COURSE STRUCTURE (R20)
Civil Engineering (R20)

I - SEMESTER

S.No	Course Code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1	20FE01	Professional Communication-I	2	0	0	2	30	70	100
2	20FE03	Differential Equations	2	1	0	3	30	70	100
3	20FE05	Applied Chemistry	3	0	0	3	30	70	100
4	20CE01	Surveying	3	0	0	3	30	70	100
5	20CE02	Building Materials and Construction	3	0	0	3	30	70	100
Laboratory Courses									
6	20FE52	Applied Chemistry Lab	0	0	3	1.5	15	35	50
7	20CE52	Civil Engineering Drafting Techniques	0	0	3	1.5	15	35	50
8	20CE51	Surveying Lab	0	0	2	1	15	35	50
9	20ME51	Engineering Workshop	0	0	3	1.5	15	35	50
		Total	13	01	11	**19.5**	**210**	**490**	**700**

II - SEMESTER

S. No	Course Code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1	20FE02	Professional Communication -II	2	0	0	2	30	70	100
2	20FE04	Linear Algebra and Transformation Techniques	2	1	0	3	30	70	100
3	20FE08	Engineering Physics	2	1	0	3	30	70	100
4	20CS01	Programming for Problem Solving using C	3	0	0	3	30	70	100
5	20CE03	Applied Mechanics	2	1	0	3	30	70	100
6	20MC01	Constitution of India	2	0	0	0	30	70	100
Laboratory Courses									
7	20FE51	Professional Communication Skills Lab	0	0	2	1	15	35	50
8	20FE55	Engineering Physics Lab	0	0	3	1.5	15	35	50
9	20CS51	Programming for Problem Solving using C Lab	0	0	3	1.5	15	35	50
10	20ME54	Computer Aided Engineering Graphics	0	0	3	1.5	15	35	50
		Total	13	03	11	**19.5**	**240**	**560**	**800**

III SEMESTER

S. No	Course code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1	20FE10	Numerical Methods and Integral Calculus	2	1	0	3	30	70	100
2	20CE05	Mechanics of Fluids	3	0	0	3	30	70	100
3	20CE06	Solid Mechanics	3	0	0	3	30	70	100
4	20CE07	Concrete Technology	3	0	0	3	30	70	100
5	20CE08	Engineering Geology	3	0	0	3	30	70	100
6	20MC02	Environmental Science	2	0	0	0	30	70	100
Laboratory Courses									
7	20CE54	Solid Mechanics Lab	0	0	3	1.5	15	35	50
8	20CE55	Building Materials and Concrete Technology Lab	0	0	3	1.5	15	35	50
9	20CE56	Engineering Geology Lab	0	0	3	1.5	15	35	50
10	20ITS1	Problem Solving Using Python	1	0	2	2		50	50
Total			17	1	11	21.5	225	575	800

IV SEMESTER

S. No	Course code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1	20FE09	Probability and Statistics	3	0	0	3	30	70	100
2	20CE09	Hydraulics and Hydraulic Machinery Systems	3	0	0	3	30	70	100
3	20CE10	Geo Technical Engineering	3	0	0	3	30	70	100
4	20CE11	Structural Analysis	3	0	0	3	30	70	100
5	20HS01	Universal Human values 2: Understanding Harmony	3	0	0	3	30	70	100
Laboratory Courses									
6	20CE57	Hydraulics and Hydraulic Machinery Lab	0	0	3	1.5	15	35	50
7	20CE58	Geo Technical Engineering Lab	0	0	3	1.5	15	35	50
8	20CE59	Advanced Surveying Lab	0	0	3	1.5	15	35	50
9	20CES1	Problem Solving using MAT Lab	1	0	2	2		50	50
Total			16	0	11	21.5	195	505	700
Honors/Minor Courses						4			

V - SEMESTER

S.No	Course Code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1	20CE12	Design of Reinforced Concrete Structures	2	1	0	3	30	70	100
2	20CE13	Hydrology and Water Resources Engineering	3	0	0	3	30	70	100
3	20CE14	Environmental Engineering	2	1	0	3	30	70	100
4		**PROGRAM ELECTIVE – I**	3	0	0	3	30	70	100
	20CE15	Remote Sensing and Geographical Information Systems							
	20CE16	Town Planning and Architecture							
	20CE17	Safety Engineering							
5		**OPEN ELECTIVE – I**	3	0	0	3	30	70	100
Laboratory Courses									
6	20CE60	Environmental Engineering Lab	0	0	3	1.5	15	35	50
7	20CE61	GIS and Computer Applications Lab	0	0	3	1.5	15	35	50
8	20CES2	Computer Aided Building Drawing Lab	1	0	2	2	-	50	50
9	20PI01	Summer Internship	-	-	-	1.5	-	50	50
		TOTAL	**14**	**2**	**8**	**21.5**	**180**	**520**	**700**

VI - SEMESTER

S.No	Course Code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1	20CE18	Highway Engineering	3	0	0	3	30	70	100
2	20CE19	Design of Steel Structures	2	1	0	3	30	70	100
3	20CE20	Estimation and Quantity Surveying	2	1	0	3	30	70	100
4		**PROGRAM ELECTIVE – II**	3	0	0	3	30	70	100
	20CE21	Advanced Design of Reinforced Concrete Structures							
	20CE22	Construction Management							
	20CE23	Low-Cost Eco-Friendly Building Techniques							
5		**OPEN ELECTIVE – II**	3	0	0	3	30	70	100
Laboratory Courses									
6	20CE62	Quantity Estimation and Project Management Lab	0	0	3	1.5	15	35	50
7	20CE63	Highway Engineering Lab	0	0	3	1.5	15	35	50
8	20CE64	Computer Aided Analysis and Design Lab	0	0	3	1.5	15	35	50
9	20HSS1	Soft Skills Course	1	-	2	2	-	50	50
		TOTAL	14	02	11	21.5	195	505	700
Honors/Minor Courses			3	1	0	4	30	70	100

