program Outcome (PO)	PO(s):Action Verb and BTL	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co’s Action verb	BTL			
1	11	18.03%	2	Understand	L2	PO1	Apply (L3)	2
2	11	18.03%	2	Analyze	L4	PO3 PO4	Apply (L3) Apply (L3)	3 3
3	13	21.31	3	Analyze	L4	PO1 PO10	Apply (L3) Apply (L3)	3 3
4	13	21.31	3	Analyze	L4	PO1	Apply (L3)	3
5	13	21.31	3	Analyze	L4	PO1	Apply (L3)	3
Total	61	100						

JUSTIFICATION:

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)

CO3: Analyze the various sources of finance to entrepreneurs.

Action Verb: Analyze (L4)

PO1: Apply (L3)

CO3 Action verb is more than PO1 verb by one level. Therefore, the correlation is High (3)

PO10: Apply (L3)

CO3 Action verb is more than PO10 verb by one level. 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 by one level. Therefore, the correlation is High (3)

IV YEAR

I SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20AMOC0103	INTELLECTUAL PROPERTY RIGHTS	2	1	0	3

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

- CO1:** Understand the concepts of intellectual property rights
- CO2:** Understand the process of acquisition of trade mark rights
- CO3:** Understand about the law of copy rights
- CO4:** Understand the concepts of Trade secretes
- CO5:** Understand the intellectual property laws at the international level

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	concepts of intellectual property rights			L2
CO2	Understand	process of acquisition of trade mark rights			L2
CO3	Understand	the law of copy right			L2
CO4	Understand	concepts of Trade secretes			L2
CO5	Understand	intellectual property laws at the international level			L2

UNIT-I

INTRODUCTION TO INTELLECTUAL PROPERTY: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT-II

TRADE MARKS: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

UNIT-III

LAW OF COPY RIGHTS: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Law of Patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT-IV

TRADE SECRETS: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secret elitigation. Unfair Competition: Misappropriation right of publicity, false advertising.

UNIT-V

NEW DEVELOPMENT OF INTELLECTUAL PROPERTY: New developments in trade mark law; copy right law, patent law, intellectual property audits -International overview on intellectual property, international - trade mark law, copy right law, international patent law, international development in trade secrets law.

TEXT BOOKS

1. Intellectual property right, Deborah, E. Bouchoux, Cengage learning
2. Intellectual property rights: Protection and Management. India, Nityananda KV, Cengage Learning India Private Limited.

REFERENCES

1. Intellectual property right - Unleashing the knowledge economy, Prabuddhaganguli, Tata McGraw Hill Publishing Company Ltd.
2. Law relating to Intellectual Property rights. India. Ahuja VK IN: Lexis Nexis
3. Intellectual Property Rights, India. Neeraj P & Khushdeep D, PHI learning pvt limited

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

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	17.5	Understand	PO1	Apply	2
CO2	17.5	Understand	PO6	Thumb Rule	2
CO3	21.1	Understand	PO2	Analyze	1
CO4	17.5	Understand	PO5	Create	1
CO5	26.3	Understand	PO1	Apply	2

JUSTIFICATION

CO1: Understand the concepts of intellectual property rights

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 process of acquisition of trade mark rights

Action Verb: Understand (L2)

PO6: Thumb rule

CO2 Action verb blooms level 2 correlates with PO6. Therefore, the correlation is medium (2)

CO3: Understand about the law of copy rights

Action Verb: Understand (L2)

PO2: Analyze (L4)

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

CO4: Understand the concepts of Trade secretes

Action Verb : Understand (L2)

PO5: create (L6)

CO3 Action verb is less than PO5 verb by four levels. Therefore, the correlation is low (1)

CO5: Understand the intellectual property laws at the international level.

