DEPARTMENT OF CIVIL ENGINEERING

COURSE STRUCTURE AND SYLLABUS For UG –R22 B. TECH – CIVIL ENGINEERING (Applicable for batches admitted from 2022-2023)



ST.ANN'S COLLEGE OF ENGINEERING & TECHNOLOGY (AUTONOMOUS)

COURSE STRUCTURE

Year: I Semester: I

Category	Course Code	Course Title	Theory/ Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self- Study (SS)	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits	
BS	22UMT01	Mathematics – I	3	1			4	30	70	100	3	
HS	22UEN01	Communicative English	3	1			4	30	70	100	3	
BS	22UCH04	Engineering Chemistry	3	1			4	30	70	100	3	
ES	22UCE01	Building Materials & Construction	3	1			4	30	70	100	3	
ES	22UCS01	Programming for Problem Solving using C	3	1			4	30	70	100	3	
HS	22UEN02	English Communication Skills Laboratory			3		3	15	35	50	1.5	
BS	22UCH05	Engineering Chemistry Laboratory			3		3	15	35	50	1.5	
ES	22UCS02	Programming for Problem Solving Using C Laboratory			3		3	15	35	50	1.5	
МС	22UCH03	Environmental Science	2				2				0	
	TOTAL 16 5 9 - 31 195 455 650 19.5											
HS-Hun	nanities & Science	es, BS-Basic Sciences, ES	-Engineering	Sciences, MO Elective, OO	C-Mandatory (C-Online Cours	Course, PC	-Professional (Core, PE-P	rofessional 1	Elective, OE	2-Open	

Year: I Semester: II

Category	Course Code	Course Title	Theory/ Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self- Study (SS)	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits	
BS	22UMT02	Mathematics - II	3	1	-	-	4	30	70	100	3	
BS	22UPH03	Engineering Physics	3	1	-	-	4	30	70	100	3	
ES	22UME01	Engineering Mechanics	3	1	-	-	4	30	70	100	3	
ES	22UCE02	Engineering Geology	3	1	-	-	4	30	70	100	3	
ES	22UME02	Engineering Drawing	1	-	4	-	5	30	70	100	3	
BS	22UPH04	Engineering Physics Laboratory	-	-	3	-	3	15	35	50	1.5	
ES	22UCE03	Engineering Geology Lab	-	-	3	-	3	15	35	50	1.5	
ES	22UCE04	Civil Engineering Workshop	-	-	3	-	3	15	35	50	1.5	
МС	22UEN03	Constitution of India	2	-	-	-	2	-	-	-	0	
OC	22UOC01	SWAYAM, NPTEL, Spoken Tutorials	-	-	-	2	2	-	-	-	0	
TOTAL 15 4 13 2 34 195 455 650 19.5												
HS-Hum	HS-Humanities & Sciences, BS-Basic Sciences, ES-Engineering Sciences, MC-Mandatory Course, PC-Professional Core, PE-Professional Elective, OE-Open Elective, OC-Online Course											

Year: II Semester: I

Category	Course Code	Course Title	Theo ry/ Lectu re (L)	Tutorial (T)	Practical/ Drawing (P)	Self- Study (SS)	Duratio n in hours	CIE Marks	SEE Marks	Total Marks	Credits			
ES	22UCE05	Building Planning and Drawing	3	1	-	-	4	30	70	100	3			
ES	22UCE06	Surveying -I	3	1	-	-	4	30	70	100	3			
ES	22UCE07	Strength of Materials -I	3	1	-	-	5	30	70	100	3			
ES	22UCE08	Fluid Mechanics	3	1	-	-	5	30	70	100	3			
ES	22UCE09	Concrete Technology	3	1	-	-	4	30	70	100	3			
ES	22UCE10	Surveying Field Work - I	-	-	3	-	3	15	35	50	1.5			
ES	22UCE11	Strength of Materials Lab	-	-	3	-	3	15	35	50	1.5			
ES	22UCE12	Concrete Technology Lab	-	-	3	-	3	15	35	50	1.5			
SOC	22UCE13	Estimation of Building Works (using CAE)	1	-	2	-	2	-	50	50	2			
	TOTAL 16 5 11 - 33 195 505 700 21.5													
HS-Hum	nanities & Sci	ences, BS- <mark>Bas</mark> i Electi	c Sciences ve, OE-O	s, ES-Engine pen Elective,	ering Sciences OC-Online Co	, MC-Mand ourse, SOC	latory Cour - Skill Oriei	se, PC-Prof nted Course	essional Co	re, PE-Prof	fessional			

Year: II Semester: II

Category	Course Code	Course Title	Theory/ Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self- Study (SS)	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits		
ES	22UMT03	Mathematics –III	3	1	-	-	4	30	70	100	3		
ES	22UCE14	Surveying -II	3	1	-	-	4	30	70	100	3		
ES	22UCE15	Strength of Materials -II	3	1	-	-	5	30	70	100	3		
ES	22UCE16	Hydraulics and Hydraulic Machinery	3	1	-	-	5	30	70	100	3		
ES	22UCE17	Environmental Engineering	3	1	-	-	4	30	70	100	3		
ES	22UCE18	Surveying Field Work -II	-	-	3	-	3	15	35	50	1.5		
ES	22UCE19	FM Lab	-	-	3	-	3	15	35	50	1.5		
ES	22UCE20	Environmental Engineering Lab	-	-	3	-	3	15	35	50	1.5		
SOC	22UCE21	SOC 2: Utility Network Design	1	-	2	-	2	-	50	50	2		
CSP		Community Service Project	-	-	-				100	100	4		
	TOTAL 16 5 11 - 33 195 605 800 25.5												
HS-Huma	HS-Humanities & Sciences, BS-Basic Sciences, ES-Engineering Sciences, MC-Mandatory Course, PC-Professional Core, PE-Professional Elective, OE- Open Elective, OC-Online Course, SOC- Skill Oriented Course, CSP- Community Service Project												

Year & Sem	I Year – I Se	I Year – I Semester										
Course Code	22UMT01	L	Т	Р	SS	С						
Course Name	MATHEMATICS-I	3	1	0	0	3						

Course Objectives:

- To instruct the concept of Matrices in solving linear algebraic equations.
- To assist the students to learn the concepts of partial differentiation.
- To enlighten the learners in the concept of differential equations.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.
- To make clear the students in the concepts of Multiple Integrals.

Course Outcomes:

At the end of the course, the student will be able to

- **CO1:** Apply matrix techniques to model and solve system of linear equations.
- **CO2:** To apply the mean value theorems to real life problems.
- CO3: Solve the differential equations related to various engineering fields.
- **CO4:** Apply double integration techniques in evaluating areas bounded by region.
- **CO5:** Student will learn important tools of calculus in higher dimensions. Students will become familiar with 2-dimensional and 3-dimensional coordinate systems.

UNIT-I: System of Linear Equations, Eigen Values, Eigen Vectors (12 Hours)

Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non-homogeneous linear equations – Gauss Elimination method – Eigen values and Eigen vectors and properties. Cayley-Hamilton theorem (without proof) – Reduction of a matrix to Diagonal form. Applications –Finding the inverse and power of a matrix by Cayley Hamilton theorem.

Learning Resources: Text Book-1

UNIT-II: Differential Calculus

(12 Hours)

Mean Value Theorems (without proofs): Rolle's Theorem – Lagrange's mean value theorem – Cauchy's mean value theorem–Taylor's and Mac Laurin's theorems with remainders, Problems and applications on the above theorem. Partial Differentiation: Introduction–Homogeneous function–Euler's theorem–Total derivative – Chain rule – Jacobian – Functional dependence –Taylor's and Mac Laurin's series expansion of functions of two variables. Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method. Learning Resources: Text Book-1

UNIT-III: Differential Equations of First Order and First Degree (12 Hours)

Linear differential equations - Bernoulli's equations - Exact equations and

equations reducible to exact form. Applications: Newton's Law of cooling – Law of natural growth and decay – Orthogonal trajectories. Learning Resources: Text Book-1

UNIT-IV: Differential Equations of Second and Higher Order (14 Hours)

Homogeneous and Non-homogeneous differential equations of higher order with constant coefficients – with non-homogeneous term of the type e^{ax} , sin ax, cos ax, polynomials in x^n , $e^{ax}V(x)$ and $x^nV(x)$ – Method of Variation of parameters, Cauchy and Legendre's linear equations.

Applications: LCR circuits.

Learning Resources: Text Book-1

UNIT-V: Multiple Integrals

(14 Hours)

Double and Triple integrals – Change of order of integration in double integrals – Change of variables to polar, cylindrical and spherical coordinates. Applications: Finding Areas and Volumes.

Learning Resources: Text Book-1

Text Books:

1. **B.S.Grewal**, Higher Engineering Mathematics, 44th Edition, Khanna Publishers.

Reference Books:

- 1. Dr.T.K.V. Iyengar, Dr. B.Krishna Gandhi, S.Ranganadham, Dr. M.V.S.S.N. Prasad, a text book of Engineering Mathematics, S.Chand Publications.
- 2. **N.P.Bali, Manish Goyal**, A text book of Engineering Mathematics, Lakshmi Publications
- 3. **B.V.Ramana**, Higher Engineering Mathematics, 2007 Edition, Tata Mc.Graw Hill Education.
- 4. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley-India.

Contribution of Course Outcomes (CO's) towards the achievement of programme outcomes (PO's) (Strong -3, Moderate -2, Weak -1)

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

Year & Sem	I Year – I Se	mester	r			
Course Code	22UEN01	L	Т	Р	SS	С
Course Name	COMMUNICATIVE ENGLISH	3	1	0	0	3

Introduction

With the growing importance of English for global communication and the emphasis on training the learners to gain communicative competence, the syllabus is designed to develop linguistic and communicative competence of the engineering students. The major focus of the syllabus is to enhance the communicative ability, with the focus on the language skills, grammar, vocabulary of the learners and to improve the learner's ability to use English language effectively in social, academic and professional contexts. There is a shift from learning about the language to using the language. Thereby enables the learner to appear confidently for international language qualification tests like IELTS, TOEFL, BEC Etc.

Course Objectives:

- Help students develop effective listening skills so that they can understand academic lectures and native English speakers' speech.
- Encourage the development of speaking abilities by taking part in exercises like roleplaying, dialogues, and organized talks / oral presentations.
- Pay special attention to effective reading techniques for understanding a range of academic literature and real-world resources.
- Introduce useful writing techniques and illustrate them by summarizing, composing essays with a clear structure, recording and reporting relevant information.
- Increase vocabulary and grammatical knowledge, and promote proper use of words both in speech and writing.

Course Outcomes:

At the end of the module, the learners will be able to

- Comprehend social or transactional discussions presented by native English speakers and recognize the context, subject, and specific information.
- Introduce one self and others and engage in general conversation about well-known subjects.
- Employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information.
- Recognize paragraph structure and be able to match beginnings/endings/headings withparagraphs
- Form sentences using proper grammatical structures and correct word forms.

Unit-1

Lesson-1: The Scare Crow by Satyajit Ray from Panorama, a course on reading, Oxford publications. Listening: Listening to short audio texts and identifying the topic. Listening to prose and conversations. Speaking: Asking and answering general questions

on familiar topics such as home, family, work studies and interests. Self-introduction and introducing others. **Reading:** Skimming text to get the main idea. Scanning to look for specific pieces of information. **Writing:** Paragraph writing (specific topics) using suitable cohesive devices, linkers, sign posts and transition signals; mechanics of writing - punctuation, capital letters.

Vocabulary: Synonyms and Antonyms, Affixes.

Grammar: Content words and function words, word forms.

<u>Unit-2</u>

Lesson-1: Nehru's letter to his daughter Indira on her birthday from "**Infotech English**", Maruthi Publications.

Listening: Answering a series of questions about the main idea and supporting ideas after listening to audio texts, both in speaking and writing.

Speaking: Discussion in pairs / small groups on specific topics followed by short structured talks. Functional English: Greetings and leave takings. **Reading**: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together. **Writing**: Summarizing - identifying main idea and rephrasing what is read; avoiding redundancies and repetitions. **Vocabulary**: Synonyms and Antonyms, Root words **Grammar**: Parts of Speech.

<u>Unit- 3</u>

Lesson-1: Telephone Conversation by Wole Soyinka

Listening: Listening for global comprehension and summarizing what is listened to, both in speaking and writing. **Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed. Functional English: Complaining and Apologizing. **Reading**: Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension. Critical reading. **Writing**: Letter writing-types, format and principles of letter writing. E-mail etiquette, Writing CV's. **Vocabulary**: Synonyms and Antonyms, Word Formation

Grammar: Verbs, Subject Verb agreement, Common Errors.

<u>Unit 4</u>

Lesson-1: Water the Elixir of life by C.V.Raman

Listening: Making predictions while listening to conversations/ transactional dialogues without video (only audio); listening to audio-visual texts. **Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. Functional English: Permissions, Requesting, Inviting. **Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicative process or display complicated data.

Writing: Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs / tables, writing for media. **Vocabulary**: Synonyms and Antonyms, Phrasal verbs.

Grammar: Tenses, correction of sentences.

<u>Unit 5</u>

Lesson-1: Stay Hungry-Stay foolish from "Infotech English", Maruthi Publications

Listening: Identifying key terms, understanding concepts and interpreting the concepts both in speaking and writing, TEDX Videos. **Speaking:** Formal oral presentations on topics from academic contexts - without the use of PPT slides. Functional English: Suggesting/Opinion giving. **Reading**: Reading for comprehension. RAP Strategy Intensive reading and Extensive reading techniques. **Reading for Writing**: Writing academic proposals- writing research articles: format and style. **Vocabulary**: Synonyms and Antonyms, Idioms and Phrases. **Grammar**: Voices, Degrees of comparison & Reported speech.