VII - SEMESTER

S.No	Course Code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1		**PROGRAM ELECTIVE - III**	3	0	0	3	30	70	100
	20CE24	Pre-Stressed Concrete							
	20CE25	Environmental Pollution Control							
	20CE26	Building Services							
2		**PROGRAM ELECTIVE - IV**	3	0	0	3	30	70	100
	20CE27	Watershed Management							
	20CE28	Railways and Airport Engineering							
	20CE29	Green Buildings							
3		**PROGRAM ELECTIVE - V**	3	0	0	3	30	70	100
	20CE30	Repair and Rehabilitation of Structures							
	20CE31	Environmental Hydraulics and Advanced Water Treatment							
	20CE32	Foundation Engineering							
4		**OPEN ELECTIVE– III**	3	0	0	3	30	70	100
5		**OPEN ELECTIVE– IV**	3	0	0	3	30	70	100
6	20HS02	Management Science for Engineers	3	0	0	3	30	70	100
Laboratory Courses									
7	20PI02	Industrial / Research Internship	-	-	-	3	-	50	50
8	20CES3	IOT Applications in Civil Engineering	1	0	2	2	-	50	50
		TOTAL	**19**	**0**	**2**	**23**	**180**	**520**	**700**
		Honors/Minor Courses	3	1	0	4	30	70	100

VIII - SEMESTER

S.No	Course Code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Laboratory Courses									
1	20PI03	Project Work	0	0	24	12	60	140	200

OPEN ELECTIVES

Course Code	Course Name	Offered to the branches
20AD81	Introduction to Artificial Intelligence	ASE, CE, ECE, EEE, & ME
20AD82	Introduction to Data Science	ASE, CE, ECE, EEE, & ME
20AD83	Introduction to Machine Learning	ASE, CE, ECE, EEE, & ME
20AD84	Fundamentals of Deep Learning	ASE, CE, ECE, EEE, & ME
20AE81	Principles of Flight	AI&DS, CE, CSE, CSE(AI&ML), ECE, EEE, IT & ME
20AE82	Space Science	AI&DS, CE, CSE, CSE(AI&ML), ECE, EEE, IT & ME
20AE83	Aircraft Systems	AI&DS, CE, CSE, CSE(AI&ML), ECE, EEE, IT & ME
20AE84	Air Transportation Systems	AI&DS, CE, CSE, CSE(AI&ML), ECE, EEE, IT & ME
20CE81	Basics of Civil Engineering	AI&DS, ASE, CSE, CSE(AI&ML), ECE, EEE, IT & ME
20CE82	Disaster Management	AI&DS, ASE, CSE, CSE(AI&ML), ECE, EEE, IT & ME
20CE83	Fundamentals of Geospatial Technologies	AI&DS, ASE, CSE, CSE(AI&ML), ECE, EEE, IT & ME
20CE84	Environmental Sanitation	AI&DS, ASE, CSE, CSE(AI&ML), ECE, EEE, IT & ME
20CS81	Unix and Shell Programming	ASE, CE, ECE, EEE, & ME
20CS82	Introduction to Algorithm Techniques	ASE, CE, ECE, EEE, & ME
20CS83	Principles of Computer Architecture	ASE, CE, ECE, EEE, & ME
20CS84	PHP Programming	ASE, CE, ECE, EEE, & ME
20CS85	Object Oriented Software Engineering	ASE, CE, ECE, EEE, & ME
20EC81	Satellite Technology	AI&DS, ASE, CE, CSE, CSE(AI&ML), EEE, IT & ME
20EC82	Elements of Communication Systems	AI&DS, ASE, CE, CSE, CSE(AI&ML), EEE, IT & ME
20EC83	Microprocessors and Interfacing	AI&DS, ASE, CE, CSE, CSE(AI&ML), EEE, IT & ME
20EC84	Analog and Digital Communications	AI&DS, ASE, CE, CSE, CSE(AI&ML), EEE, IT & ME
20EC85	Systems and Signal Processing	AI&DS, ASE, CE, CSE, CSE(AI&ML), EEE, IT & ME
20EC86	Cellular Technology	AI&DS, ASE, CE, CSE, CSE(AI&ML), EEE, IT & ME

OPEN ELECTIVES

Course Code	Course Name	Offered to the branches
20EE81	Linear Control Systems	AI&DS, ASE, CE, CSE, CSE(AI&ML), ECE, IT & ME
20EE82	Basics of Electrical Measurements	AI&DS, ASE, CE, CSE, CSE(AI&ML), ECE, IT & ME
20EE83	Utilization of Electrical Energy	AI&DS, ASE, CE, CSE, CSE(AI&ML), ECE, IT & ME
20EE84	Electric Vehicles	AI&DS, ASE, CE, CSE, CSE(AI&ML), ECE, IT & ME
20IT81	OOP through JAVA	ASE, CE, ECE, EEE, & ME
20IT82	Web Technologies using PHP	ASE, CE, ECE, EEE, & ME
20IT83	Mobile Application Development	ASE, CE, ECE, EEE, & ME
20IT84	Cyber Security & Digital Forensics	ASE, CE, ECE, EEE, & ME
20ME81	Renewable Energy Sources	AI&DS, CE, CSE, CSE(AI&ML), ECE, EEE & IT
20ME82	Robotics in Automation	AI&DS, CE, CSE, CSE(AI&ML), ECE, EEE & IT
20ME83	Operations Research Techniques	AI&DS, CE, CSE, CSE(AI&ML), ECE, EEE & IT
20ME84	Elements of Automobile Engineering	AI&DS, CE, CSE, CSE(AI&ML), ECE, EEE & IT

	L	T	P	Cr.
B.Tech. (I Sem.)　**20FE01 - PROFESSIONAL COMMUNICATION-I**	2	0	0	2

Pre-requisites: Nil

Course Educational Objectives: To improve English language proficiency of the students in various aspects like vocabulary, grammar, communication skills, listening skills, reading & writing skills.