Action Verb: Understand (L2)

PO1: Apply (L3)

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

IV Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APE0116	PRESTRESSED CONCRETE	2	1	0	3

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

CO1: Understand the fundamental principles of Prestressed concrete

CO2: Analyze the losses of prestress in pretensioned and posttensioned members

CO3: Design of prestressed beams under flexure and shear considerations

CO4: Analyze the short- term and long-term deflection of prestressed beams

CO5: Analyze the prestressing concepts in composite beams

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	Fundamental principles		Prestressed concrete	L2
CO2	Analyze	Losses of prestress		pretensioned and posttensioned members	L4
CO3	Design	Prestressed beams	flexure and shear considerations		L6
CO4	Analyze	Short- term and long-term deflection		Prestressed beams	L4
CO5	Analyze	Prestressing concepts		Composite beams	L2

UNIT – I INTRODUCTION

Principles of pre-stressing – Pre stressing systems - Pre-tensioning and post tensioning- Advantages and limitations of Pre stressed concrete- Need for high strength materials. Methods of pre-stressing: Pre-tensioning (Hoyer system) and Post-tensioning methods (Freyssinet system and Gifford- Udall System).

UNIT –II LOSSES OF PRE-STRESS

Loss of pre-stress in pre-tensioned and post-tensioned members due to elastic shortening, shrinkage and creep of concrete, relaxation of stress in steel, anchorage slip and frictional losses.

UNIT -III FLEXURE AND SHEAR

Analysis of beams for flexure and shear - Beams pre-stressed with straight, concentric, eccentric, bent and parabolic tendons- Kern line - Cable profile - Design of PSC beams (rectangular and I sections) using IS 1343. Analysis and design of rectangular and I beams for shear. Introduction to Transmission length and End block (no Design and Analytical problems).

UNIT – IV DEFLECTIONS

Control of deflections- Factors influencing deflections - Short term deflections of uncracked beams- Prediction of long time deflections.

UNIT – V COMPOSITE BEAMS

Different Types- Propped and Un-propped- stress distribution- Differential shrinkage- Analysis of composite beams.

TEXT BOOKS

1. N. Krishna Raju, —Prestressed Concrete, Tata Mc.Graw Hill Publications.
2. Praveen Nagrajan, —Prestressed Concrete Design, Pearson publications, 2013.

REFERENCES

1. T.Y. Lin & Ned H. Burns, —Design of Prestressed Concrete Structures, John Wiley & Sons.

2. Ramamrutham, —Prestressed Concretel, Dhanpatrai Publications.
3. Rajagopalan, —Prestressed concretel, Narosa Publishing House.
4. BIS code on —prestressed concretel, IS: 1343 to be permitted into the examination Hall.

CORRELATION OF COS WITH THE POS & PSOS:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1				2						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		3						2	2

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s):Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	13/81	16	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
2	18/81	22	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	3 3 3 3
3	19/81	24	3	Design	L6	PO1 PO2 PO3 PO4 PO6	Apply (L3) Analyze (L4) Design (L6) Analysis (L4) Thumb Rule	3 3 3 3 3
4	17/81	22	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	3 3 3 3
5	16/81	21	3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	3 3 3 3

JUSTIFICATION STATEMENTS:

CO1: Understand the fundamental principles of Prestressed concrete

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO2: Analyze the losses of prestress in pretensioned and posttensioned members

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO3: Design of prestressed beams under flexure and shear considerations

Action Verb: Create or Design (L6)

PO1: Apply (L3)

CO3: Action verb is greater than PO1 verb; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO3 Action verb is greater than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3: Design

CO3 Action verb is equal to PO3 verb by one level; Therefore, correlation is high (3).

PO4: Analysis

CO3 Action verb is less than PO3 verb; Therefore, correlation is moderate (2).

PO6: Action verb Evaluate is of BTL 6. Using Thumb rule, L6 correlates PO6 as High (3)

CO4: Analyze the short- term and long-term deflection of prestressed beams

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO5: Analyze the prestressing concepts in composite beams

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

CO5 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as moderate (3).