Suggested books:

- 1. "Infotech English", Maruthi Publications.
- 2. "Panorama, a course on reading", Oxford publications
- **3.** Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
- **4.** Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
- **5.** Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
- 6. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012
- 7. <u>https://onlinecourses.nptel.ac.in/noc20_hs19/preview</u>
- 8. https://nptel.ac.in/courses/109106094
- 9. <u>https://news.stanford.edu</u> (Steve Jobs' Speech)

Contribution of Course Outcomes (CO's) towards the achievement of programme outcomes (PO's) (Strong -3, Moderate -2, Weak -1)

	10.01		101									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	1	1	3	1	1
CO2	-	-	-	-	-	-	-	-	-	3	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	2	-	-
CO5	-	-	-	-	-	-	-	-	-	2	-	-

Year & Sem	I Year – I Se	I Year – I Semester										
Course Code	22UCH04	L	Т	Р	SS	С						
Course Name	ENGINEERING CHEMISTRY	3	1	0	0	3						

COURSE OBJECTIVES

- Importance of usage of plastics in household appliances and composites (FRP) in aerospace and automotive industries.
- Outline the basics for the construction of electrodes and batteries. Understand
- the mechanism of corrosion and how it can be prevented.
- Express the increases in demand as wide variety of advanced materials are introduced; which have excellent engineering properties. Classify and discuss the materials used in major industries like steel industry, metallurgical industries and construction industries and electrical equipment manufacturing industries. Lubrication is also summarized.
- Relate the need of fuels as a source of energy to any industry, particularly industries like thermal power stations, steel industry, fertilizer industry etc., and hence introduced.
- Explain the importance and usage of water as basic material in almost all the industries; interpret drawbacks of steam boilers and also how portable water is supplied for drinking purposes.

UNIT I: POLYMER TECHNOLOGY

<u>Polymerization</u>: -Introduction, types and methods of polymerization (emulsion and suspension), mechanical properties.

<u>Plastics</u>: Types, Compounding, Fabrication (compression, injection, blowing and extrusion mouldings), preparation, properties and applications (PVC, polycarbonates and Bakelite), mention some examples of plastic materials used in electronic gadgets, recycling of e-plastic waste (waste to wealth).

Elastomers: -Introduction, vulcanization of rubber, advantages of vulcanized rubber, preparation, properties and applications (BunaS, Thiokol and polyurethanes).

<u>**Composite materials:**</u> Fiber reinforced plastics, conducting polymers, biodegradable and biomedical polymers.

UNIT II: ELECTRO CHEMICAL CELLS AND CORROSION

Electrochemical cell, Single electrode potential, standard hydrogen electrode, calomel electrode, construction of glass electrode, electrochemical series and uses of series, galvanic

series, differentiation between electrochemical series and galvanic series, batteries (Dry cell, Li ion battery and zinc air cells).

Corrosion: -Definition, factors influencing rate of corrosion, theories of corrosion (direct chemical attack and electrochemical), galvanic corrosion, differential aeration corrosion, stress corrosion, corrosion control (proper designing and cathodic protection), Protective coatings (surface preparation, cathodic coatings, anodic coatings, electroplating and electroless plating [nickel]), Paints (constituents and special paints).

UNIT III: MATERIAL CHEMISTRY

PART I:

NANOMATERIALS:

Introduction, sol-gel method, characterization by (Brunauer Emmet Teller [BET]), (scanning electron microscopy [SEM]) and (transmission electron microscopy [TEM]), applications of graphene and fullerences, carbon nanotubes (types, preparation and applications).

Refractories: Definition, classification, properties (refractoriness, refractoriness under load, porosity and thermal spalling), failure of refractories.

PART 2:

Lubricants:-Definition, mechanismof

lubricants, properties (definition and importance). **Cement:** - Constituents, manufacturing, parameters to characterize the clinker formation: limesaturation factor (LSF), silica ratio (SR) and alumina ratio (AR), chemistry of setting and hardening, deterioration of cement.

UNITIV:FUELS

Introduction, calorific value, higher calorific value, lower calorific values, problems using Dulong'sformula, proximate and ultimate analysis of coal sample and their significance, petroleum (refining-cracking), synthetic petrol (Fischer Tropsch and Bergius), petrol knocking, diesel knocking, octane and cetane ratings, anti-knocking agents, Introduction to alternative fuels (Bio-fuel, natural gas, liquefied petroleum gas, compressed natural gas), Flue gas analysis by Orsat apparatus, rocketfuels.

UNITV:WATERTECHNOLOGY

Hardnessofwater,

determinationofhardnessbycomplexometricmethod, boilertroubles(primingand foaming, scale

formation, boiler corrosion, caustic embrittlement), internal treatments, softening ofhard water (zeolite process and ion exchange process), treatment of industrial wastewater, characteristics of potable water, steps involved in purification of water, chlorination, breakpointchlorination-desalination(reverseosmosisandelectro dialysis)

StandardBooks:

- P.C.JainandM.Jain"EngineeringChemistry",15/e,DhanpatRai&Sons,Delhi, (Latestedition).
- 2. ShikhaAgarwal, "EngineeringChemistry", CambridgeUniversityPress, NewDelhi, (2019).
- 3. S.S.Dara, "ATextbookofEngineeringChemistry", S.Chand&Co, (2010).
- 4. ShashiChawla, "EngineeringChemistry", DhanpatRaiPublicatingCo. (Latestedition).

Reference Books:

- 1. K.Sesha,MaheshwarammaandMridulaChugh,"**EngineeringChemistry**",PearsonIndia Edn.
- O.G.Palana, "EngineeringChemistry", TataMcGrawHillEducationPrivateLimited, (20 09).
- 3. CNRRaoandJMHonig(Eds) "**Preparationandcharacterizationof materials**" Academicpress, New York(latest edition)
- 4. B.S.Murthy, P.Shankarandothers, "**TextbookofNanoscienceandNanotechnology**", Uni versity press(latest edition.

Contribution of Course Outcomes (CO's) towards the achievement of programme outcomes (PO's) (Strong -3, Moderate -2, Weak -1)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1												
CO-2	1											
CO-3												
CO-4						1						
CO-5						1						1
AVG	1	NC	NC	NC	NC	1	NC	NC	NC	NC	NC	1

Year & Sem	I Year – I Sem	lester				
Course Code	22UCE01	L	Т	Р	SS	С
Course Name	BUILDING MATERILAS & CONSTRUCTION	3	1	0	0	3

COURSE OBJECTIVES:

- Make the student aware of the knowledge of basic building materials and their properties.
- Imparting the knowledge of course pattern in masonry construction and flat roofs and techniques of forming foundation, columns, beams, walls, sloped and flat roofs.
- The student is to be exposed to the various patterns of floors, walls, different types ofpaints and varnishes.
- Imparting the students with the techniques of formwork and scaffolding.
- The students should be exposed to classification of aggregates, moisture content of the aggregate.

COURSE OUTCOMES:

- **CO1:** The student should be able to identify different building materials and their importance in building construction.
- **CO2:** The student is expected to differentiate brick masonry, stone masonry construction. Understand different timber types, their defects and alternative materials to wood.
- **CO3:** Understand cement types, their properties, cement lab test and chemical reactions for strength and durability.
- CO4: Understand types of vaults, floors, roof and their applications in construction.
- CO5: Gain knowledge of different types of paints, scaffolding and aggregate properties.

UNIT I:

(12 Hours)

Stones, Bricks and Tiles: Properties of building stones – relation to their structural requirements, classification of stones – stone quarrying – precautions in blasting, dressing of stone, composition of good brick earth, various methods of manufacturing of bricks. Characteristics of good tile - manufacturing methods, types of tiles. Uses of materials like Aluminum, Gypsum, Glass and Bituminous materials

UNIT II Masonry:

Types of masonry, English and Flemish bonds, Rubble and Ashlar Masonry. Cavity and partition walls. Wood: Structure – Properties- Seasoning of timber- Classification of various types of woods used in buildings- Defects in timber. Alternative materials for wood – Galvanized Iron, Fiber Reinforced Plastics, Steel, Aluminium.

UNIT III:

Lime and Cement: Lime: Various ingredients of lime – Constituents of lime stone – classification of lime – various methods of manufacture of lime.

Cement: Portland cement- Chemical Composition – Hydration, setting and fineness of cement. Various types of cement and their properties. Various field and laboratory tests for Cement. Various ingredients of cement concrete and their importance – various tests for concrete.

UNIT IV:

Building Components: Lintels, arches, vaults, stair cases – types. Different types of floors – Concrete, Mosaic, Terrazzo floors, Pitched, flat roofs. Lean to roof, Coupled Roofs. Trussed roofs – King and Queen post Trusses. R.C.C Roofs, MadrasTerrace and Pre-fabricated roofs.

UNITV:

(14 Hours)

Finishings and Aggregates: Damp Proofing and water proofing materials and uses –
Plastering Pointing, white washing and distempering. Paints: Constituents of a paint
– Types of paints – Painting of new/old wood- Varnish. Form Works and Scaffoldings.
Aggregates - Classification of aggregate – Coarse and fine aggregates- particle shape and texture – Bond and Strength of aggregate – Specific gravity – Bulk Density, porosity and absorption – Moisture content of Aggregate- Bulking of sand – Sieve analysis.

Text Books:

- 1. Building Materials, S. S. Bhavikatti, Vices publications House privateltd.
- 2. Building Construction, S. S. Bhavikatti, Vices publications House privateltd.
- 3. Building Materials, B. C. Punmia, Laxmi Publications privateltd.
- 4. Building Construction, B.C. Punmia, Laxmi Publications (p)ltd.

(14 Hours)

(14 Hours)

(10 Hours)

References:

- 1. Building Materials, S. K. Duggal, New Age International Publications.
- 2. Building Materials, P. C. Verghese, PHI learning (P)ltd.
- 3. Building Materials, M. L. Gambhir, Tata McGraw Hill Publishing Co. Ltd. New Delhi.
- 4. Building construction, P. C. Verghese, PHI Learning (P)Ltd.
- 5. Building Materials, Construction and Planning, S.Mahaboob Basha, Anuradha Publications, Chennai.

Contribution of Course Outcomes (CO's) towards the achievement of programme outcomes (PO's) (Strong -3, Moderate -2, Weak -1)

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

CO – PO MAPPING:

Year & Sem	I Year – I Semester										
Course Code	22UCS01	L	Т	Р	SS	С					
Course Name	PROGRAMMING FOR PROBLEM SOLVING USING C	3	1	0	0	3					

Course Objectives:

The objectives of Programming for Problem Solving Using C are

- To learn about the computer systems, computing environments, developing of a computerprogram and Structure of a C Program
- To gain knowledge of the operators, selection, control statements and repetition in C
- To learn about the design concepts of arrays, strings
- To assimilate about pointers, dynamic memory allocation
- To assimilate about File, I/O and significance of functions

Course Outcomes:

Upon the completion of the course the student will learn

CO1: To write algorithms and to draw flowcharts for solving problems and to convert

flowcharts/algorithms to C Programs, compile and debug programs

CO2: To use different operators, data types and write programs that use two-way/ multi-way selection

CO3: To select the best loop construct for a given problem

CO4: To design and implement programs to analyze the different pointer applications

CO5: To decompose a problem into functions and to develop modular reusable code and to apply File I/O operations

UNIT-I

Introduction to Computers: Computer Systems – Block Diagram of Computer, Hardware, Software, Algorithms, Flow Charts, Pseudocode Introduction to the C Language: Background, C Programs, Identifiers, Types, Variable, Constants, Input/output, Programming Examples. Structure of a C Program: Expressions, types of expressions, Precedence and Associativity, Evaluating Expressions, Type Conversion Statements, Simple Programs.

UNIT-II

Bitwise Operators: Logical Bitwise Operators, Shift Operators, Programming Examples. **Selection & Making Decisions:** Logical Data and Operators, Two Way Selection, Multi waySelection, Programming examples. **Repetition:** Concept of Loop,

Pretest and Post-test Loops, Initialization and Updating, Event and Counter Controlled Loops, Loops in C, Looping Applications, Programming Examples.

UNIT-III

Arrays: Concepts, Using Array in C, Array Application, Two Dimensional Arrays, Multidimensional Arrays, Programming Examples. **Strings:** String Concepts, C String, String Input / Output Functions, Arrays of Strings, String Manipulation Functions, Programming Examples.

UNIT-IV

Functions: Designing, Structured Programs, Function in C, User Defined Functions, Types of functions, Standard Functions, Passing Array to Functions and Passing Pointers to Functions, Recursion, Scope – Global Scope, Local Scope, Function Scope, and Storage Classes. **Pointers:** Introduction - Definition, Declaration, Initialization, Accessing, Benefits of Pointers, Why Pointers, Pointers to pointers, Arrays, and Pointers, Pointer Arithmetic and Arrays, Memory Allocation Function, Array of Pointers, Programming Application.

UNIT-V

Structures and Union: Structure- Definition, Declaration, Accessing, Initialization, Arrays in Structures, Array of Structures, Structure Pointers, structures and functions, Unions and Programming Examples. **Files:** Files, Streams, Types of Files- Text and Binary Files, Standard Library Input / Output Functions, Formatting Input / Output Functions, Character Input / Output Functions, Programming Examples

Text Books:

- 1) Programming for Problem Solving, Behrouz A. Forouzan, Richard F.Gilberg, CENGAGE.
- 2) The C Programming Language, Brian W.Kernighan, Dennis M. Ritchie, 2e, Pearson.

Reference Books:

- 1) Computer Fundamentals and Programming, Sumithabha Das, Mc Graw Hill.
- 2) Programming in C, Ashok N. Kamthane, Amit Kamthane, Pearson.
- 3) Computer Fundamentals and Programming in C, Pradip Dey, Manas Ghosh, OXFORD.