Course Outcomes: At the end of the course, the student will be able to

CO1 : Write sentences and paragraphs using proper grammatical structures and word forms (**Remember – L1**)

CO2 : Comprehend the given text by employing suitable strategies for skimming and scanning and draw inferences (**Understand – L2**)

CO3 : Write summaries of reading texts using correct tense forms & appropriate structures (**Remember – L1**)

CO4 : Write Formal Letters, Memos & E-Mails (**Apply – L3**)

CO5 : Edit the sentences/short texts by identifying basic errors of grammar/vocabulary/syntax (**Understand – L2**)

Unit - I
Exploration - 'A Proposal to Girdle the Earth – Nellie Bly'; Reading: Skimming for main idea; Scanning for specific information; Grammar & Vocabulary: Content Words; Function Words; Word Forms: verbs, nouns, adjectives and adverbs; Nouns: Countable and Uncountable, Singular and Plural forms; Wh - Questions; Word Order in Sentences; Writing: Paragraph Analysis; Paragraph Writing; Punctuation and Capital Letters

Unit – II
On Campus- 'The District School as it Was by One Who Went to it – Warren Burton'; Reading: Identifying Sequence of Ideas; Grammar & Vocabulary: Cohesive Devices: Linkers/Signposts/Transition signals, Synonyms, Meanings of Words/Phrases in the context; Writing: Memo Drafting.

Unit – III
Working Together-'The Future of Work'
Reading: Making basic inferences; Strategies to use text clues for comprehension; Summarizing; Grammar & Vocabulary: Verbs: Tenses; Reporting Verbs for Academic Purpose; Writing**:** Rephrasing what is read; Avoiding redundancies and repetitions; Abstract Writing/ Summarizing.

Unit – IV
'A.P.J.Abdul Kalam'; Grammar & Vocabulary: Direct & Indirect Speech; Articles and their Omission; Writing: E-Mail Drafting.

Unit – V
'C.V.Raman'; Grammar & Vocabulary: Subject-Verb Agreement; Prepositions; Writing: Formal Letter Writing.

Text Books:
1. Prabhavati. Y & et al, "English All Round – Communication Skills for Undergraduate Learners", Orient BlackSwan, Hyderabad, 2019.
2. "Panorama – A Course on Reading", A collection of prose selections, Oxford University Press, New Delhi, 2016.

Reference Books:
1. Swan, M., "Practical English Usage", Oxford University Press, 2016.
2. Kumar,S and Latha, P, "Communication Skills", Oxford University Press, 2018.
3. Rizvi Ashraf M., "Effective Technical Communication", Tata Mc Graw Hill, New Delhi, 2008.
4. Baradwaj Kumkum, "Professional Communication", I.K. International Publishing House Pvt. Ltd., New Delhi, 2008.
5. Wood, F.T., "Remedial English Grammar", Macmillan, 2007.

L	T	P	Cr.
2	1	0	3

B.Tech. (I Sem.)   **20FE03 - DIFFERENTIAL EQUATIONS**

Pre-requisites: Nil

Course Educational Objective: The objective of this course is to introduce the first order and higher order differential equations, functions of several variables. The students also learn solving of first order partial differential equations.

Course Outcomes: At the end of this course, the student will be able to

CO1: Apply first order and first-degree differential equations to find orthogonal trajectories (**Apply – L3**)

CO2: Distinguish between the structure and methodology of solving higher order differential equations with constant coefficients (**Understand – L2**)

CO3: Apply various Numerical methods to solve initial value problem (**Apply – L3**)

CO4: Generate the infinite series for continuous functions and investigate the functional Dependence (**Understand – L2**)

CO5: Solve partial differential equations using Lagrange's method (**Apply – L3**)

UNIT –I

Differential Equations of First Order and First Degree

Differential equations of first order and first degree –Exact and Non Exact differential Equations, Applications of differential equations – Orthogonal Trajectories.

UNIT –II
Linear Differential Equations of Higher Order
Homogeneous and Non-Homogeneous Linear differential equations of second and higher order with constant coefficients with R.H.S. functions e^{ax}, sin $(ax+b)$, cos $(ax+b)$, x^m, $e^{ax}V(x)$, $xV(x)$, Method of variation of parameters.

UNIT – III
Numerical solution of Ordinary Differential Equations
Numerical solution of Ordinary Differential equations, Solution by Taylor's series - Picard's Method of successive approximations.
Euler's Method - Runge- Kutta Methods.

UNIT –IV
Functions of several variables
Generalized Mean Value Theorem (without proof), Maclaurin's series, Functions of several variables, Jacobians (Cartesian and polar coordinates), Functional dependence. Maxima and Minima of function with two variables.

UNIT – V
Partial Differential Equations

Formation ofPartial Differential Equations by elimination of arbitrary constants and arbitrary functions.Solution of first order and first degree linear partial differential equation – Lagrange's method.

Text Books:

1. B.S. Grewal, "*Higher Engineering Mathematics*", 42ndEdition, Khanna Publishers, New Delhi, 2012.

2. B. V. Ramana, "*Higher Engineering Mathematics*", 1stEdition, TMH Publications, New Delhi, 2010

Reference Books:

1.   M. D. Greenberg, "*Advanced Engineering Mathematics*", 2nd Edition, TMH Publications, New Delhi, 2011.

2.   Erwin Kreyszig, *"Advanced Engineering Mathematics"*, 8th Edition, John Wiley & sons, New Delhi, 2011.

3.   W.E. Boyce and R. C. Diprima, " *Elementary Differential Equations"*, 7th Edition, John Wiley & sons, New Delhi, 2011.

4.   S. S. Sastry, *"Introductory Methods of Numerical Analysis",* 5th Edition, PHI Learning Private Limited, New Delhi, 2012.

L	T	P	Cr.
3	0	0	3

B.Tech. (I Sem.)   **20FE05 - APPLIED CHEMISTRY**

Pre-requisites: Nil

Course Educational Objective: It enables the students to understand the fundamental concepts of chemistry and to provide them with the knowledge of industrial problems and finding the solutions. It helps to strengthen the basic concepts of water, fuel technologies, electrochemistry, corrosion and advanced materials used in technologies.