IV Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APE0117	GROUND IMPROVEMENT TECHNIQUES	2	1	0	3

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

CO1: Understand the grouting techniques and their applications

CO2: Apply the densification methods in granular and cohesive soils

CO3: Apply the ground improvement methods to stabilize soil

CO4: Apply the reinforcement principles of earth wall

CO5: Apply the techniques for improvement of expansive soils and foundations

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	Grouting techniques and their applications			L2
CO2	Apply	Densification methods		Granular and cohesive soils	L3
CO3	Apply	Ground improvement methods to stabilize soil			L3
CO4	Apply	Reinforcement principles		Earth wall	L3
CO5	Apply	Techniques for improvement		Expansive soils and Foundations	L3

UNIT – I GROUTING

Introduction to ground modification, need and objectives of Grouting- Grouts and Their Properties- Grouting Methods Ascending, Descending and Stage Grouting- Hydraulic Fracturing in Soils And Rocks Post Grout Test.

UNIT – II IN-SITU DENSIFICATION OF COHESIVE AND COHESIONLESS SOILS

In situ densification methods- in situ densification of granular soils- vibration at ground surface and at depth, impact at ground and at depth – in situ densification of cohesive soils – pre loading – vertical drains – sand drains and geo drains – stone columns.

UNIT – III STABILISATION

Methods of Stabilization-Mechanical-Cement- Lime, Chemical Stabilization with Calcium Chloride, Sodium Silicate and Gypsum

UNIT – IV REINFORCED EARTH

Principles – Components of Reinforced Earth – Factors Governing Design of Reinforced Earth Walls – Design Principles Of Reinforced Earth Walls.

GEOSYNTHETICS: Geotextiles- Types, Functions and Applications – Geogrids and Geomembranes – Functions and Applications.

UNIT - V EXPANSIVE SOILS

Problems Of Expansive Soils – Tests for Identification – Methods of Determination Of Swell Pressure. Improvement Of Expansive Soils – Foundation Techniques in Expansive Soils – Under Reamed Piles.

TEXT BOOKS

1. Engineering Principles of Ground Modification, Haussmann M.R. (1990), McGraw-Hill International Edition.

2. Ground Improvement Techniques by Dr.P.Purushotham Raj, Laxmi Publications, New Delhi / University Science Press, New Delhi

3. Ground Improvement Techniques by NiharRanajanPatra. Vikas Publications, New Delhi

REFERENCES

1. Ground Improvement, Blackie Academic and Professional by Moseley M.P. (1993), Boca Taton, Florida, USA.

2. Ground Control and Improvement by Xanthakos P.P, Abramson, L.W and Brucwe, D.A (1994), John Wiley and Sons, New York, USA.

3. Designing with Geosynthetics by Robert M. Koerner, Prentice Hall New Jercey, USA

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s):Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	10/62	16	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
2	13/62	21	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
3	13/62	21	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
4	13/62	21	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
5	13/62	21	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2

JUSTIFICATION STATEMENTS:

CO1: Understand the grouting techniques and their applications

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO2: Apply the densification methods in granular and cohesive soils

Action Verb: Apply (L3)

PO1: Apply(L3)

CO2 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO2: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

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

CO3: Apply the ground improvement methods to stabilize soil

Action Verb: Apply (L3)

PO1: Apply(L3)

CO3 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO3: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

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

CO4: Apply the reinforcement principles of earth wall

Action Verb: Apply (L3)

PO1: Apply(L3)

CO4 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO4: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO4 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

CO5: Apply the techniques for improvement of expansive soils and foundations

Action Verb: Apply (L3)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO5: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO5 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

IV Year

I Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APE0118	REPAIR AND REHABILITATION OF STRUCTURES	2	1	0	3

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

CO1: Understand the maintenance and causes of deterioration in structures

CO2: Understand the different NDT techniques for damage assessment

CO3: Understand the different type of repair materials

CO4: Apply various repair techniques for concrete structures

CO5: Apply different strengthening techniques for structural members

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	Maintenance and causes of deterioration		In Structures	L2
CO2	Understand	Different NDT techniques		For damage assessment	L2
CO3	Understand	Different type of repair materials			L2
CO4	Apply	Various repair techniques		For concrete structures	L3
CO5	Apply	Different strengthening techniques		For structural members	L3