Contribution of Course Outcomes (CO's) towards the achievement of programme outcomes (PO's) (Strong – 3, Moderate – 2, Weak – 1)

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	3	1	2									
CO3	3		1									
CO4		2	3	2	3							
CO5		1		2	3							
AVG	3	1.3	2	2	3							

Year & Sem	I Year – I Semester										
Course Code	22UEN02	L	Т	Р	SS	С					
Course Name	ENGLISH COMMUNICATION SKILLS LAB	0	0	3	0	1.5					

Course Objectives

- Learners learn the basics of phonetics- recognize phonetic symbols and facilitates the learners' use of dictionary for pronunciation.
- To enhance the articulation of the sounds and pronunciation of words.
- To improve the communication skills and clarity of speech.
- To enhance effective communication skills.
- Enables learners to speak and communicate confidently.

Course Outcomes:

By the end of the semester the learners develop

- CO1. Proper and accurate articulation of the sounds by following standard pronunciation of words and communicate intelligibly.
- CO2. Speaking fluently with neutral accent.
- CO3. Clarity of speech.
- CO4. To communicate in various contexts using choice of appropriate expressions.
- CO5. To acquire several communicative functions. Thereby enable to interact in different social and work situations.

The course material is divided into five units.

Unit 1:

Introduction and importance of phonetics. Letters and Sounds, Sounds of English (Consonant Sounds, Vowel Sounds)

Unit 2

Pronunciation and pronunciation rules, Plural and past tense marker rules.

Unit 3:

Syllable, word stress, stress in mono, di, and poly syllabic words, stress in compound words, contrastive, word stress, Rhythm and Intonation.

<u>Unit 4:</u>

Just A Minute (JAM)

<u>Unit 5:</u>

Group Discussions and Interview Skills

Suggested books:

- 1. Infotech English, Maruthi Publications (with Compact Disc).
- 2. English Pronunciation in use- Mark Hancock, Cambridge University Press.
- 3. English Pronunciation Dictionary- Daniel Jones, Cambridge University Press.
- 4. English Phonetics for Indian Students- P. Bala Subramanian, Mac Millan Publications.
- 5. Strengthen your communication skills by Dr M Hari Prasad, Dr Salivendra Raju
- 6. English for Professionals by Prof Eliah, B.S Publications, Hyderabad.
- 7. Cornerstone, Developing soft skills, Pearson Education Technical Communication-Meenakshi Raman, Sangeeta Sharma, Oxford University Press.
- 8. https://nptel.ac.in/courses/109106067

Contribution of Course Outcomes (CO's) towards the achievement of programme outcomes (PO's) (Strong – 3, Moderate – 2, Weak – 1)

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

Year & Sem	I Year – I Semester										
Course Code	22UCH05	L	Т	Р	SS	С					
Course Name	ENGINEERING CHEMISTRY LABORATORY	0	0	3	0	1.5					

Introduction to Chemistry laboratory – Molarity, normality, primary, secondary standard solutions, volumetric titrations, quantitative analysis

Experiments List

- 1. Determination of HCl using standard Na2CO3 solution.
- 2. Determination of alkalinity of a sample containing Na2CO3 and NaOH.
- 3. Determination of Mn+2 using standard oxalic acid solution.
- 4. Determination of ferrous iron using standard K2Cr2O7 solution.
- 5. Determination of Cu+2 using standard hypo solution.
- 6. Determination of temporary and permanent hardness of water using standard EDTA solution.
- 7. Determination of Fe+3 by a colorimetric method.
- 8. Determination of the concentration of acetic acid using sodium hydroxide (pH-metry method).
- 9. Determination of pH by using pH-meter.
- 10. Determination of the concentration of strong acid vs strong base (by conductometric method).
- 11. Determination of strong acid vs strong base (by potentiometric method).
- 12. Determination of Mg+2 present in an antacid.
- 13. Determination of CaCO3 present in an egg shell.
- 14. Estimation of Vitamin C.
- 15. Determination of phosphoric content in soft drinks.
- 16. Adsorption of acetic acid by charcoal.
- 17. Preparation of nylon-6, 6 and Bakelite (demonstration only).

Of the above experiments at-least 10 assessment experiments should be completed in a semester.

Outcomes:

The students entering into the professional course have practically very little exposure to lab classes. The experiments introduce volumetric analysis; redox titrations with different indicators; EDTA titrations; then they are exposed to a few instrumental methods of chemical analysis. Thus, at the end of the lab course, the student is exposed to different methods of chemical analysis and use of some commonly employed instruments. They thus acquire some experimental skills.

Reference Books

1. A Textbook of Quantitative Analysis, Arthur J. Vogel.

Contribution of Course Outcomes (CO's) towards the achievement of programme outcomes (PO's) (Strong -3, Moderate -2, Weak -1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	2	-	-	-	-	-	-	-	1
CO2	3	3	2	2	-	-	-	-	-	-	-	1
CO3	3	3	3	1	2	-	-	-	-	-	-	2
CO4	3	3	3	1	2	-	-	-	-	-	-	2
CO5	3	3	3	1	2	-	-	-	-	-	-	2
AVG	3	3	2.4	1.4	2							1.6

Year & Sem	I Year – I Semester										
Course Code	22UCS02	L	Т	Р	SS	C					
Course Name	PROGRAMMING FOR	0	0	3	0	1.5					
	PROBLEM SOLVING USING C										
	LAB										

Course Objectives:

- Apply the principles of C language in problem solving.
- To design flowcharts, algorithms and knowing how to debug programs.
- To design & develop of C programs using arrays, strings pointers & functions.
- To review the file operations.

Course Outcomes:

By the end of the Lab, the student

CO1: Gains Knowledge on various concepts of a C language.

CO2: Able to draw flowcharts and write algorithms.

CO3: Able design and development of C problem solving skills.

- CO4: Able to design and develop modular programming skills.
- **CO5**: Able to trace and debug a program

Exercise 1:

1. Write a C program to print a block F using hash (#), where the F has a height of sixcharacters and width of five and four characters.

2. Write a C program to compute the perimeter and area of a rectangle with a height of 7 inches and width of 5 inches.

Exercise 2:

1. Write a C program to calculate the distance between the two points.

2. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values", otherwise print "Wrong values".

Exercise 3:

1. Write a program in C which is a Menu-Driven Program to compute the area of the various geometrical shape.

2. Write a C program to calculate the factorial of a given number.

Exercise 4:

1. Write a program in C to display the n terms of harmonic series and their sum. $1 + 1/2 + 1/3 + 1/4 + 1/5 \dots 1/n$ terms.

2. Write a C program to check whether a given number is an Armstrong number or not.

Exercise 5:

1.Write a program to display all prime numbers less than n

2. Write a program to display the following output format

1				
2	2			
3	3	3		
4	4	4	4	
5	5	5	5	5

Exercise 6:

1.Write a program in C to separate odd and even integers in separate arrays.

2. Write a program in C to sort elements of array in ascending order.

Exercise 7:

1. Write a program in C for multiplication of two square Matrices.

2.Write a program in C to find transpose of a given matrix

Exercise 8:

1. Write a program in C to compare two strings without using string library functions.

2. Write a program in C to copy one string to another string.

Exercise 9:

1. Write a c program to read and display the details of an employee using structure

2. Write a c program to demonstrate array of structures

Exercise 10:

1. Write a program in C to demonstrate the use of & (address of) and *(value at address)operator.

2. Write a C program to find sum of n elements entered by user using pointers

3. Write a C Program to Store Information Using Structures with Dynamically MemoryAllocation

Exercise 11:

1. Write a program in C to swap elements using call by reference

2. Find factorial of given number using recursion

3. Write a program in C to get the largest element of an array using the function **Exercise 12:**

1.Write a program in C to append multiple lines at the end of a text file.

2.Write a program in C to copy a file in another name.

3.Write a program in C to remove a file from the disk

Contribution of Course Outcomes (CO's) towards the achievement of programme outcomes (PO's) (Strong -3, Moderate -2, Weak -1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	1	2							1
CO2	3			2	3							1
CO3		3		2	3							1
CO4	3	2		2	3							1
CO5	3		2	2	3							1
Avg	3	2.33	2.5	1.8	2.8							1

Year & Sem	I Year – I Se	I Year – I Semester										
Course Code	22UCH03	L	Т	Р	SS	С						
Course Name	ENVIRONMENTAL SCIENCE	2	0	0	0	0						

Knowledge of basic concepts of Environmental Engineering which will help students as professional engineers later in design and material selection, as well as utilizing the available resources.

COURSE OBJECTIVES

The objectives of the course are to impart:

- Overall understanding of the natural resources.
- Basic understanding of the ecosystem and its diversity.
- Acquaintance on various environmental challenges induced due to unplanned Anthropogenic activities.
- An understanding of the environmental impact of developmental activities.
- Awareness on the social issues, environmental legislation and global treaties.

COURSE OUTCOMES

CO1: The natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources

CO2: The concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food web

CO3: The biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity

CO4: Various attributes of the pollution and their impacts and measures to reduce or control the pollution along with waste management practices

CO5: About environmental assessment and the stages involved in EIA and the environmental audit.

UNIT-I:

Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance – Sustainability: Stockholm and Rio Summit–Global Environmental Challenges: Global warming and climate change, acid rains, ozone layer depletion, population growth and explosion, effects; Role of information technology in environment and human health.

Ecosystems: Concept of an ecosystem. - Structure and function 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 Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems.

UNIT-II:

Natural Resources: Natural resources and associated problems.

Forest resources: Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people.

Water resources: Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Food resources: World food problems, changes caused by non-agriculture activities-effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources.

Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification; Role of an individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

UNIT-III:

Biodiversity and its conservation: Definition: genetic, species and ecosystem diversityclassification - Value of biodiversity: consumptive use, productive use, social-Biodiversity at national and local levels. India as a mega-diversity nation - Hot-sports of biodiversity -Threats to biodiversity: habitat loss, man- wildlife conflicts. - Endangered and endemic species of India – Conservation of biodiversity: conservation of biodiversity.

UNIT – IV:

Environmental Pollution: Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, nuclear hazards. Role of an individual in prevention of pollution. - Pollution case studies, Sustainable Life Studies. Impact of Fire Crackers on Men and his wellbeing.

Solid Waste Management: Sources, Classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products, Biomedical, Hazardous and e – waste management.

UNIT-V:

Social Issues and the Environment: Urban problems related to energy -Water

conservation, rain water harvesting - Resettlement and rehabilitation of people; its problems and concerns.

Environmental ethics: Issues and possible solutions. Environmental Protection Act -Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act -Wildlife Protection Act - Forest Conservation Act-Issues involved in enforcement of environmental legislation. -Public awareness.

Environmental Management: Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS, Environmental audit. Ecotourism, Green Campus – Green business and green politics. The student should Visit an Industry / Ecosystem and submit a report individually on any issues related to Environmental Studies course and make a power point presentation.

Text Books:

- 1. Environmental Studies, K. V. S. G. Murali Krishna, VGS Publishers, Vijayawada
- 2. Environmental Studies, R. Rajagopalan, 2nd Edition, 2011, Oxford UniversityPress.
- 3. EnvironmentalStudies,P.N.Palanisamy,P.Manikandan,

A.Geetha, and K.Manjula Rani; Pearson Education, Chennai

Reference:

- 1. TextBook of Environmental Studies, Deeshita Dave & P.UdayaBhaskar, CengageLearning.
- 2. A Textbook of Environmental Studies, Shaashi Chawla, TMH, NewDelhi
- 3. Environmental Studies, Benny Joseph, Tata McGraw Hill Co, NewDelhi
- 4. Perspectives in Environment Studies, Anubha Kaushik, C P Kaushik, NewAge InternationalPublishers, 2014

Contribution of Course Outcomes (CO's) towards the achievement of programme

outcomes (PO's) (Strong - 3, Moderate - 2, Weak - 1)

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

Year & Sem	I Year – II S	I Year – II Semester									
Course Code	22UMT02	L	Т	Р	SS	С					
Course Name	MATHEMATICS-II	3	1	0	0	3					

Course Objectives:

- To illuminate the different numerical methods to solve nonlinear algebraic equations.
- To give a definition of Interpolation as it relates to mapping / surveying.
- To familiarize the Laplace, transform techniques in solving the Differential Equations.
- To familiarize the Fourier Series expansions for periodic functions.
- To furnish the learners with basic concepts Fourier Transform techniques to lead them into advanced level by handling various real-world applications.

Course Outcomes:

At the end of the course, the student will be able to

CO1: Evaluate the approximate roots of polynomial and Transcendental equations by different

algorithms

CO2: Apply Newton's forward & backward interpolation and Lagrange's formulae

for equal and unequal intervals.

CO3: Apply the Laplace transform for solving differential equations.

CO4: Find or compute the Fourier series of periodic signals.

CO5: Apply integral expressions for the forwards and inverse Fourier transform to arrange of non - Periodic wave forms.

UNIT-I Iterative Methods

Introduction– Bisection method–Secant method – Method of false position– Iteration method –Newton - Raphson method (One variable only) – Jacobi and Gauss-Seidel methods for solving system of equations numerically. Learning Resources: Text Book – 1

UNIT-II Interpolation

Introduction – Errors in polynomial interpolation – Finite differences – Forward differences–Backward differences – Central differences – Relations between operators – Newton's forward and backward formulae for interpolation – Interpolation with un equal intervals –Lagrange's interpolation formula – Newton's divide difference formula.

Learning Resources: Text Book - 1

UNIT-III Laplace Transforms and Inverse Laplace Transforms (14 Hours)

Laplace transforms –Definition and Laplace transforms of some certain functions – Shifting theorems – Transforms of derivatives and integrals – Unit step function –Dirac's delta function Periodic function – Inverse Laplace

(12 Hours)

(12 Hours)

transforms – Convolution theorem (without proof). Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms.

Learning Resources: Text Book - 1

UNIT IV Fourier Series

Introduction– Periodic functions – Fourier series of periodic function – Dirichlet's conditions– Even and odd functions–Change of interval– Half - range sine and cosine series.