Course Outcomes: At the end of the course, student will be able to:

CO1: Identify the troubles due to hardness of water and its maintenance in industrial applications. (**Understand - L2**)

CO2: Understand the issues related to conventional fuels, biofuels and photo-voltaic cells in energy production. (**Understand - L2**)

CO3: Apply Nernst Equation for calculating electrode cell potentials and compare batteries for different applications. (**Apply - L3**)

CO4: Apply principles of corrosion for design and effective maintenance of various equipment. (**Apply - L3**)

CO5: Analyse the suitability of engineering materials like polymers, lubricants, nano materials and composites in technological applications. (**Understand – L2**)

UNIT – I
WATER TECHNOLOGY
Sources of water and quality; Hardness of Water - Temporary and permanent hardness, units and their inter relation, problems on hardness and disadvantages of hard water in industries. Boiler troubles - Reasons, disadvantages and methods of prevention for Scale and sludge formation, caustic embrittlement, boiler corrosion and carry over (priming and foaming), W.H.O standards of potable water; Water softening: Ion- Exchange Process, merits and demerits; Desalination of brackish water - Electro dialysis and reverse osmosis; Treatment of industrial waste water.

UNIT – II
FUEL TECHNOLOGY
Classification of fuels (solid, liquid and gaseous fuels, merits and demerits) and characteristics of a good fuel; Calorific value -Definition, gross and net calorific values (definition only).Solid fuels - Coal – origin, proximate analysis of coal and significance; Liquid Fuels - Petroleum-origin, types of crude oil and refining of petroleum. Cracking - moving bed catalytic cracking and synthetic petrol –Fischer Tropsch's process; Gaseous fuels - Natural gas composition and C.N.G - advantages.Bio fuels - Characteristics of bio fuels, sources of bio mass and advantages -Production of biodiesel from rape seed oil; Photo-voltaic Cell - Design, working, schematic diagram, advantages and disadvantages.

UNIT – III
ELECTRO CHEMISTRY & BATTERIES
Types of Electrodes - Calomel Electrode, Glass Electrode, Calculation of EMF of Cell, Applications of Nernst Equation, Applications of Electro chemical Series
Batteries -Lead-acid Battery, Lithium ion Battery, H_2– O_2 Fuel Cell, Mg-Cu reserve battery.

UNIT – IV
SCIENCE OF CORROSION
Dry Corrosion (Direct Chemical corrosion) - Types of dry corrosion-oxidative corrosion, Pilling Bed worth rule, corrosion by other gases and liquid metal corrosion; Wet Corrosion (Electro Chemical corrosion) - Mechanism- oxygen absorption, hydrogen evolution, types of wet corrosion, Galvanic Corrosion, Concentration Cell Corrosion, passivity and Galvanic series; Factors Influencing Corrosion -Nature of metal (purity, position in galvanic series, relative area of cathode & anode, nature of surface film) and nature of environment (temperature, humidity, atmospheric pollution and nature of ions in the medium); Control of Corrosion - Cathodic Protection - Sacrificial anode and impressed current methods, electro plating and metal cladding.

UNIT – V
CHEMISTRY OF ENGINEERING MATERIALS
Polymers - Differences between thermoplasts and thermosets, Types of polymerization with examples, Preparation properties and engineering applications of PVC, Teflon, BUNA-S and Polyurethane;
Lubricants -Characteristics of a good lubricant and properties of lubricants (viscosity, flash and fire points, cloud and pour points, aniline point) and applications.
Nano Materials -Introduction, definition, extraordinary changes observed at nano size of materials and reasons, types of nano-materials, Gas-Phase Synthesis of nanomaterials, Applications;
Composites -Advantageous characteristics of Composites, Constituents, Fibre reinforced composites (GFRP, CFRP), Reasons for failure of composites.

TEXT BOOKS:
1. Shashi Chawla, "A Text book of Engineering Chemistry", Dhanpat Rai Publishing Company, New Delhi, 3rd Edition, 2003.
2. Jain, Jain, "A Text book of Engineering Chemistry", Dhanpat Rai Publishing Company, New Delhi, 16th Edition, 2015.

REFERENCE:
1. Shikha Agarwal, "A text book of Engineering Chemistry", Cambridge University Press, New Delhi, 1st Edition, 2015.
2. S.S. Dara, S.S. Umare, "A Text book of Engineering Chemistry", S. Chand Publications, New Delhi, 12th Edition, 2010.
3. Y. BharathiKumari, Jyotsna Cherukuri, "A Text book of Engineering Chemistry", VGS Publications, Vijayawada, 1st Edition, 2009.

L	T	P	Cr.
3	0	0	3

B.Tech. (I Sem.)   **20CE01 - SURVEYING**

Pre-requisites: NIL

Course Educational Objective:
The course aims to teach the basic principles of surveying and various methods for measuring linear and angular measurements. The coverage of the course enables the students to differentiate the available surveying equipments suitable for a specific purpose.

Course Out comes: At the end of the course, the student will be able to:
CO1: Understand the basic principles involved in linear and angular measurements, functioning of total station, levelling measurements and characteristic properties of simple curves. (**Understand-L2**)
CO2: Develop the longitudinal, lateral and contour profiles of a given area using fundamental principles of levelling. (**Understand-L2**)
CO3: Calculate the area and volume of required boundaries. (**Apply-L3**)
CO4: Determine the distance and elevations of an object using tacheometer and EDM principles. (**Apply-L3**)
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UNIT-I
Introduction: Definition-Uses of Surveying- - Overview of Plane Surveying (Chain, Compass and Plane Table), Objectives, Principles and Classifications.
Linear and Angular Measurements: Linear Measurements Using Tape and Chain-– Errors and their adjustment-corrections. Compass Survey - Bearings, Local Attraction and Computation of angle.