UNIT – I MAINTENANCE AND DETERIORATION OF STRUCTURES

Maintenance, Repair and Rehabilitation - Facets of Maintenance, Importance of Maintenance-Distress in Structures – Causes of deterioration of structures - Construction and design errors- Causes and mechanism of corrosion in steel reinforcement

UNIT – II DAMAGE ASSESSMENT

Visual inspection- Assessment procedure for evaluating a damaged structure- NDT for Strength assessment: rebound hammer test, Ultrasonic pulse velocity test and pull-out test - NDT for Corrosion Potential Assessment: Half-cell potential survey and Electrical Resistivity - NDT for Structural Integrity: Impact Echo Method and Acoustic Emission technique

Unit III REPAIR MATERIALS

Essential parameters for repair materials- Polymer concrete- Expansive cement- Epoxy Resin-Sulphur Infiltrated Concrete-Fibre reinforced polymer - Corrosion control materials

UNIT IV REPAIR TECHNIQUES

Epoxy injection- Routing and sealing- Blanketing- External stressing- Stitching- Autogenous Healing - Dry packing- Prepacked Concrete-Cathodic Protection-Shotcrete- Repairs in under water structures

UNIT V STRENGTHENING TECHNIQUES

Strengthening techniques for structural members -Underpinning- Jacketing- Plate bonding- Fibre Wrap Technique- Composite construction- Post-Tensioning-Steel bracing.

TEXT BOOKS

1. “Concrete Technology” A.R. Santakumar, Oxford University press.
2. “Maintenance Repair & Rehabilitation & Minor Works of Buildings” P.C. Varghese, PHI Learning Pvt.

Ltd.

2. "Maintenance and Repair of Civil Structures", B.L. Gupta and Amit Gupta, Standard Publication

Reference books

1. "Handbook on Repair and Rehabilitation of R.C.C Buildings", Central Public Works Department (CPWD), Government of India, New Delhi, 2002.

2. "Concrete Technology – Theory and Practice", M. S. Shetty, S. Chand and Company, 7th edn.,

3. "Design and Construction Failures", DovKaminitzky, Galgotia Publications Pvt. Ltd., 2001.

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s):Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	12/63	19	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
2	12/63	19	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
3	12/63	19	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 1 2
4	13/62	21	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
5	14/63	22	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2

JUSTIFICATION STATEMENTS:

CO1: Understand the maintenance and causes of deterioration in structures

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO2: Understand the different NDT techniques for damage assessment

Action Verb: Understand (L2)

PO1: Apply(L3)

(Effective for the students admitted from the AY 2022-23 & LE from 2023-24)

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

PO2: Analyze (L4)

CO2 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

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

CO3: Understand the different type of repair materials

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO3 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO3 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO4: Apply various repair techniques for concrete structures

Action Verb: Apply (L3)

PO1: Apply(L3)

CO4 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO4: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO4 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

CO5: Apply different strengthening techniques for structural members

Action Verb: Apply (L3)

PO1: Apply(L3)

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

PO2: Analyze (L4)

CO5: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

CO5 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

IV YEAR

I SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20AOE9901	ENGLISH FOR RESEARCH PAPER WRITING	2	1	0	3

Course Outcomes: After studying the course, students 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.

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the writing skills and level of readability			L2
CO2	Apply	the rules, principles	for writing abstract and introduction part of research article		L3
CO3	Apply	the right methods	to write the review of literature, results and conclusions		L3
CO4	Apply	the special skills.	for writing a title, abstract, review and introduction of literature		L3
CO5	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's book.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

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	15	20	2	Understand	L2	PO9, PO11	Thumb Rule Thumb Rule	2, 2
2	18	23	3	Apply	L3	PO5, PO9	Thumb Rule Thumb Rule	2, 1
3	14	18.4	2	Apply	L3	PO2, PO11	Thumb Rule Thumb Rule	2, 2
4	14	18.4	2	Apply	L3	PO9	Thumb Rule	2
5	14	18.4	2	Apply	L3	PO9 PO11	Thumb Rule Thumb Rule	2, 2

JUSTIFICATION:

CO1: Understand writing skills and level of readability.