Learning Resources: Text Book – 1

UNIT V Fourier Transforms

Fourier integral theorem (without proof) – Fourier sine and cosine integrals –Sine and cosine transforms – Properties – inverse transforms –Convolution theorem (without proof) – Finite Fourier transforms.

Learning Resources: Text Book - 1

Text Books:

1. **B.S.Grewal,**Higher Engineering Mathematics, 44thEdition, Khanna Publishers.

Reference Books:

- 1. Dr.T.K.V. Iyengar, Dr. B. Krishna Gandhi, S. Ranganadham, Dr. M.V.S.S.N. Prasad, A text book of Engineering Mathematics, S. Chand Publications.
- 2. **B.V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.
- 3. **N.P. Bali, Manish Goyal**, A text book of Engineering Mathematics, Lakshmi Publications
- 4. Erwin Kreyszig, Advanced Engineering Mathematics, 10thEdition, Wiley-India.

Contribution of Course Outcomes (CO's) towards the achievement of programme outcomes (PO's) (Strong -3, Moderate -2, Weak -1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	-	-	-	-	-	-	-	3
CO2	3	2	3	2	-	-	-	-	-	-	-	3
CO3	2	2	2	2	-	-	-	-	-	-	-	2
CO4	2	3	3	2	-	-	-	-	-	-	-	2
CO5	3	3	2	2	-	-	-	-	-	-	-	3
AVG	2.6	2.5	2.5	2								2.5

(12 Hours)

(14 Hours)

Year & Sem	I Year – II Semester								
Course Code	22UPH03	L	Т	Р	SS	С			
Course Name	ENGINEERING PHYSICS	3	1	0	0	3			

The course provides a strong conceptual foundation of fundamental Physics upon which engineering applications are built. Knowledge of basic concepts of Physics for Engineering students will help them as professional engineers later in design and material selection, as well as utilizing the available resources.

COURSE OBJECTIVES

CO1. To identify the importance of the optical phenomenon i.e., interference, diffraction and polarization related to its Engineering applications

CO2. Understand the mechanism of emission of light, utilization of lasers as coherent light sources for low and high energy applications, study of propagation of light through optical fibers and their implications in optical communications.

CO3. Enlightenment of the concepts of Quantum Mechanics and to provide fundamentals of deBroglie matter waves, quantum mechanical wave equation and its application, the importance of free electron theory for metals and band theory for crystalline solids. Metals- Semiconductors-Insulators concepts utilization of transport phenomenon of charge carriers in semiconductors.

CO4. To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.

CO5. Interpret various crystal systems and analyze the characterization of materials by. Identify the important properties of crystals like the presence of long-range order and periodicity.

Unit-I: Wave Optics

(12 Hours)

Interference: Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colors in thin films- Newton's Rings-Determination of wavelength and refractive index.

Diffraction: Introduction - Fresnel and Fraunhofer diffraction - Fraunhofer diffraction due to single slit, double slit - N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative).

Polarization: Introduction-Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

Unit-II: Lasers and Fiber optics

Lasers: Introduction – Characteristics of laser – Spontaneous and Stimulated emissions of radiation – Einstein's coefficients – Population inversion – Lasing action - Pumping mechanisms – Ruby laser – He-Ne laser - Applications of lasers.

Fiber optics: Introduction –Principle of optical fiber- Acceptance Angle - Numerical Aperture - Classification of optical fibers based on refractive index profile and modes – Propagation of electromagnetic wave through optical fibers - Applications.

Unit III: Dielectric and Magnetic Materials

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility and Dielectric constant - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field-Clausius-Mossotti equation- Piezoelectricity.

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability - Origin of permanent magnetic moment - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials- Eddy currents- Engineering applications.

Unit IV: Acoustics & Ultrasonics

(8 Hours)

Acoustics: Introduction to acoustics, Reverberation and Reverberation time, Sabine's formula, Absorption coefficient, Absorption coefficient determination, Factors affecting acoustics of buildings and their remedies

Ultrasonics: Introduction and Properties of Ultrasonics, Production of ultrasonics by Magnetostriction method, Production of ultrasonics by Piezoelectric method, Non-Destructive Testing: Pulse echo system through transmission and reflection modes, A, B and C – scan displays, Applications of Ultrasonics

(8 Hours)

(10 Hours)

Unit-V: Crystallography and X-ray diffraction

(12 Hours)

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattice – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC **X-ray diffraction:** Miller indices – separation between successive (hkl) planes- Bragg's law - X-ray Diffractometer

Text books:

1. Engineering Physics – Dr. M.N. Avadhanulu& Dr. P.G. Kshirsagar, S. Chand and Company

2. Engineering physics – D.K. Battacharya and Poonam Tandon, Oxford University press.

3. Engineering Physics by P.K.Palanisamy SciTech publications.

Reference Books:

1. Fundamentals of Physics - Halliday, Resnick and Walker, John Wiley & Sons

2. Engineering Physics - M.R.Srinivasan, New Age Publications

3. Engineering Physics – D K Pandey, S. Chaturvedi, Cengage Learning

4. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press

5.Shatendra Sharma and Jyotsna Sharma, "Engineering Physics", Pearson India Education services, 1st edition, 2008.

6.V. Rajendran, "Engineering Physics", Tata Mc-Graw Hill Publications, 2nd edition, 2017.

Contribution of Course Outcomes (CO's) towards the achievement of programme outcomes (PO's) (Strong – 3, Moderate – 2, Weak – 1)

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	-	3	3	3	-	-	-	-	-
CO2	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	-	-	-
Avg	3	3	3	3	3	3	3		3			

Year & Sem	I Year – II Semester									
Course Code	22UME01	L	Т	Р	SS	С				
Course Name	ENGINEERING MECHANICS	3	1	0	0	3				

COURSE OBJECTIVES:

- The students about the concepts of force and friction, direction and its application.
- The students regarding the application of free body diagrams. Solution to problems using graphical methods and law of triangle of forces.
- The concepts of center of gravity, moment of inertia and polar moment of inertia including transfer methods and their applications.
- The understanding of motion in straight line and in curvilinear paths, its velocity and acceleration computation and methods of representing plane motion.
- The knowledge on rigid motion kinematics and kinetics.

COURSE OUTCOMES:

- **CO1:** Draw free body diagrams for particles and rigid bodies in plane and space and problems to solve the unknown forces, orientations and geometric parameters.
- **CO2:** Determine centroid for lines, areas and center of gravity for volumes and their composite
- **CO3**: Determine area and mass movement of inertia for composite sections
- **CO4:** Analyze motion of particles and rigid bodies and apply the principles of motion, work energy and impulse momentum.
- **CO5:** Understanding rigid body motion

UNIT – I

Introduction to Engg. Mechanics – Basic Concepts. Systems of Forces: Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems. Friction: Introduction, limiting friction and impending motion, coulomb's laws of dry friction, coefficient of friction, cone of friction

UNIT – II

Equilibrium of Systems of Forces: Free Body Diagrams, , Lami's Theorm, Equations of Equilibrium of Coplanar Systems, Graphical method for the equilibrium, Triangle law of forces, converse of the law of polygon of forces condition of equilibrium, Equations of Equilibrium for Spatial System of forces, Numerical examples on spatial system of forces using vector approach, Analysis of plane trusses.

UNIT – III

Centroid: Centroids of simple figures (from basic principles) – Centroids of Composite Figures Centre of Gravity: Centre of gravity of simple body (from basic principles), centre of gravity of composite bodies, Pappus theorems.

Area moments of Inertia: Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia. Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies. **UNIT – IV**

Rectilinear and Curvilinear motion of a particle: Kinematics and Kinetics- Work Energy method and applications to particle motion- Impulse momentum method. **UNIT – V**

Rigid body Motion: Kinematics and kinetics of translation, Rotation about fixed axis and plane motion, Work Energy method and Impulse momentum method.

TEXT BOOK:

1. Engg. Mechanics - S.Timoshenko & D.H.Young., 4 th Edn - , Mc Graw Hill publications.

REFERENCES:

- 1. Engineering Mechanics statics and dynamics R.C.Hibbeler, 11th Edn Pearson Publ.
- 2. Engineering Mechanics, statics J.L.Meriam, 6th Edn Wiley India Pvt Ltd.
- 3. Engineering Mechanics, statics and dynamics I.H.Shames, Pearson Publ.

4. Mechanics For Engineers, statics - F.P.Beer & E.R.Johnston – 5th Edn Mc Graw Hill Publ.

5. Mechanics For Engineers, dynamics - F.P.Beer & E.R.Johnston –5th Edn Mc Graw Hill Publ.

6. Theory & Problems of engineering mechanics, statics & dynamics - E.W.Nelson,

C.L.Best & W.G. McLean, 5th Edn – Schaum's outline series - Mc Graw Hill Publ.

7. Singer's Engineering Mechanics: Statics and Dynamics, K. Vijay Kumar Reddy, J. Suresh Kumar, Bs Publications

8. Engineering Mechanics, Fedinand . L. Singer, Harper – Collins.

9. Engineering Mechanics statics and dynamics, A Nelson, Mc Graw Hill publications.

Contribution of Course Outcomes (CO's) towards the achievement of programme outcomes (PO's) (Strong – 3, Moderate – 2, Weak – 1) CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	2	-	-	-	-	-	-	2
CO2	3	2	2	3	2	-	-	-	-	-	-	2
CO3	3	2	2	3	2	-	-	-	-	-	-	2
CO4	3	2	2	3	2	-	-	-	-	-	-	2
CO5	3	2	2	3	2							2
AVG	3	2	2	3	2	-	-	-	-	-	-	2

Year & Sem	I Year – II Semester										
Course Code	22UCE02	L	Т	Р	SS	С					
Course Name	ENGINEERING GEOLOGY	3	1	0	0	3					

COURSE OBJECTIVES:

- To introduce the course: Engineering Geology to the Civil Engineering graduates.
- To enable the students, understand what minerals and rocks are and their formation andidentification.
- To highlight significance/ importance/ role of Engineering Geology in construction of CivilEngineering structures.
- To enable the student, realise its importance and applications of Engineering Geology in CivilEngineering constructions.

COURSE OUTCOMES:

CO1: Identify and classify the geological minerals. Measure the rock strengths of various rocks

CO2: Classify and measure the earthquake prone areas to practice the hazard zonation

CO3: Classify, monitor and measure the Landslides and subsidence

CO4: Prepares, analyses and interpret the Engineering Geologic maps

CO5: Analyses the ground conditions through geophysical surveys.

UNIT-I:

Introduction: Branches of Geology, Importance of Geology in Civil Engineering with case studies. **Weathering:** Weathering of rocks, Geological agents, weathering process of Rock, Rivers and geological work of rivers.

UNIT-II

Mineralogy and Petrology: Definitions of mineral and rock-Different methods of study of mineral and rock. Physical properties of minerals and rocks for megascopic study for the following minerals and rocks. Common rock forming minerals: Feldspar, Quartz Group, Olivine, Augite, Hornblende, Mica Group, Asbestos, Talc, Chlorite, Kyanite, Garnet, Calcite and ore forming minerals are Pyrite, Hematite, Magnetite, Chlorite, Galena, Pyrolusite, Graphite, Chromite, Magnetite and Bauxite. Classification, structures, textures and forms of Igneous rocks, Sedimentary rocks, Metamorphic rocks, and their megascopic study of granite varieties, (pink, gray, green). Pegmatite, Dolerite, Basalt etc., Shale, Sand Stone, Lime Stone, Laterite, Quartzite, Gneiss, Schist, Marble, Khondalite and Slate.

UNIT-III

Structural Geology: Strike, Dip and Outcrop study of common geological structures associating with the rocks such as Folds, Faults, Joints and Unconformities- parts, types, mechanism and their importance in Civil Engineering.

UNIT-IV

Ground Water: Water table, Cone of depression, Geological controls of Ground Water Movement, Ground Water Exploration Techniques.

(14 Hours)

(8 Hours)

(10 Hours)

(10 Hours)

Earthquakes and Land Slides: Terminology, Classification, causes and effects, Shield areas and Seismic bells, Richter scale intensity, Precautions of building constructions in seismic areas. Classification of Landslides, Causes and Effects, measures to be taken prevent their occurrence at Landslides.

Geophysics: Importance of Geophysical methods, Classification, Principles of Geophysical study by Gravity method, Magnetic method, Electrical methods, Seismic methods, Radiometric method and Electrical resistivity, Seismic refraction methods and Engineering properties of rocks.

UNIT-V

(10 Hours)

Geology of Dams, Reservoirs and Tunnels: Types and purpose of Dams, Geological considerations in the selection of a Dam site. Geology consideration for successful constructions of reservoirs, Lifeof Reservoirs. Purpose of Tunnelling, effects, Lining of Tunnels. Influence of Geology for successful Tunnelling.

TEXT BOOKS:

- 1. 'Engineering Geology' by Subinoy Gangopadhay, Oxford University press.
- 2. 'Engineering Geology' by D. Venkat Reddy, Vikas Publishing House pvt. Ltd, 2013.
- 'Engineering Geology' by N. Chenn kesavulu, Trinity Press (Laxmi Publications), 2ndEdition, 2014.
- 4. 'Engineering Geology' by Vasudev Kanithi, University Press.

REFERENCES:

- 1. 'Engineering Geology for Civil Engineers' by P.C. Varghese, PHI learning pvt. Ltd.
- 2. 'Geology for Engineers and Environmental Society' by Alan E Kehew, person publications,3rd edition
- 3. 'Fundamentals of Engineering Geology' by P.G.Bell, B.S.P. Publications, 2012.
- 4. 'Engineering Geology' by V.Parthesarathi et al., Wiley Publications
- 5. 'Environmental Geology' by K.S.Valdiya, McGraw Hill Publications, 2nd ed.