UNIT - II
Leveling: Concept and Terminology, Temporary and Permanent Adjustments – Rise-fall method and HI method- Reciprocal Levelling.
Contouring: Characteristics and Uses of Contours- purpose and methods of Conducting Contour Surveys and their Plotting.

UNIT - III
Areas and Volumes:
Area from Field notes, Computation of Areas along Irregular boundaries and area consisting of regular boundaries by using Simpson's rule-trapezoidal rule- Mid ordinate & Average ordinate rule. Computation of volume using trapezoidal rule and prismoidal rule for roadwork and canal work.

UNIT - IV
Theodolite: Theodolite, Description, Uses and Adjustments – Temporary and Permanent, Measurement of Horizontal and Vertical Angles.
Traversing - Purpose-Types of Traverse-Traverse Computation - Traverse Adjustments -
Tacheometric Surveying: Stadia and Tangential Methods of Tachometry. Distance and Elevation Formulae for Staff Vertical Position.

UNIT - V
Simple Curves and Total Station: Introduction- Types of curves-applications- Elements of a simple circular curve; Degree of curve- Relationship between radius and degree of curve;

Calculation of various elements of Simple curve- Simple problems-Introduction to Total Station- applications and advantages- Introduction to Global Positioning System- applications.

TEXT BOOKS
1. R. Agor "A Text Book of Surveying and Leveling", Khanna Publishers, New Delhi, 1998.
2. Punmia B.C., "Surveying Vol I and II", Laxmi Publications 9th, 10th Edition, 1987.

REFERENCES:
1. R.Subramanya "Surveying and Leveling"- Oxford Publication
2. Arora K R, "Surveying Vol 1, 2 & 3", Standard Book House, Delhi, 2004
3. N.N Basak, "Surveying and Leveling", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1994.
4. Kanetkar T.P and S.V. Kulkarni, "Surveying and Leveling- Part I and II", VidyarthiPrakasan, Pune, 1997.

	L	T	P	Cr.
B.Tech. (I Sem.) **20CE02 - BUILDING MATERIALS AND CONSTRUCTION**	3	0	0	3

Pre-requisites: NIL

Course Educational Objective: This course aims to provide study of the properties, making and applications of basic civil engineering materials such as stones, bricks, lime, cement and wood. The course also provides an insight into the different types masonry work used in construction practice, various building components and building finishing activities.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand the preparation process and the composition of construction materials such as Stones, bricks and timber. (**Understand-L2**)

CO2: Describe the sources, constituents and storage of lime and cement for their appropriate usage as building materials based on their specific attributes. (**Understand-L2**)

CO3: Identify the different components in a building and their specific purpose in the building. (**Remember-L1**)

CO4: Classify the various types of mortars, masonry components and finishings used in the buildings. (**Understand-L2**)

CO5: Identify the uses, good and faulty characteristics of different building materials. (**Remember-L1**)

UNIT-I: STONES & BRICKS

Introduction- Classification of rocks: Characteristic of good building stone-Dressing of stones-common building stones, their properties- compositions- uses.

Bricks: Composition of brick, constituents of brick earth- manufacturing process of bricks, characteristics of good building bricks, classification of bricks- Fly ash bricks, hollow bricks – uses.

UNIT-II: LIME AND CEMENT:

Lime -Introduction-lime stone- limestone cycle-sources of lime-properties of lime-uses – constituent of lime-classification of lime-precaution in handling of lime-storage of lime.

Cement-Introduction –classification-properties of cements- comparison between cement and lime-constituents of cement-functions of ingredients of cement-out line of manufacture of Portland cement- field tests for cement -types and uses of cements-storage of cements.

UNIT-III: MORTAR AND MASONRY

Introduction- classification of mortars-characteristics of good mortar-Types of mortars - Preparation of mortar-Uses-Precautions in the uses of mortars. Types of masonry-joints in stone masonry, different bonds in bricks-tools for brick laying- English and Flemish bonds-defects in brick masonry- importance of Cavity and Partition walls.

UNIT-IV: BUILDING COMPONENTS:

Components of a building – Substructure and superstructure-Importance of foundation-functions of foundations-requirements of good foundations - different types of foundations –Purposes of foundation. Basic details of Lintels, Arches, walls, stair cases - types of floors - types of roofs -

UNIT-V: TIMBER AND FINISHINGS IN BUILDINGS:

Classification of timber trees, cross section of exogenous tree, seasoning of timber, important types of timber and their uses, plywood and its uses.

Paints: Functions of paints-types of paints - constituents of paints - characteristics of good paint-General precautions-defects in painting.

Damp proofing: Introduction-effects of dampness- methods of damp proofing –material used for D.P.C and treatment in buildings.

TEXT BOOKS

1. Rangwala "Engineering Materials (Material science)" Charotar Publishing House Pvt. ltd., Edition-2012
2. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain-"Building Construction"- Laxmi Publications (P) Ltd.

REFERENCES

1. S.K. Duggal "Building Materials"- - New age International Publisher, Fourth edition-2012
2. R.K. Rajput "Engineering Materials (Including construction materials)"-, S.Chand Publications.
3. P.C Varghese "Building Construction" Prentice-Hall of India Private Ltd.

L	T	P	Cr.
0	0	3	1.5

B.Tech. (I Sem.)　　　　**20FE52 - APPLIED CHEMISTRY LAB**

Pre-requisites: Nil

Course Educational Objectives:
This course enables thestudents to analyze water samples and perform different types of volumetric titrations. It provides them with an overview of preparation of polymers and properties of fuels.

Course Outcomes: At the end of the course, the students will be able to
CO1: Assess quality of water based on the procedures given.(**Understand-L2**)
CO2: Distinguish different types of titrations in volumetric analysis after performing the experiments listed in the syllabus.(**Understand-L2**)
CO3: Acquire practical knowledge related to preparation of polymers.(**Understand-L2**)
CO4: Exhibit skills in performing experiments based on theoretical fundamentals. (**Apply-L3**)

List of Experiments
(Any of the 10 experiments are required to be conducted)

Model Experiment
1) Determination of amount of Na_2CO_3 using standard HCl solution.