Action Verb: Understand (L2)

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

CO2: Apply the rules, principles for writing abstract and introduction part of research article.

Action Verb: Apply (L3)

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

CO2 Action Verb is Apply of BTL 3. Using Action verb, Modern Tool usage L3 correlates PO5, CO level is two less than PO, so correlation is low(1).

CO3: Apply the right methods to write the review of literature, results and conclusions.

Action Verb: Apply (L3)

CO3 Action Verb is Apply of BTL 3. Using Action verb, Problem Analysis L3 correlates PO2, CO level is one less than PO, so Correlation is Moderate (2)

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

CO4: Apply special skills for writing a title, abstract, review and introduction of literature.

Action Verb: Apply (L3)

CO4 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).

CO5: Apply key skills for results in discussion and conclusion.

Action Verb: Apply (L3)

CO5 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).

IV YEAR

I SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
20AHE9903	PROFESSIONAL COMMUNICATION	2	1	0	3

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

- CO1:** Understand the communication skills effectively for professional success
- CO2:** Analyze the communication skills clearly and concisely in formal and informal conversations.
- CO3:** Apply the information through drafting, editing and presentation
- CO4:** Apply the interpersonal skills in appropriate manner towards the growth of best career.
- CO5:** Apply the sentence structures using correct vocabulary and without any grammatical errors.

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the communication skills effectively		for professional success	L2
CO2	Analyze	the communication skills clearly and concisely	in formal and informal conversations		L4
CO3	Apply	the information	through drafting, editing and presentation		L3
CO4	Apply	the interpersonal skills		in appropriate manner towards the growth of best career	L3
CO5	Apply	the sentence structures	using correct vocabulary and without any grammatical errors		L3

UNIT: 1- GRAMMAR & VOCABULARY

- Parts of Speech
- Articles
- The Prepositions
- Subject-Verb agreement
- Tenses
- Active and Passive Voice
- Direct & Indirect Speech
- Degrees of Comparison
- Punctuation
- Vocabulary

UNIT: 2 - COMMUNICATION SKILLS:

- Importance of Communication
- Non-verbal Communication
- Introduction
- Kinesics

Proxemics
Chronemics
Basics of Technical Communication
Group Discussion
Interviews
Conversations

UNIT:3 – TELEPHONE SKILLS:

Understanding Telephone Communication
Types of calls
Handling calls
Leaving a message
Making requests
Asking for and giving information
Giving Instructions
Making or changing appointments

UNIT:4 – INTERPERSONAL SKILLS

Team management
Problem solving and Decision Making
Managing Time and Stress
Technology @ work
Etiquette

UNIT:5 – WRITTEN COMMUNICATION

Email
Professional Letters
(a) Letters of application
(b) Business letters
(c) Using Salutations
(d) Routine letters
(e) Request letters
(f) Persuasive letters
Report writing
Note making
Meetings, Agenda, Notice

Suggested books for reading:

1. Meenakshi Raman, Sangeeta Sharma, Technical Communication – Principles and Practice, 3rd Edition, Oxford University Press, 2015.
2. Professional Communication Skills, Er A.K. Jain, Dr. Pravin S.R. Bhatia, Dr. A.M. Sheikh, S.Chand & Company Ltd, New Delhi, 2011.
3. Soft Skills for everyone, Jeff Butterfield, Cengage Learning India Private Ltd, New Delhi, 2014.
4. Basic communication Skills P. Kiranmai Dutt, Geetha Rajeevan, Cambridge University Press India Pvt. Ltd, New Delhi, 2010.
5. A Course in Communication Skills, P.Kiranmai Dutt, Geetha Rajeevan, CLN Prakash, Cambridge University Press India Pvt Ltd, New Delhi, 2013