Contribution of Course Outcomes (CO's) towards the achievement of programme outcomes (PO's) (Strong -3, Moderate -2, Weak -1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	1			2		1	1			1	1	
CO 2	1			2		2	1			2	1	
CO 3	2			1		1	1		1	1	1	
CO 4	3					2	2		1	1	2	
CO 5	2	1		1	2	2	2		1	1	1	
AVG	1.8	1		1.5	2	1.6	1.4		1	1.2	1.2	

Year & Sem	I Year – II Semester									
Course Code	22UME02	L	Т	Р	SS	С				
Course Name	ENGINEERING DRAWING	3	1	0	0	3				

Course Objectives: To impart

- The students to use drawing instruments and to draw polygons, Engineering. Curves.
- The students to use orthographic projections, projections of points & simple lines. To make the students draw the projections of the lines inclined to both the planes.
- The students draw the projections of the plane inclined to both the planes.
- The students draw the projections of the various types of solids indifferent positions inclined to one of the planes.
- The students to construct object in 3D view through isometric view, to represent and convert the isometric view to orthographic view and vice versa.

Course Outcomes: The student will be able to

- CO1: Understand the fundamental principles of Engineering Drawing.
- CO2: Analyze the applications of scales in Engineering.
- CO3: Develop projections of points, lines, planes and solids.
- CO4: Understand the applications of orthographic projections
- CO5: Understand the applications of isometric projections

UNIT I:

Polygons: Constructing regular polygons by general methods, inscribing and describing polygons on circles.

Curves: Parabola, Ellipse and Hyperbola by general and special methods, cycloids, involutes, tangents & normal for the curves. Scales: Plain scales, diagonal scales and Vernier scales

UNIT II:

Orthographic Projections: Reference plane, importance of reference lines, projections of points in various quadrants, projections of lines, line parallel to both the planes, line parallel to one plane and inclined to another plane.

Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclination and traces.
UNIT III:

Projections of planes: regular planes perpendicular/parallel to one reference plane and inclined to the other reference plane; inclined to both the reference planes.

UNIT IV

Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to one of the plane.

UNIT V:

Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

TEXT BOOKS:

- 1. Engineering Drawing by N.D. Bhatt, Chariot Publications
- 2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

REFERENCE BOOKS:

- 1. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers
- 2. Engineering Graphics for Degree by K.C. John, PHI Publishers
- 3. Engineering Graphics by PI Varghese, McGraw Hill Publishers

Contribution of Course Outcomes (CO's) towards the achievement of programme outcomes (PO's) (Strong -3, Moderate -2, Weak -1)

CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	2	-	-	-	-	-	-	2
CO2	3	2	2	3	2	-	•	-	-	-	-	2
CO3	3	2	2	3	2	-	•	-	-	-	-	2
CO4	3	2	2	3	2	-	•	-	-	-	-	2
CO5	3	2	2	3	2	-	•	-	-	-	-	2
AVG	3	2	2	3	2							2

Year & Sem	I Year – II Semester											
Course Code	22UPH04	L	Т	Р	SS	С						
Course Name	ENGINEERING PHYSICS LAB	0	0	3	0	1.5						

List of Engineering Physics Experiments

- 1. Laser: Determination of wavelength using diffraction grating.
- 2. Young's modulus of given material by Strain gauge method.
- 3. Study of variation of magnetic field along the axis of a current carrying circular coil by Stewart & Gee's method.
- 4. Determination of ultrasonic velocity in given liquid (Acoustic grating).
- 5. Determination of dielectric constant using charging and discharging method.
- 6. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
- 7. Estimation of Planck's constant using photoelectric effect.
- 8. Rigidity modulus of material of a wire-dynamic method (Torsional pendulum).
- 9. Determination of numerical aperture and acceptance angle of an optical fiber.
- 10. Determination of thickness of thin object by wedge method.
- 11. Determination of radius of curvature of given Plano convex lens by Newton's rings.
- 12. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
- 13. Determination of dispersive power of the prism.
- 14. Sonometer: Verification of laws of string.
- 15. Measurement of magnetic susceptibility by Kundt's tube method.

References:

1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.

Contribution of Course Outcomes (CO's) towards the achievement of programme outcomes (PO's) (Strong – 3, Moderate – 2, Weak – 1) CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	3	-	-	-	-	-	-	-
CO2	3	-	-	-	3	-	-	-	-	-	-	-
CO3	2	-	-	-	3	-	-	-	-	-	-	-
CO4	3	-	-	-	3	-	-	-	-	-	-	-
CO5	3	-	-	-	3	-	-	-	-	-	-	-
AVG	2.8				3							

Year & Sem	I Year – II Semester										
Course Code	22UCE03	22UCE03 L T P SS (
Course Name	ENGINEERING GEOLOGY LAB	0	0	3	0	1.5					

COURSE OBJECTIVES:

- To identify the Megascopic types of Ore minerals & Rock forming minerals.
- To identify the Megascopic types of Igneous, Sedimentary, Metamorphic rocks.
- To identify the topography of the site & material selection.

COURSE OUTCOMES:

- CO1. Identify Megascopic minerals & their properties.
- CO2. Identify Megascopic rocks & their properties.
- CO3. Identify the site parameters such as contour, slope & aspect for topography.
- CO4. Know the occurrence of materials using the strike & dip problems.

LIST OF EXPERIMENTS

- 1. Physical properties of minerals: Mega-scopic identification of
 - a. Rock forming minerals Quartz group, Feldspar group, Garnet group, Mica group & Talc,
 - Chlorite, Olivine, Kyanite, Asbestos, Tourmelene, Calcite, Gypsum, etc...
 - b. Ore forming minerals Magnetite, Hematite, Pyrite, Pyralusite, Graphite, Chromite, etc...
- 2. Megascopic description and identification of rocks.
 - a) Igneous rocks Types of Granite, Pegmatite, Gabbro, Dolerite, Syenite, Granite Poryphery, Basalt, etc.
 - b) Sedimentary rocks Sand stone, Ferrugineous sand stone, Lime stone, Shale, Laterite, Conglamorate, etc.
 - c) Metamorphic rocks Biotite Granite Gneiss, Slate, Muscovite & Biotiteschist, Marble, Khondalite, etc.
- 3. Interpretation and drawing of sections for geological maps showing tilted beds, faults, unconformities etc.
- 4. Simple Structural Geology problems.
- 5. Bore hole data.
- 6. Strength of the rock using laboratory tests.
- 7. Field work To identify Minerals, Rocks, Geomorphology & Structural Geology.

REFERENCES:

- 1. 'Applied Engineering Geology Practicals' by M T Mauthesha Reddy, New Age InternationalPublishers, 2nd Edition.
- 2. 'Foundations of Engineering Geology' by Tony Waltham, Spon Press, 3rd edition, 2009.

Year & Sem	I Year – II Semester												
Course Code	22UCE04 L T P SS (
Course Name	CIVIL ENGG. WORK SHOP	2	0	0	0	0							
	LAB												

COURSE OBJECTIVES:

- To outline the process of identification of various building components and their estimation
- To provide knowledge on operation of the various survey instruments used for linear and angular measurements.
- To explain the concept of measurement of discharge and velocity in a pipe and density of water
- To demonstrate automatic weather station

COURSE OUTCOMES:

Learners at the end of this Laboratory course will be able to

- CO1. Identify various components of a building and give lump-sum estimate.
- CO2. Determine distances and irregular areas using conventional survey instruments like chain, tape, cross-staff and compass
- CO3. Identify different soils
- CO4. Know various traffic signs & signals
- CO5. Determine centre of gravity and moment of inertia of channel and I-sections.
- CO6. Set out a signal room building as per given plan
- CO7. Install simple sanitary filling and find discharge/velocity in a water pipe line as density of water
- CO8. Know to the process of making cement mortar / concrete for nominal mix

LIST OF EXPERIMENTS

- 1. Demonstration on usage of chain
- 2. Ranging offsets chain-age
- 3. To find the area of an irregular polygon using chain by using horizontal measurements
- 4. Determination of bearings and included angles with prismatic compass.
- 5. Demonstration on various Building materials used in construction
- 6. Estimation of quantity of bricks, concrete, wood, paint for the given single room building
- 7. Masonry work hands on practice work deferent types of bonds in brick masonry
- 8. Identification of quality of brick through physical tests
- 9. Identification of soil based on their physical properties
- 10. Setting out of building: The student is required to set out a building (Single room only) as per the given building plan using tape and cross staff.
- 11. Demonstration on Installation of simple sanitary fittings and fixtures like Tap, T-joint, Elbow, bend, threading etc.
- 12. Finding the discharge velocity in a water pipe line also find density of water
- 13. Computation of Centre of gravity and moment of inertial of (i) I-section and (ii) Channel section.

- 14. Welding (arc welding and gas welding)
- 15. Carpentry (Demonstration)
- 16. Identify deferent types of roads in the campus and write the physical characteristics of layers
- 17. Demonstration on making of cement mortar/concrete for the given nominal mix
- 18. Study of given Topo-sheet

REFERENCE BOOKS

1. Laboratory Manual for Basic Civil Engineering workshops

Year & Sem	I Year – II Semester											
Course Code	22UEN03 L T P SS C											
Course Name	CONSTITUTION OF INDIA	2	0	0	0	0						

Course Objectives:

- To Enable the student to understand the importance of Constitution
- To understand the structure of Executive, Legislature and Judiciary
- To understand philosophy of Fundamental Rights and Duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and High Court Controller and Auditor General of India and Election Commission of India.
- To understand the Central and State relation Financial and Administrative.

Course Outcomes:

At the end of the semester/course, the student will be able to have a clear knowledge on the following:

- CO1. Understand Historical Background of the Constitution Making and its importance for building a Democratic India.
- CO2. Understand the functioning of three wings of the Government i.e., Executive, Legislative and Judiciary.
- CO3. Understand the value of the Fundamental Rights and Duties for becoming good citizen of India.
- CO4. Analyze the decentralization of power between Central, State and local Self-Government.
- CO5. Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining Democracy.
- 1. Know the sources, features and principles of Indian Constitution.
- 2. Learn about Union Government, State Government and its Administration.
- 3. Get acquainted with Local Administration and Panchayati Raj.
- 4. Be aware of basic concepts and developments of Human Rights.
- 5. Gain knowledge on Roles and Functioning of Election Commission.

UNIT-I

Introduction to Indian Constitution: Constitution meaning of the term, Indian Constitution -

Sources and Constitutional History, Features - Citizenship, Preamble, Fundamental Rights

and Duties, Directive Principles of State Policy.

Learning outcomes:

After completion of this unit student will

- Understand the concept of Indian Constitution
- Apply the knowledge on Directive Principle of State Policy
- Analyze the History, Features of Indian Constitution
- Evaluate Preamble Fundamental Rights and Duties

UNIT-II

Union Government and its Administration Structure of the Indian Union: Federalism, Centre-State relationship, President: Role, Power and Position, PM and Council of Ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions

Learning outcomes: -After completion of this unit student will

- Understand the structure of Indian Government
- Differentiate between the State and Central Government
- Explain the role of President and Prime Minister
- Know the Structure of Supreme Court and High court

UNIT-III

State Government and its Administration Governor - Role and Position - CM and Council of Ministers, State Secretariat: Organization, Structure and Functions

Learning outcomes: -After completion of this unit student will

- Understand the structure of State Government
- Analyze the role of Governor and Chief Minister
- Explain the role of State Secretariat
- Differentiate between Structure and Functions of State Secretariat

UNIT-IV

A. Local Administration - District's Administration Head - Role and Importance,
Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation
Pachayati Raj: Functions PRI: Zilla Panchayat, Elected Officials and their roles, CEO Zilla
Panchayat: Block level Organizational Hierarchy - (Different departments), Village level Role of Elected and Appointed officials - Importance of grass root Democracy

Learning outcomes: -After completion of this unit student will

• Understand the Local Administration

- Compare and contrast District Administration role and importance
- Analyze the role of Mayor and elected representatives of Municipalities
- Evaluate Zilla panchayat block level organization

UNIT-V

Election Commission: Election Commission- Role of Chief Election Commissioner and

Election Commissionerate State Election Commission: Functions of Commissions for the welfare of SC/ST/OBC and women

Learning outcomes: -After completion of this unit student will

- Know the role of Election Commission apply knowledge
- Contrast and compare the role of Chief Election Commissioner and Commissionerate
- Analyze role of State Election Commission
- Evaluate various commissions of viz SC/ST/OBC and women

References:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice - Hall of India

Pvt.Ltd.. NewDelhi

- 2. Subash Kashyap, Indian Constitution, National Book Trust
- 3. J.A. Siwach, Dynamics of Indian Government & Politics
- 4. D.C. Gupta, Indian Government and Politics
- 5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
- 6. J.C. Johari, Indian Government and Politics Hans
- 7. J. Raj Indian Government and Politics
- 8. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law,

Prentice -Hall of India Pvt. Ltd. New Delhi

- 9. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil
- Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

E-resources:

- 1. nptel.ac.in/courses/109104074/8
- 2. nptel.ac.in/courses/109104045/
- 3. nptel.ac.in/courses/101104065/
- 4. www.hss.iitb.ac.in/en/lecture-details
- 5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

Contribution of Course Outcomes (CO's) towards the achievement of programme outcomes (PO's) (Strong – 3, Moderate – 2, Weak – 1)

CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	-	-	-	-	-	-
CO2	-	-	-	-	-	1	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	2	-	-	-	-
CO4	-	-	-	-	-	-	-	1	-	-	-	-
CO5	-	-	-	-	-	1	-	-	-	-	-	-
AVG						1.3		1.5				

Year & Sem	II Year – I Semester											
Course Code	22UCE05	L	Т	Р	SS	С						
Course Name	Building Planning & Drawing	3	1	0	0	3						

UNIT I: BUILDING BYELAWS AND REGULATIONS Introduction- terminology-

objectives of building byelaws- floor area ratio floor space index- principles under laying building bye laws- classification of buildings- open space requirements – built up area limitations- height of buildings- wall thickness – lightening and ventilation requirements.

UNIT. II: RESIDENTIAL BUILDINGS Minimum standards for various parts of buildingsrequirements of different rooms and their grouping- characteristics of various types residential buildings.