Water Analysis
2) Determination of alkalinity of water sample**.**
3) Determination of total Hardness of water by EDTA method.
4) Determination of permanent hardness of water by EDTA method.

Preparation of Polymers
5) Nylon Fibers
6) Bakelite

Redox Titrations
7) Estimation of Mohr's salt by using potassium permanganate.
8) Estimation of Mohr's salt by using potassium dichromate.
9) Determination of Copper(II) using standard hypo solution.

Demonstration Experiments
10) Determination of pH of the given sample solution/ soil using pH meter.
11) Determination of Turbidity of the given sample water.

Estimations
12) Determination of ferrous content in the given sample of iron ore against potassium dichromate using potassium ferricyanide as external indicator.
13) Determination of Iron(III) by colorimetric method.

Fuels
14) Determination of flash and fire points of a given fuel/lubricant.

REFERENCES
　　Lab manual

	L	T	P	Cr.
B.Tech. (I Sem.) · **20CE52 - CIVIL ENGINEERING DRAFTING TECHNIQUES**	0	0	3	1.5

Pre-requisites: Nil

Course Educational Objective:
The course aims to teach fundamental free hand civil engineering drafting techniques using conventional drawing tools. The student is asked to develop and draw simple geometrical constructions used in engineering drawing. The student is then exposed to ArchiCAD fundamentals and is asked to develop and draw few civil engineering elements.

Course Outcomes: At the end of the course, the student will be able to-
CO1: Draw simple objects based on principles of geometry.(**Understand-L2**)
CO2: Sketch the projections of anobject based on the angles of projection. (**Understand-L2**)
CO3: Draft simple objects using ArchiCAD software. (**Understand-L2**)

List of Experiments

Part A: BASIC PRINCIPLES OF ENGINEERING DRAFTING

1. Fundamentals: Basic tools and instruments used in conventional drawing.
2.Geometrical construction: Bisection of a line, draw perpendiculars of line, draw parallel lines, divide a line, divide a circle, bisect an angle, trisecting an angle, finding center of an arc, constructing equilateral triangles, polygons, polygons inscribed in circles, draw tangents, length of arcs, circle and lines in contact, inscribed circles.
3. Curves and projections in engineering practice: Ellipse, Parabola.Projections:First and third angle projections, front view, top view, side view of some simple objects

Part B: ARCHICAD FUNDAMENTALS

1. Introduction to ArchiCAD
2. Basic tools (document tools)-line, circle, poly line, dimensional tools, text, fill, etc.
3. Design tools-wall, window, column, beam, slab, stair, roof, sheet, etc.
4. Drawing some simple objects

REFERENCES
1. N.D. Bhatt. "Engineering Drawing", Charotar Publications, 53rdedition, 2014.
2. Lecture material prepared by department faculty.
3. Video material based on topics covered.

L	T	P	Cr.
0	0	2	1

B.Tech. (I Sem.)   **20CE51 - SURVEYING LAB**

Pre-requisites: Surveying

Course Educational Objective:
The course teaches the basic principles of surveying, various methods of linear and angular measuring instruments through hands-on practice sessions and enable the students to use surveying equipments.

Course Outcomes: At the end of the course, the student will be able to-
CO1: Compute linear and angular measurements in the field using chain and compass.
        (**Remember-L1**)
CO2: Plot a given area using plane table in the field. (**Understand-L2**)
CO3: Determine the elevations of different points on the ground using principles of leveling.
        (**Apply-L3**)

List of Experiments
(Any of the 10 experiments are required to be conducted)

CHAIN SURVEYING
1. Chaining of a line using chain/Tape and recording of details along the chain line.
2. Measurement of a given area using Cross staff survey.
3. Determination of Obstacle length.

COMPASS SURVEYING
4. To perform compass traversing and calculate the errors in balancing the traverse.
5. To measure the distance between two inaccessible points.

PLANE TABLE SURVEYING
6. Radiation method of plane table survey.
7. Intersection method of plane table survey.

LEVELING
8. Determination of elevations of given points using Rise and fall Method & HI method.
9. Determination of elevation difference between two points using Reciprocal levelling method.
10. Determination of elevations and plotting of longitudinal Sectioning and Cross Section of a given area.
11. Plotting the contours of a given area using method of blocks.

Text Book/Reference Books:
Laboratory Manual prepared by Civil Engineering Department.

L	T	P	Cr.
0	0	3	1.5

B.Tech. (I Sem.)   **20ME51 - ENGINEERING WORKSHOP**

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVE:

The objective of this course is to get familiarized with various trades used in Engineering Workshop and learn the safety precautions to be followed in the workshops while working with the different tools.

COURSE OUTCOMES: After completion of the course students will be able to:

CO1: Develop different prototypes in the carpentry section. (**Understand - L2**)
CO2: Fabricate various basic prototypes in fitting trade. (**Understand - L2**)
CO3: Demonstrate various operations related to plumbing, tinsmithy and black smithy. (**Understand - L2**)
CO4: Perform various basic house wiring techniques. (**Apply - L3**)
(Conduct at least 4 Trades with 2 exercises from each Trade and demonstrate about 2 Trades)

Trade –1: CARPENTRY SHOP

Introduction to various types of wood such as Teak, Sal, Oak, Beach, Neam, Wallnut Mango, Shisham, Deodar, Babul. demonstration, function and use of carpentry hand-tools and their safety precautions. Introduction to various types of wooden joints, their relative advantages and uses.

Job I - Marking, sawing, plaining and chiselling operations.

Job II - Preparation of half lap-joint

Job III – Preparation of Mortise and Tenon Joint

Trade –2: FITTING SHOP

 Introduction to fitting shop tools, common materials used in fitting shop, description, demonstration, care, use of tools and safety precautions.

Job I- Making a L-Fit from a rectangular piece of Mild Steel Flat (MS).