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

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	16	25	2,2,2	Understand	L2	PO6, PO9, PO11	Thumb Rule Thumb Rule Thumb Rule	2, 2, 2
2	12	19	2,2,2	Analyze	L4	PO8, PO9, PO11	Thumb Rule Thumb Rule Thumb Rule	3, 3, 3
3	10	15	2,2,2	Apply	L3	PO8, PO9, PO11	Thumb Rule Thumb Rule Thumb Rule	2, 2, 2
4	10	15	2,2,2	Apply	L3	PO8, PO9, PO11	Thumb Rule Thumb Rule Thumb Rule	2, 2, 2
5	17	26	2	Apply	L3	PO9	Thumb Rule	2

JUSTIFICATION:

CO1: Understand the communication skills effectively for professional success.

Action Verb: Undersatand-L2

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

CO2: Analyze communication skills clearly and concisely in formal and informal conversations.

Action Verb: Analyze (L4)

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

CO3: Apply and communicate the information through drafting, editing and presentation.

Action Verb: Apply (L3)

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

CO4: Apply interpersonal skills in appropriate manner towards the growth of best career.

Action Verb: Apply (L3)

CO4 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).

CO5: Apply sentence structures using correct vocabulary and without any grammatical errors.

Action Verb: Apply (L3)

CO5 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).

IV Year

II Semester

Subject code	Subject Name	L	T/CLC	P	Credits
20APC0129	STRUCTURAL ANALYSIS DESIGN SOFTWARE LABORATORY	0	1	2	2

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

CO1: Analyze a Building subjected to Various loads as per IS Standards

CO2: Analyze the Building subjected to Dead and Live loads in Staad Pro

CO3: Analyze the Building subjected to Wind load in Staad Pro

CO4: Analyze the Building subjected to Seismic loads in Staad Pro

CO5: Analyze the Isolated Footing in Staad Foundation

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Analyze	Building subjected to Various loads		As per IS Standards	L4
CO2	Analyze	Building subjected to	Dead and Live Loads in Staad Pro		L4
CO3	Analyze	Building subjected	To Wind load in Staad Pro		L4
CO4	Analyze	Building subjected	To Seismic load in Staad Pro		L4
CO5	Analyze	The Isolated Footing	In Staad Foundation		L4

LIST OF EXPERIMENTS

1. Analyze the building for the determination of dead and live loads using the critical factors outlined in IS 875 Part 1 and Part 2 guidelines
2. Analyze the building for the determination of Wind loads using the critical factors outlined in IS 875 Part 3 and compare with ASCE Calculations
3. Analyze the building for the determination of Seismic loads using the critical factors outlined in IS 1893 part 2 guidelines
4. Analysis and Design of a Building with Dead and Live load configuration by Using Staad Pro.
5. Analysis and Design of a Building with Wind load configuration by Using Staad Pro.
6. Analysis and Design of a Building with Seismic load configuration by Using Staad Pro.
7. Design of Isolated Foundation by Using Staad Foundation

MAPPING OF COS TO POS AND PSOS

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

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

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

CO4: Analyze the Building subjected to Seismic loads in Staad Pro

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

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

CO5: Analyze the Isolated Footing in Staad Foundation

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 equal to PO2 verb. Therefore, the correlation is high (3)

PO 4: Analysis (L4)

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

CO5 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as moderate (3).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)

CIVIL ENGINEERING

AK20 REGULATION

(Effective for the students admitted from the AY 2022-23 & LE from 2023-24)

Semester VIII (Fourth year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		C	CIE	SEE
1	MOOC (NPTEL)	20MOC0101		3	0	0	3	25	75	100
2	Internship (3 Months)	20APR0102		0	0	0	3	100	-	100
3	Major Project	20APR0103		0	0	0	9	60	140	200
Total credits							15	185	215	400