UNIT. III: PUBLIC BUILDINGS Planning of educational institutions, hospitals, dispensaries, office buildings, banks, industrial buildings, hotels & motels, buildings for recreation.

UNIT.IV : SIGN CONVENTIONS AND BONDS Brick, stone, plaster, sand filling, concrete, glass, steel, cast iron, copper alloys, aluminium alloys etc., lead, zinc, tin etc., earth, rock, timber and marbles. English bond and Flemish bond- odd and even courses for one, one-half, two and two & half brick walls in thickness at the junction of a corner.

UNIT.V: DOORS, WINDOWS, VENTILATORS AND ROOFS Panelled door, panelled and glassed door, glassed windows, panelled windows, swing ventilators, fixed ventilators, coupled roof, collar roofs. King Post truss, Queen Post truss Sloped and flat roof buildings : drawing plans, Elevations and Cross Sections of given sloped roof buildings. PLANNING AND DESIGNING OF BUILDINGS Draw the Plan, Elevation and sections of a Residential & Public buildings from the given line diagram.

TEXT BOOKS: 1. Planning and Design of buildings by Y.S. Sane

- 2. Planning, designing and Scheduling by Gurucharan Singh and Jagadish Singh
- 3. Building planning and drawing by M. Chakravarthi.
- 4. 'A' Series & 'B' Series of JNTU Engineering College, Anantapur,

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	1		2							1	
CO 2	2				1		2				2	
CO 3	3	1	2								2	
CO 4	3		2	2							1	
CO 5	3	3					1				1	

REFERENCES: 1. Building drawing by Shah and Kale

Year & Sem	II Year – I Semester											
Course Code	22UCE06 L T P SS C											
Course Name	Surveying -I	3	1	0	0	3						

UNIT – I, Introduction: definition-Uses of surveying- overview of plane surveying (chain, compass and plane table), Objectives, Principles and classifications – Errors in survey measurements

UNIT – **II, Chain Surveying** Equipment used and their functions, Chains and arrows. Metallic tapes and Steel tapes, ranging rods, offset rods, pegs, plumb bob, Optical square, Line ranger, Different operations in Chain Surveying- Direct ranging and Indirect ranging ,Chaining on Flat ground, Chaining on sloping ground and chaining when high ground intervenes., Setting out right angles with or with out cross staff, Principles of Chain triangulation. Types of stations and types of chain lines, Recording field notes – field book-Conventional signs, Errors in chain survey, Correction due to incorrect length of Chain – problems, Obstacles in chain survey -methods to overcome obstacles – problems.

UNIT – **III, Compass Surveying** Purpose and principle of compass Survey, Parts of prismatic compass – identification and their function, Meridians - true meridian, magnetic meridian, arbitrary Meridian – Bearings whole Circle bearing, Quadrant bearing -. Dip, Declination and local attraction, conversion of whole circle bearing to Quadrantal bearing and vice versa, Local attraction- and its effects, Detection of local attraction and computation of corrected bearings – problems, Determination of included angles and true bearings of lines in a Compass Closed traverse from data – declination – Problems, Operations involved in field in Compass Survey – Types of compass surveys, Method of recording field notes, Plotting of Closed traverse-closing error and adjustments by Bowditch method, Errors in Compass Surveying-Personal, Instrumental and Natural

UNIT – **IV**, **Definition of leveling**, Types of levelling instruments, Definitions :Datum or Datum plane, Reduced level, Level surface, Horizontal surface, Vertical Line . Station. Mean sea level, and. Bench Mark, Component parts of a Dumpy level and their functions sketch of dumpy level, Temporary adjustments of a Dumpy level – setting , levelling and elimination of parallex, Steps involved in performing Temporary adjustments of a dumpy level, Back

sight, Fore sight, Intermediate sight and Change Point, Tabulation of levelling field data, methods of reducing levels, height of instrument and Rise and fall methods, Computation of reduced levels by height of instrument and Rise and fall methods, and apply check, Errors in leveling, Errors due to 1. Curvature and 2. Refraction 3. Combined error – corrections, Reciprocal levelling, Derivation of the formula for true difference in elevation and true error between two points in reciprocal leveling, Calculation of true difference in elevation and collimation error in reciprocal leveling.

UNIT – V, Contouring- Characteristics and uses of Contours, methods of contour surveying.

Areas - Determination of areas consisting of irregular boundary and regular boundary.

Volumes -Determination of volume of earth work in cutting and embankments for level section, volume of borrow pits, capacity of reservoirs.

TEXT BOOKS:

1. Surveying (Vol - 1, 2), by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi.

2. Chandra A M, "Plane Surveying and higher surveying", New Age International Pvt. Ltd., Publishers, New Delhi.

3. Duggal S K, "Surveying (Vol – 1 & 2), Tata McGraw Hill Publishing Co. Ltd. New Delhi. REFERENCES:

1. Arthur R Benton and Philip J Taety, Elements of Plane Surveying, McGraw Hill.

2. Surveying and levelling by R. Subramanian, Oxford university press, New Delhi

3. Arora K R "Surveying Vol 1, 2 & 3), Standard Book House, Delhi

										-		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1		2	2	2			1	2	2
CO2	2	3	1	1	2		2		1		1	1
CO3	2	3	1	1	1		2		1		2	1
CO4	2	3		2	2		1		1		2	2
CO5	2	2	3	2	2		3		2		2	1
AVG	2.2	2.8	1.5	1.5	1.8	2	2		1	1	1.8	1.4

Year & Sem	II Year – I Semester											
Course Code	22UCE07 L T P SS C											
Course Name	Strength of Materials-I	3	1	0	0	3						

Course Learning Objectives:

- To impart preliminary concepts of Strength of Material and Principles of Elasticity and Plasticity Stress conditions and to develop diagrams of variation of various stresses across the length.
- To give concepts of stresses developed in the cross section and bending equations calculation of section modulus of sections with different cross sections
- The concepts above will be utilized in measuring deflections in beams under various loading and support conditions
- To classify cylinders based on their thickness and to derive equations for measurement of stresses across the cross section when subjected to external pressure.

Course Outcomes:

- The student will be able to understand the basic materials behavior under the influence of different external loading conditions and the support conditions
- The student will be able to draw the diagrams indicating the variation of the key performance features like bending moment and shear forces
- The student will have knowledge of bending concepts and calculation of section modulus and for determination of stresses developed in the beams and deflections due to various loading conditions
- The student will be able to assess stresses across section of the thin and thick cylinders to arrive at optimum sections to withstand the internal pressure using Lame's equation.

UNIT – I:

Simple Stresses And Strains : Elasticity and plasticity – 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 – stresses in composite bars – Temperature stresses.

Strain Energy – Resilience – Gradual, sudden, impact and shock loadings – simple applications.

UNIT – II: Shear Force and Bending Moment: Definition of beam – Types of beams – Concept of shear force and bending moment – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam; S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads, partial uniformly distributed loads, couple and combination of these loads.

UNIT - III: Flexural and shear Stresses in beams

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

Shear Stresses: Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, I, T Angle sections.

UNIT – IV: Deflection of Beams: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic curve of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads, partial uniformly distributed loads, couple and combination of these loads. Mohr's theorems – Moment area method – application to simple cases of cantilever

UNIT – V: Thin and Thick Cylinders:

Thin cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders.

Thick cylinders: Introduction: Lames theory for thick cylinders, Derivation of Lames formulae, distribution of hoop and radial stresses across the thickness, compound cylinders-distribution of stresses.

TEXT BOOKS:

1. A Textbook of Strength of Materials, by R. K. Rajput, 7e (Mechanics of Solids) SI Units S. Chand & Co, NewDelhi

2. Strength of materials by R. K. Bansal, Lakshmi Publications.

REFERENCES:

1. Mechanics of Materials- by R. C. Hibbler, Pearson publishers

2. Mechanics of Solids – E P Popov, Prentice Hall.

3.Strength of Materials by B.S.Basavarajaiah and P. Mahadevappa, 3rd

Edition, Universities Press

4.Mechanics of Structures Vol – I by H.J.Shah and S.B.Junnarkar, Charotar Publishing House Pvt. Ltd.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3		1								1
CO2	2	3		1	1							1
CO3	2	3		1								1
CO4	2	3		1								1
CO5	2	3		1								1
AVG	2.2	3		1	1							1

Year & Sem	II Year – I Semester								
Course Code	22UCE08 L T P SS C								
Course Name	Fluid Mechanics	3	1	0	0	3			

Course Learning Objectives:

- To understand the properties of fluids and fluid statics
- To derive the equation of conservation of mass and its application
- To solve kinematic problems such as finding particle paths and streamlines
- To use important concepts of continuity equation, Bernoulli's equation and turbulence, and apply the same to problems
- To analyze laminar and turbulent flows
- To understand the various flow measuring devices
- To study in detail about boundary layers theory

Course Outcomes:

Upon successful completion of this course the students will be able to:

- Understand the various properties of fluids and their influence on fluid motion and analyse a variety of problems in fluid statics and dynamics.
- Calculate the forces that act on submerged planes and curves.
- Ability to analyse various types of fluid flows.
- Apply the integral forms of the three fundamental laws of fluid mechanics to turbulent and laminar flow through pipes and ducts in order to predict relevant pressures, velocities and forces.
- Able Measure the quantities of fluid flowing in pipes, tanks and channels.

UNIT I

Introduction: Dimensions and units – Physical properties of fluids - specific gravity, viscosity, surface tension, vapour pressure and their influences on fluid motion, pressure at a point, Pascal's law, Hydrostatic law -atmospheric, gauge and vacuum pressures- measurement of pressure. Pressure gauges, Manometers: Differential and Micro Manometers.

Hydrostatics: Hydrostatic forces on submerged plane, Horizontal, Vertical, inclined and curved surfaces – Center of pressure.

UNIT – II

Fluid Kinematics: Description of fluid flow, Stream line, path line and streak line and stream tube. Classification of flows: Steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational and irrotational flows – Equation of continuity for one, two, three dimensional flows – stream and velocity potential functions, flow net analysis.

Fluid Dynamics: Surface and body forces – Euler's and Bernoulli's equations for flow along a stream line - Momentum equation and its application – forces on pipe bend.

$\mathbf{UNIT}-\mathbf{III}$

Laminar Flow and Turbulent Flows: Reynold's experiment – Characteristics of Laminar & Turbulent flows, Shear and velocity distributions, Laws of Fluid friction, Hagen-Poiseulle Formula, Flow between parallel plates, Flow through long tubes, hydro-dynamically smooth and rough flows.

Closed Conduit Flow: Darcy-Weisbach equation, Minor losses – pipes in series – pipes in parallel – Total energy line and hydraulic gradient line, variation of friction factor with Reynold's number – Moody's Chart, Pipe network problems, Hazen-Williams formula, Hard-Cross Method,

UNIT - IV

Measurement of Flow: Pitot tube, Venturi meter and Orifice meter – classification of orifices, small orifice and large orifice, flow over rectangular, triangular, trapezoidal and Stepped notches, Broad crested weirs and Ogee weirs.

UNIT - V

Boundary Layer Theory: Boundary layer (BL) – concepts, Prandtl contribution, Characteristics of boundary layer along a thin flat plate, Vonkarman momentum integral equation, laminar and turbulent Boundary layers (no deviations)- BL in transition, separation of BL, Control of BL, flow around submerged objects-Drag and Lift- Magnus effect.

Text Books:

- 1. Modi P.N and Seth S.M.(2018), "Fluid mechanics", Standard book house, New Delhi
- 2. AtextofFluidmechanicsandhydraulicmachines,R.K.Bansal-LaxmiPublications (P) ltd., New Delhi

References:

- 1.K.Subramanyam, Fluid mechanics and hydraulic machines Mc graw hill education, IInd edition
- 2. Fluid Mechanics and Machinery, C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, Oxford Higher Education.
- 3. Principle of fluid mechanics and fluid machines III edition, university press

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										1
CO2	3	2	2	1	2							1
CO3	3	3	2	1	1							1
CO4	1	3	2									1
CO5	2	2	2	2	3							2
AVG	2.4	2.4	2	1.3	2							1.2

Year & Sem	II Year – I Semester								
Course Code	22UCE09 L T P SS C								
Course Name	Concrete Technology	3	1	0	0	3			

Course Learning Objectives:

- To learn concepts of Concrete production and behaviour in various environments.
- To learn test procedures for determination of properties of concrete.
- To understand durability properties of concrete in various environments.

Course Outcomes:

Upon successful completion of this course, student will be able to

- understand basic concepts of concrete.
- realize importance of quality of concrete.
- familiarize basic ingredients of concrete and their role in concrete and their behaviour in the field.
- test fresh concrete properties and hardened concrete properties.
- evaluate ingredients of concrete through lab tests. design concrete mix by IS method.
- familiarize basic concepts of special concrete and their production and applications. understand the behaviour of concrete in various environments.

UNIT I : Ingredients of Concrete :

Portland cement – Chemical composition – Hydration, Setting times, Fineness, Structure – Tests on cement for physical properties – Grades of cements – Admixtures – Mineral and chemical admixtures – accelerators, retarders, air entrainers, plasticizers, super plasticizers, fly ash and silicafume.

Aggregates: Classification – Particle shape & texture – Bond, strength & other mechanical properties – Specific gravity, Bulk density, porosity, adsorption & moisture content – Bulking of sand –Deleterious substance – Soundness – Alkali aggregate reaction – Thermal properties – Sieve analysis – Fineness modulus – Grading curves – Grading of fine & coarse Aggregates – Gap graded and well graded aggregate as per relevant IS code – Maximum aggregate size. Quality of mixing water.

UNIT – II : Mix Design and Fresh Concrete

Mix Design: Factors affecting mix proportions – Durability of concrete – Quality Control of concrete – Statistical methods – Acceptance criteria – Concepts Proportioning of concrete mixes by IS method.