Job II-Making a T-Fit from a rectangular piece of MS Flat.

 Job III-Making a V-Fit from a rectangular piece of MS Flat

Job IV-Making a Half round fit from a rectangular piece of MS flat.

Trade -3: TIN- SMITHY SHOP

Introduction to tin-smithy, specification and use of hand tools, accessories and the safety precautions.

Job I -   Preparation of a rectangular tray using GI sheet.

Job II-   Preparation of an open scoop/ funnel using GI sheet.

Job III - Preparation of a Single Seam Joint and Double Seam Joint using GI sheet.

Job IV - Preparation of a Corner Seam Joint using GI sheet.

Trade –4: PLUMBING SHOP

Introduction to plumbing – demonstration, use of hand tools, accessories and safety precautions.

Job I – preparation of pipe layout.

Job II – Pipe threading.

Trade -5: BLACK SMITHY

Introduction–demonstration of tools, equipment, and safety precautions.

Job I – Preparation of S–Hook.

Job II – Preparation of Chisel

Trade -6: HOUSE WIRING

Demonstration and identification of common electrical materials such as wires, cables, switches, fuses, PVC Conduits. Study of electrical safety measures and demonstration about use of protective devices such as fuses, and relays including earthling.

Job I – One lamp controlled by one-way switch.

Job II – Two lamps in series and parallel connection with one-way switch.

Job III- Florescent lamp and calling bell circuit.

Job IV - One lamp connection with two 2- way switches (stair case connection).

Job V -- House wiring circuit.

REFERENCES

1. LBRCE Workshop Lab Manual.
2. S.K.HajraChoudary and A.K.Choudary, ‒Workshop Technology-I‖, MediaPromotersand Publishers Pvt.Ltd., Mumbai,2012.
3. B.S.Raghuvamsi, ‒Workshop Technology-I‖, Dhanpatrai and Company, New Delhi, 2014.
4. P.Kannaiah, K.L.Narayana, ‒Workshop Mnaual,ScitechPublicationsIndiaPvt.Ltd, 2015.

	L	T	P	Cr.
B.Tech. (II Sem.) **20FE02 - PROFESSIONAL COMMUNICATION-II**	2	0	0	2

Pre-requisites: Nil

Course Educational Objective: To improve English language proficiency of the students in various aspects like vocabulary, grammar, communication skills, listening skills, reading & writing skills.

Course Outcomes: At the end of the course, the student will be able to
- **CO1:** Produce a coherent paragraph interpreting a figure/graph/chart/table (**Understand – L2**)
- **CO2:** Comprehend the given texts thoroughly by guessing the meanings of the words contextually (**Understand – L2**)
- **CO3:** Use language appropriately fordescribing /comparing/contrasting/givingdirections & suggestions (**Remember – L1**)
- **CO4:** Write formal/informal dialogues with an understanding of verbal/non-verbal features of communication. (**Understand – L2**)
- **CO5:** Write well structured essays; Reports &Résumé (**Apply – L3**)

UNIT - I
Fabric of Change- 'H.G. Wells and the Uncertainties of Progress – Peter J. Bowler'; Reading: Studying the use of Graphic elements in texts; Grammar & Vocabulary**:** Quantifying Expressions; Adjectives and adverbs; Comparing and Contrasting; Degrees of Comparison;
Writing: Information Transfer

UNIT - II
Tools for Life - 'Leaves from the Mental Portfolio of a Eurasian – Sui Sin Far'; Reading: Global Comprehension; Detailed Comprehension; Grammar & Vocabulary**:** Active & Passive Voice; Idioms & Phrases; Writing: Structured Essays using suitable claims and evidences

UNIT - III
'Homi Jahangir Bhabha';
Grammar & Vocabulary: Words often confused; Common Errors; Writing**:** Incident & Investigation Reports

UNIT - IV
'Jagadish Chandra Bose'; Grammar & Vocabulary: Use of Antonyms; Correction of Sentences; Writing**:** Dialogue Writing

UNIT - V
'**Prafulla Chandra Ray'**; Grammar & Vocabulary: Analogy; Sentence Completion; Writing**:** Writing a Résumé

TEXT BOOKS:

1. Prabhavati. Y & et al, "English All Round – Communication Skills for Undergraduate Learners", Orient Black Swan, Hyderabad, 2019.
2. "The Great Indian Scientists" published by Cengage Learning India Pvt. Ltd., Delhi, 2017

REFERENCE BOOKS:

1. Swan, M., "Practical English Usage", Oxford University Press, 2016.
2. Kumar,S and Latha, P, "Communication Skills", Oxford University Press, 2018.
3. Rizvi Ashraf M., "Effective Technical Communication", Tata Mc Graw Hill, New Delhi, 2008.
4. Baradwaj Kumkum, "Professional Communication", I.K.International Publishing House Pvt.Ltd., New Delhi, 2008.
5. Wood,F.T., "Remedial English Grammar", Macmillan, 2007.

L	T	P	Cr.
2	1	0	3

B.Tech. (II Sem.)

20FE04 - LINEAR ALGEBRA AND TRANSFORMATION TECHNIQUES

Pre-requisites: Nil

Course Educational Objective: In this course, students learn Matrix Algebra and introduced with transformation techniques such as Laplace Transforms and Z – Transforms.

Course Outcomes: At the end of the course, the student will be able to
CO1: Investigate the consistency of the system of equations and solve them (Apply – L3)
CO2: Determine the eigen vectors and inverse, powers of a matrix using Cayley – Hamilton Theorem (Apply - L3)
CO3: Use the concepts of Laplace Transforms to various forms of functions (Understand – L2)
CO4: Solve ordinary differential equations by using Laplace Transforms (Apply – L3)
CO5: Apply Z - Transforms to solve difference equations (Apply – L3)

UNIT – I
System of Linear Equations
Matrices - Rank- Echelon form, Normal form, PAQ form– Solution of Linear Systems – Homogeneous system of equations and Non-Homogeneous system of equations.