Fresh Concrete: Production of Concrete-mix proportion, mixing, placing,

compaction, finishing, curing – including various types in each stage. Properties of fresh concrete - Workability – Factors affecting workability – Measurement of workability by different tests, Setting times of concrete, Effect of time and temperature on workability – Segregation & bleeding – Mixing and vibration of concrete, Ready mixed concrete, Shotcrete

UNIT – III : Hardened Concrete: Water - Cement ratio – Abram's Law – Gel space ratio –strength of concrete –Maturity concept – Strength in tension & compression – Factors affecting strength – Relation between compression & tensile strength – Curing, Testing of Hardened Concrete: Compression tests – Tension tests – Factors affecting strength – Flexure tests –Splitting tests – Non-destructive testing methods – code provisions for NDT.

UNIT – IV : Elasticity, Creep & Shrinkage, Modulus of elasticity, Dynamic modulus of elasticity, Poisson's ratio, Creep of concrete and factors influencing creep, Relation between creep & time, Nature of creep, Effects of creep – Shrinkage –types of shrinkage.

UNIT – V : Special Concretes: Ready mixed concrete, Shotcrete, Light weight aggregate concrete, Cellular concrete, No-fines concrete, High density concrete, Fibre reinforced concrete, Different types of fibres, Factors affecting properties of FRC, Polymer concrete, Types of Polymer concrete, Properties of polymer concrete, High performance concrete–Self compacting concrete, SIFCON, self healing concrete.

Text Books:

- 1. Concrete Technology, M. S. Shetty. S. Chand & Company
- 2. Concrete Technology, A. R. Santhakumar, Oxford University Press, NewDelhi

References :

- 1. Properties of Concrete, A. M. Neville Pearson 5thedition
- 2. Concrete, Microstructure, Properties and Materials by P.K.Mehta and Moterio, McGraw Hill
- 3. Concrete Technology, M.L. Gambhir. Tata Mc. Graw Hill Publishers, NewDelhi

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2				1	2	2			1	3	1
CO 2	3		1	2	3		2		2		2	1
CO 3	2		2	2	3		2		2		2	1
CO 4	2	2		3			1				2	
CO 5	2		3	2		1	1		2		2	1
AVG	2.2	2	2	2.25	2.3	2.5	1.6		2	1	2.2	1

Year & Sem	II Year – I Semester									
Course Code	22UCE10	22UCE10 L T P SS								
Course Name	Surveying Field Work - I	0	1	2	0	1.5				

List of Field Works:

- 1. Survey by chain survey of road profile with offsets in case of road widening.
- 2. Survey in an area by chain survey (Closed circuit)
- 3. Determination of distance between two inaccessible points by using compass.
- 4. Finding the area of the given boundary using compass (Closed Traverse)
- 5. Plane table survey; finding the area of a given boundary by the method of Radiation
- 6. Plane table survey; finding the area of a given boundary by the method of intersection.
- 7. Two Point Problem by the plane table survey.
- 8. Fly leveling : Height of the instrument method (differential levelling)
- 9. Fly leveling: rise and fall method.
- 10. Fly leveling: closed circuit/ open circuit.
- 11. Fly leveling; Longitudinal Section and Cross sections of a given road profile.
- 12. Fly leveling and Fly chaining (complete field work).

Note: Any 10 field work assignments must be completed.

Year & Sem	II Year – I Semester									
Course Code	22UCE11	22UCE11 L T P SS								
Course Name	Strength of Materials Lab	0	1	2	0	1.5				

Experiments

- 1. Tension test on Mild steel bar
- 2. Bending test on (Steel / Wood) Cantilever beam.
- 3. Bending test on simply supported beam.
- 4. Torsion test
- 5. Hardness test
- 6. Spring test
- 7. Compression test on wood or concrete
- 8. Impact test (Charpy and Izod impact test)
- 9. Shear test (on UTM)
- 10. Verification of Maxwell's Reciprocal theorem on beams.
- 11. Use of Electrical resistance strain gauges
- 12. Continuous beam deflection test.

Note: Any 10 field work assignments must be completed.

Year & Sem	II Year – I Semester									
Course Code	22UCE12	22UCE12 L T P SS								
Course Name	Concrete Technology Lab	0	1	2	0	1.5				

Course Learning Objectives:

• To study basic properties ingredients of concrete, fresh and hardened concrete properties

Course Outcomes: Upon successful completion of this course, student will be able to

- Determine consistency and fineness of cement.
- Determine setting times of cement.
- Determine specific gravity and soundness of cement.
- Determine compressive strength of cement.
- Determine workability of cement concrete by compaction factor, slump and Vee Beetests
- Determine specific gravity of coarse aggregate and fine aggregate by Sieve analysis.
- Determine flakiness and elongation index of aggregates.
- Determine bulking of sand.
- Understand non-destructive testing procedures on concrete.

List of Experiments: At least 10 experiments must be conducted (at least one for each property)

- 1. Determination of normal Consistency and fineness of cement.
- 2. Determination of initial setting time and final setting time of cement.
- 3. Determination of specific gravity and soundness of cement.
- 4. Determination of compressive strength of cement.
- 5. Determination of grading and fineness modulus of Coarse aggregate by sieve analysis.
- 6. Determination of specific gravity of coarse aggregate
- 7. Determination of grading and fineness modulus of fine aggregate (sand) by sieve analysis.
- 8. Determination of bulking of sand.
- 9. Determination of workability of concrete by compaction factor method.
- 10.Determination of workability of concrete by slump test
- 11. Determination of compressive strength of cement concrete and its young's modulus
- 12. Determination of split tensile strength of concrete. Non-Destructive testing on concrete (for demonstration)

Year & Sem	II Year – I S	II Year – I Semester									
Course Code	22UCE13	22UCE13 L T P SS									
Course Name	SKILL ORIENTED COURSE* (Estimation of Building Works	1	1	2	0	2					
	using CAE)										

Any five-building works from the following list

- 1. Excavation
- 2. Footing P.C.C.
- 3. Footing R.C.C.
- 4. Column up to Plinth Level R.C.C.
- 5. Backfilling
- 6. Plinth Beam R.C.C.
- 7. Grae Slab R.C.C.
- 8. Column Up to Slab Level R.C.C.
- 9. Brick Masonry
- 10. In Side Plaster
- 11. Out Side Plaster
- 12. Celling Plaster
- 13. Slab R.C.C.
- 14. In Side Paint
- 15. Out Side Paint

Year & Sem	II Year – II Semester								
Course Code	22UMT03 L T P SS								
Course Name	Mathematics - III	3	1	0	0	3			

Course Objectives:

- To develop the students to solve real time engineering problems using partial differential equations.
- To familiarize the techniques in partial differential equations to describe a wide range of natural processes and other areas of mathematics such as analysis and differential geometry.
- To understand the properties of Beta and Gamma functions with their integral representations.
- To prepare the students to learn the concepts of Vector Calculus.
- To spread out the use of different numerical techniques for carrying out numerical integration.

Course Outcomes:

At the end of the course, the student will be able to

- **CO1**: Solve problems related to basic linear and non-linear partial differential equations.
- **CO2**: Identify solution methods for partial differential equations that model physical processes.
- **CO3**: Explain the applications and the usefulness of the Beta and Gamma functions by their integral representations and symmetries.
- **CO4**: Interpret the physical meaning of different operators such as gradient, curl, divergence and estimates the work done against a field, circulation and flux using vector calculus.
- **CO5**: Apply Numerical Integration techniques to different engineering problems.

UNIT-I First Order PDE

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions –Solutions of first order linear (Lagrange) equation and non linear (standard types) equations.

UNIT II Higher Order Linear PDE and Applications

Solutions of linear partial differential equations with constant coefficients – nonhomogeneous term of the type e^{ax+by} , $\sin(ax+by)$, $\cos(ax+by)$, x^my^n . Applications of PDE: Method of separation of Variables –Solution of One – dimensional Wave, Heat and two – dimensional Laplace equation.

UNIT III Beta and Gamma Functions

Beta and Gamma functions – Properties – Relation between Beta and Gamma functions – Evaluation of improper integrals.

UNIT IV Vector Calculus

Vector Differentiation: Gradient – Directional derivative – Divergence –Curl – Scalar Potential

Vector Integration: Line integral – Work done – Area– Surface and volume integrals – Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof) and problems on above theorems.

UNIT-V Numerical Integration and Solution of Ordinary Differential Equations

Numerical Integration - Trapezoidal rule– Simpson's $1/3^{rd}$ and $3/8^{th}$ rules – Solution of initial value problems by Taylor's series – Picard's method of successive approximations – Euler's method – Runge - Kutta method (fourth order only).

Text Books:

2. **B.S.Grewal**, Higher Engineering Mathematics, 44th Edition, Khanna Publishers.

Reference Books:

- 1. Dr.T.K.V.Iyengar, Dr. B. Krishna Gandhi, S. Ranganadham, Dr. M.V.S.S.N. Prasad, A text book of Engineering Mathematics, S.Chand Publications.
- 2. **B.V.Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc.Graw Hill Education.
- 3. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley India.

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

Year & Sem	II Year – II Semester									
Course Code	22UCE14 L T P SS C									
Course Name	Surveying - II	3	1	0	0	3				

UNIT - I, Theodolite Surveying: Types of Theodolites, temporary adjustments, measurement of horizontal angle by repetition method and reiteration method, measurement of vertical Angle, when base is accessible and inaccessible.

Traversing: Methods of traversing, traverse computations and adjustments, Introduction to Omitted measurements.

UNIT – II, Trigonometric leveling, Principle and necessity of Trigonometric levelling, Elevations and Distance of objects whose base is accessible and base is inaccessible with instruments station in same vertical plane and different vertical plane

Tachometric Surveying: Principles of Tachometry, stadia and tangential methods of Tachometry Types and advantages of tacheometry-Stadia Tacheometry with staff held vertical and line of collimation horizontal or inclined – finding elevations and distances of staff stations – problems – determination of Tacheometric constants

UNIT – III, Curves Types of curves and their necessity, elements of simple, compound, reverse curves Simple circular curve- definition and notations used, Preparation of curve table and setting out curves by chain and tape - single and double Theodolite methods – problems.

Modern Surveying Methods: Principle and types of E.D.M. Instruments - advantages and Applications.

UNIT – IV, Total station- advantages and Applications. Introduction to Global Positioning System Parts and functions – setting up total station for taking observations - Use of Total Station - Measurement of distances and angles - multiple number of observations on a single station - measurement of area with single station setup – Traversing using a total station orientation of total station by resection method – establishing TBM by station elevation method – staking out a point, line and an arc – marking the centre line for a typical residential building - LS and CS for proposed road / canal / pipe line

UNIT - V Photogrammetry Surveying: Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereoplotting instruments, mosaics, map substitutes.

TEXT BOOKS:

1. Surveying (Vol - 1, 2), by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi.

2. Chandra A M, "Plane Surveying and highersurveying", New Age International Pvt. Ltd., Publishers, New Delhi.

3. Duggal S K, "Surveying (Vol – 1 & 2), Tata McGraw Hill Publishing Co. Ltd. New Delhi.

REFERENCES:

1. Arthur R Benton and Philip J Taety, Elements of Plane Surveying, McGraw Hill.

2. Surveying and levelling by R. Subramanian, Oxford university press, New Delhi

3. Arora K R "Surveying Vol 1, 2 & 3), Standard Book House, Delhi

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3		1		2	2	2			1	2	2
CO 2	2	3	1	1	2		2		1		1	1
CO 3	2	3	1	1	1		2		1		2	1
CO 4	2	3		2	2		1		1		2	2
CO 5	2	2	3	2	2		3		2		2	1

Year & Sem	II Year – II Semester										
Course Code	22UCE15	L	Т	Р	SS	С					
Course Name	Strength of Materials - II	3	1	0	0	3					

Course Learning Objectives:

• To give concepts of Principal stresses and strains developed in cross section of the beams on the cross section and stresses on any inclined plane. To impart concepts of failures in the material considering different theories

• To give concepts of torsion and governing torsion equation, and there by calculate the power transmitted by shafts and springs and design the cross section when subjected to loading using different theories of failures.

• To classify columns and calculation of load carrying capacity and to assess stresses due to axial and lateral loads for different edge conditions and to calculate combined effect of direct and bending stresses on different engineering structures.

• Introduce the concept of unsymmetrical bending in beams Location of neutral axis Deflection of beams under unsymmetrical bending.

Course Outcomes:

Upon successful completion of this course,

• The student will be able to understand the basic concepts of Principal stresses developed in a member when it is subjected to stresses along different axes and design the sections.

• The student can assess stresses in different engineering applications like shafts, springs, columns and struts subjected to different loading conditions

UNIT- I Principal Stresses and Strains And Theories of Failures: Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear – Mohr's circle of stresses – Principal stresses and strains – Analytical and graphical solutions.

Theories of Failures: Introduction – 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.

UNIT – II Torsion of Circular Shafts and Springs: Theory of pure torsion – Derivation of Torsion equations: $T/J = q/r = N\phi/L$ – Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust – Design of shafts according to theories of failure.

Springs: Introduction – Types of springs – deflection of close and open coiled helical springs under axial pull and axial couple – springs in series and parallel.

UNIT – III Columns and Struts: Introduction – Types of columns – Short, medium and long columns – Axially loaded compression members – Crushing load – Euler's theorem for long columns- assumptions- derivation of Euler's critical load formulae for various end

conditions – Equivalent length of a column – slenderness ratio – Euler's critical stress – Limitations of Euler's theory – Rankine – Gordon formula – Long columns subjected to eccentric loading – Secant formula – Empirical formulae – Straight line formula – Prof. Perry's formula.

UNIT – IV Direct and Bending Stresses: Stresses under the combined action of direct loading and B.M. Core of a section – determination of stresses in the case of chimneys, retaining walls and dams – conditions for stability – stresses due to direct loading and B.M. about both axis.

UNIT - V Unsymmetrical Bending and Shear Centre

Un-symmetrical Bending: Introduction – Centroidal principal axes of section – Graphical method for locating principal axes – Moments of inertia referred to any set of rectangular axes – Stresses in beams subjected to unsymmetrical bending – Principal axes

– Resolution of bending moment into two rectangular axes through the centroid – Location of neutral axis Deflection of beams under unsymmetrical bending.

Shear Centre: Introduction Shear center for symmetrical and unsymmetrical sections (channel, I, T and L sections).

TEXT BOOKS:

1. A Textbook of Strength of Materials, by R. K. Rajput, 7e (Mechanics of Solids) SI Units S. Chand & Co, NewDelhi

2. Strength of materials by R. K. Bansal, Lakshmi Publications.

REFERENCES:

1. Mechanics of Materials- by R. C.Hibbler, Pearson publishers

2. Mechanics of Solids - E P Popov, Prentice Hall.

3. Strength of Materials by B.S.Basavarajaiah and P. Mahadevappa, 3rd

Edition, Universities Press,

4. Mechanics of Structures Vol – I by H.J.Shah and S.B.Junnarkar, Charotar Publishing House Pvt. Ltd.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	3		1								1
CO 2	2	3		1								1
CO 3	2	3			1							1
CO 4	2	3			1							1
CO 5	2	3		1	1							1

Year & Sem	II Year – II Semester										
Course Code	22UCE16	L	Т	Р	SS	С					
Course Name	Hydraulics Hydraulic Machinery	3	1	0	0	3					

Course Learning Objectives:

- To study about uniform and non-uniform flows in open channel and also to learn about the characteristics of hydraulic jump
- To introduce dimensional analysis for fluid flow problems
- To understand the working principles of various types of hydraulic machines and Pumps.

Course Outcomes:

- Upon successful completion of this course the students will be able to:
- Solve uniform and non-uniform open channel flow problems.
- Apply the principals of dimensional analysis and similitude in hydraulic model testing.
- Understand the working principles of various hydraulic machineries and pumps.

UNIT - I: UNIFORM FLOW IN OPEN CHANNEL:

Types of channels –Types of flows - Velocity distribution – Energy and momentum correction factors – Chezy's, and Manning's formulae for uniform flow – Most Economical sections, Critical flow: Specific energy-critical depth – computation of critical depth

UNIT II: NON-UNIFORM FLOW IN OPEN CHANNELS: Steady Gradually Varied flow- Dynamic equation, Mild, Critical, Steep, horizontal and adverse slopes-surface profiles-direct step method- Rapidly varied flow, hydraulic jump, energy dissipation.

UNIT – III: HYDRAULIC SIMILITUDE: Dimensional analysis-Rayleigh's method and Buckingham's pi theorem-study of Hydraulic models – Geometric, kinematic and dynamic similarities-dimensionless numbers – model and prototype relations.

UNIT – IV: BASICS OF TURBO MACHINERY: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and at tip, velocity triangles at inlet and outlet, expressions for work done and efficiency-Angular momentum principle.

UNIT – V:HYDRAULIC TURBINES – I: Layout of a typical Hydropower installation – Heads and efficiencies - classification of turbines. Pelton wheel - Francis turbine - Kaplan turbine - working, working proportions, velocity diagram, work done and efficiency, hydraulic design, draft tube – theory and efficiency. Governing of turbines-surge tanks-unit and specific quantities, selection of turbines, performance characteristics-geometric similarity-cavitation.

PUMPS:

CENTRAIFUGAL-PUMPS: Pump installation details-classification-work done-Manometric head-minimum starting speed-losses and efficiencies-specific speed, multistage pumps-pumps in parallel and series - performance of pumps-characteristic curves- NPSH- Cavitation.

RECIPROCATING PUMPS: Introduction, classification, components, working, discharge, indicator diagram, work done and slip

Text Books:

1. Open Channel flow, K. Subramanya, Tata McGraw Hill Publishers

2. Fluid mechanics and hydraulic machines, Rajput, A.K(2018), S chand, New Delhi

3. Fluid Mechanics, Modi and Seth, Standard book house.

References:

1. Fluid Flow in Pipes and Channels, G.L. Asawa, CBS

2. Fluid Mechanics and Machinery, C.S.P. OJHA, R. BERNDTSSON and P.N. Chandramouli, Oxford Higher Education.

3. Fluid Mechanics and Machinery, Md. Kaleem Khan, Oxford Higherducation.

Fluid mechanics and Hydraulic machines, R.K. Bansal, Laxmi publications ,New Delhi

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	3	3	1		1	2					1
CO 2	2	3	2	1		1	2					1
CO 3	3	3	2	1	1							1
CO 4	2	2	1	1	2							1
CO 5	1	2	2	1								1

Year & Sem	II Year – II Semester											
Course Code	22UCE17	L	Т	Р	SS	С						
Course Name	Environmental Engineering	3	1	0	0	3						

Course Learning Objectives:

The course will address the following:

- Outline planning and the design of water supply systems for a community/town/city and selection of source based on quality and quantity
- Design of water treatment plant for a village/city
- Impart knowledge on design of water distribution network
- Design of sewers and plumbing system for buildings
- Design of Sewage Treatment Plant

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

- Select a source based on quality and quantity and Estimate design population and water demand
- Design a water treatment plant for a village/city
- Design a sewer by estimating DWF and Strom water flow and plumbing system for buildings
- Design a Sewage Treatment Plant for a town/city.

UNIT–I

Introduction: Importance and Necessity of Protected Water Supply systems, Water borne diseases, Flow chart of public water supply system, Role of Environmental Engineer.

Water Demand and Quantity Estimation: Estimation of water demand for a town or city, Per capita Demand and factors influencing it - factors affecting water demand, Design Period, Population forecasting.

Sources of Water: Lakes, Rivers, Comparison of sources with reference to quality, quantity and other considerations- Ground water sources: springs, Wells and Infiltration galleries, Characteristics of water– Physical, Chemical and Biological characteristics and WHO guidelines for drinking water

- IS 10500 2012 - Water quality standards for Agriculture, Industries and Construction.

UNIT-II

Treatment of Water: Treatment methods: Theory and Design of Sedimentation, Coagulation, Filtration. **Disinfection**: Theory of disinfection-Chlorination and other Disinfection methods.

Removal of color and odors- Removal of Iron and Manganese - Adsorption- Fluoridation and deflouridation-Reverse Osmosis- Solar stills- Freezing

UNIT-III

Collection and Conveyance of Water: Factors governing the selection of the intake

structure, Conveyance of Water: Gravity and Pressure conduits, Types of Pipes, Pipe Materials, Pipe joints, Design aspects of pipe lines, Design of economical diameter of pumping main, HP of pump and monthly expenditure for an apartment and a village. Laying and testing of pipe lines- Capacity of storage reservoirs, Mass curve analysis.

Distribution of Water: Methods of Distribution system, Layouts of Distribution networks, Water main appurtenances - Sluice valves, Pressure relief valves, air valves, check valves, hydrants, and water meters–Ideal water supply system. Case studies.

$\mathbf{UNIT} - \mathbf{IV}$

Sewerage: Estimation of sewage flow and storm water drainage – fluctuations – types of sewers - design of sewers.

Sewer appurtenances – cleaning and ventilation of sewers. Sewage pumps.

House Plumbing: Systems of plumbing-sanitary fittings and other accessories– one pipe and two pipe systems – Design of drainage in Gated communities, Apartments and Hotels.

Septic Tank - working Principles and Design

UNIT – V

Sewage characteristics – Characteristics of sewage - BOD equations. ThOD, COD and BOD.

Treatment of Sewage: Primary treatment. **Secondary treatment**: Activated Sludge Process, principles, designs, and operational problems. Oxidation ponds, Trickling Filters – classification – design, operation and maintenance problems. RBCs. Fluidized bed reactors –Anaerobic digestion of sludge, Sludge Drying Beds.

Ultimate Disposal of sewage: Methods of disposal – disposal into water bodies-Oxygen Sag Curve- Disposal into sea, disposal on land, Crown corrosion, Sewage sickness. Effluent standards.

Text Books

- 1. Environmental Engineering Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus Mc-Graw-Hill Book Company, New Delhi, 1985.
- 2. Rural Municipal and Industrial water management, KVSG Murali Karishna, Environmental Protection Society, Kakinada, 2021.
- 3. Industrial Water and Wastewater Management, K.V.S.G. Murali Krishna, Paramount Publications, Visakhapatnam, 2018.

4. Elements of Environmental Engineering – K. N. Duggal, S. Chand & Company Ltd., New Delhi, 2012.

References

- 1. Water Supply Engineering P. N. Modi.
- 2. Water Supply Engineering B. C. Punmia
- 3. Water Supply and Sanitary Engineering G. S. Birdie and J. S. Birdie
- 4. Environmental Engineering, D. Srinivasan, PHI Learning Private Limited, New Delhi, 2011.
- 5. Environmental Engineering, Ruth F. Weiner and Robin Matthews 4th Edition Elsevier, 2003
- 6. Environmental Engineering, D. Srinivasan, PHI Learning Private Limited, New Delhi, 2011.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2					2	1	2	1	1		1
CO 2	2			1		2	2		1			1
CO 3	2	1				2	2		1			1
CO 4	2				1	2	2		1			1
CO 5	2			1	3	1	1		1		1	1

Year & Sem	II Year – II Semester										
Course Code	22UCE18	L	Т	Р	SS	С					
Course Name	Surveying Field Work – II Lab	0	0	3	0	1.5					

List of Experiments

- 1. Theodolite Survey: Determining the Horizontal and Vertical Angles by the method of repetition method.
- 2. Theodolite Survey: Finding the distance between two inaccessible points.
- 3. Theodolite Survey: Finding the height of far object.
- 4. Tacheomatric Survey: Heights and distance problems using tacheo matric principles.
- 5. One Exercise on Curve setting.
- 6. One Exercise on contours.
- 7. Total Station: Introduction to total station and practicing setting up, levelling up and elimination of parallax error.
- 8. Total Station: Determination of area using total station.
- 9. Total Station: Traversing
- 10. Total Station: Contouring
- 11. Total Station: Determination of Remote height.
- 12. Total Station: distance between two inaccessible points.

At least 10 field work experiments must be completed
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Year & Sem	II Year – II Semester							
Course Code	22UCE19	L	Т	Р	SS	С		
Course Name	Fluid Mechanics And Hydraulic	0	0	3	0	1.5		
	Machinery Lab							

List of Experiments

- 1. Calibration of Venturi meter & Orifice meter
- 2. Determination of Coefficient of discharge for a small orifice and mouth piece by a constant head and variable head method.
- 3. Calibration of contracted Rectangular Notch and /or Triangular Notch
- 4. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
- 5. Verification of Bernoulli's equation.
- 6. Impact of jet on vanes
- 7. Study of Hydraulic jump.
- 8. Performance test on Pelton wheel turbine
- 9. Performance test on Francis turbine.
- 10. Efficiency test on centrifugal pump.
- 11. Efficiency test on reciprocating pump.

List of Equipment:

- 1. Venturi meter setup.
- 2. Orifice meter setup.
- 3. Small orifice setup.
- 4. External mouth piece setup.
- 5. Rectangular and Triangular notch setups.
- 6. Friction factor test setup.
- 7. Bernoulli's theorem setup.
- 8. Impact of jets.
- 9. Hydraulic jump test setup.
- 10. Pelton wheel, Francis turbine and Kalpan turbines
- 11. Centrifugal and Reciprocating pumps.

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Year & Sem	II Year – II Semester							
Course Code	22UCE20	L	Т	Р	SS	С		
Course Name	ENVIRONMENTAL	0	0	3	0	1.5		
	ENGINEERING LAB							

Course Learning Objectives:

The course will address the following:

• Estimation of important characteristics of water and wastewater in the laboratory

• Inference with reference to the significance of the characteristics of the water and wastewater

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

- Estimate some important characteristics of water, wastewater and soil in the laboratory
- Draw some conclusion and decide whether the water is suitable for Drinking/Construction /

Agriculture/ Industry.

• Estimate Chloride, EC and Salinity of Soiland suggest their suitability for Construction/Agriculture

• Estimation of the strength of the sewage in terms of BOD and COD and Decide whether the water

body is polluted or not with reference to the stated parameters in the list of experiments

• Demonstration of various instruments used in testing of water and soil and study of Drinking water standards, WHO guidelines, Effluent standards and standards for Construction/ Agriculture/ Industry.

List of Experiments

- 1. Determination of pH and Electrical Conductivity (Salinity) of Water and Soil.
- 2. Determination and estimation of Total Hardness–Calcium & Magnesium in water.
- 3. Determination of P&M Alkalinity/Acidity
- 4. Determination of Chloride in water and soil

5. Determination and Estimation of total solids, organic solids and inorganic solids and Settleable Solids

by Imhoff Cone.

- 6. Determination of Dissolved Oxygen with D.O. Meter & Wrinklers Method and BOD.
- 7. Physical parameters Temperature, Color, Odor, Turbidity and Taste.
- 8. Determination of C.O.D.
- 9. Determination of Optimum coagulant dose- with and without coagulant aids
- 10. Determination of Chlorine residue and demand
- 11. Presumptive Coliform test.
- 12. Desalination by Freezing and Boiling.
- 13. EC, TDs and Chloride in RO System- Raw water, Product water and Reject.
- 14. Suitability of water for construction
- 15. Evaporation, Rainfall, Humidity, Wind speed, Wind Direction

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NOTE: At-least 10 of the experiments enlisted are to be conducted.

Text Books

1. Standard Methods for Analysis of Water and Waste Water – APHA

2. Chemical Analysis of Water and Soil by KVSG Murali Krishna, Environmental Protection Society, 4th Edition, 2021.

References

- 1. Relevant IS Codes.
- 2. Chemistry for Environmental Engineering by Sawyer and Mc.Carty.