UNIT – II
Eigen Values and Eigen Vectors
Eigen values – Eigen Vectors – Properties – Cayley-Hamilton Theorem – Inverse and Powers of a matrix by using Cayley-Hamilton Theorem.

UNIT – III
Laplace Transforms
Laplace transforms of standard functions –Linear Property - Shifting Theorems, Change of Scale Property
Multiplication and Division by't' - Transforms of derivatives and integrals – Unit step function – Dirac's delta function.

UNIT – IV
Inverse Laplace Transforms
Inverse Laplace transforms– Linear Property - Shifting Properties - Convolution theorem, Applications of Laplace transforms to ordinary differential equations.

UNIT – V
Z-Transforms
Z-transform – properties – Damping rule – Shifting rule – Initial and final value theorems - Inverse Z –transform - Convolution theorem – Solution of difference equation by Z-transforms.

Text Books:

1. B.S. Grewal, "*Higher Engineering Mathematics*", 42ndEdition, Khanna Publishers, New Delhi, 2012.
2. B. V. Ramana, "*Higher Engineering Mathematics*", 1stEdition, TMH Publications, New Delhi, 2010.

Reference Books:

1. M. D. Greenberg, "*Advanced Engineering Mathematics*", 2nd Edition, TMH Publications, New Delhi, 2011.
2. Erwin Kreyszig, *"Advanced Engineering Mathematics"*, 8th Edition, John Wiley & sons, New Delhi, 2011.
3. W.E. Boyce and R. C. Diprima, " *Elementary Differential Equations"*, 7th Edition, John Wiley & sons, New Delhi, 2011.

L	T	P	Cr.
2	1	0	3

B.Tech. (II Sem.)   **20FE08 - ENGINEERING PHYSICS**

Pre-requisites: Nil

Course Educational Objectives: It enables the students to understand the fundamental concepts of elastic behavior of materials, lasers, optical fibers, acoustics, ultrasonics, magnetic, dielectric, superconducting and nano materials.

Course Outcomes: At the end of the course, the student will be able to,
  CO1: Analyse the different mechanical properties of materials(Understand – L2).
  CO2: Apply the lasers and optical fibres in different fields(Apply - L3).
  CO3: Summarize the properties of sound waves(Understand – L2).
  CO4: Classify the different types of magnetic and dielectric materials(Understand - L2).
  CO5: Identify the properties of superconducting and nano materials(Understand – L2).

UNIT – I
Elasticity
Stress, Strain, Hooke's Law, Elastic behavior of a material, Factors affecting elasticity, Classification of elastic modulus, relation between Young's, bulk and rigidity modulus, bending of beam – bending moment of a beam and Cantilever (qualitative treatment).

UNIT – II
Lasers and Optical fibers
Lasers**:** Introduction- Principle of laser (absorption, spontaneous and stimulated emission of radiation), Einstein Coefficients, Nd - YAG laser, Helium Neon laser - applications.
Optical Fibers: Optical Fiber principle, Structure of optical fiber, numerical aperture and acceptance angle, types of optical fibers - applications.

UNIT – III
Acoustics &Ultrasonics
Acoustics: Introduction **–** Reverberation - Reverberation time - Sabine's formula (Derivation using growth and decay method) – absorption coefficient and its determination.
Ultrasonics: Production of ultrasonics by Magnetostriction - Detection of ultrasonics - acoustic grating – Non - Destructive Testing - Through transmission method and pulse echo method - Applications.

UNIT – IV
Magnetic & Dielectric materials
Magnetic parameters, Classification of magnetic materials-Diamagnetic, paramagnetic and ferromagnetic materials, Hysteresis loop, soft and hard magnetic materials, Applications of Ferro magnetic materials.
Dielectric polarization - Electronic and ionic polarization, orientation polarization (Qualitative), Local field, ClaussiusMosotti equation, Applications of dielectric materials.

UNIT – V
Superconducting and nanomaterials
Introduction - Meissner effect, Type I and Type II super conductors, Josephson Effect, Applications of super conductors.
Nanomaterials**:** Introduction, classification, properties, different methods of preparation and applications.

TEXT BOOKS
1. V. Rajendran, "*Engineering Physics*", TMH, New Delhi, 6th Edition, 2011.
2. M.N. Avadhanulu, P.G. Kshirsagar, "Engineering *Physics*", S. Chand & Co., 2ndEdition, 2014.

REFERENCE BOOKS
1. M.N. Avadhanulu, TVS Arun Murthy, "Applied *Physics*", S. Chand & Co., 2ndEdition, 2007.
2. P.K. PalaniSamy, "*Applied Physics*", Sci. Publ. Chennai, 4th Edition, 2016.
3. P. Sreenivasa Rao, K Muralidhar, "*Applied Physics*", Him. Publi. Mumbai, 1st Edition, 2016.
4. Hitendra K. Mallik , AK Singh " *Engineering Physics*", TMH, New Delhi, 1st Edition, 2009.

	L	T	P	Cr.
B.Tech. (II Sem.) **20CS01 - PROGRAMMING FOR PROBLEM SOLVING USING C**	3	0	0	3

Pre-requisite   **:**   Nil

Course Educational Objective: The Objective of the course is to make learn the basic elements of C programming, control structures, derived data types, Modular programming, user defined structures, basics of files and its I/O operations.

Course Outcomes: At the end of this course, the student will be able to

CO1: Familiar with syntax and semantics of the basic programming language constructs. **(Understand - L2)**

CO2: Construct derived data types like arrays in solving problem (**Apply - L3**)

CO3: Decompose a problem into modules and reconstruct it using various ways of user-defined functions. **(Apply - L3)**

CO4: Use user-defined data types like structures and unions and its applications to solve problems. **(Apply- L3)**

CO5: Discuss various file I/O operations and its application. **(Understand - L2)**

UNIT – I

Introduction to Problem solving through C-Programming: Problem Specification, Algorithm / pseudo code, flowchart, examples.

C-Programming: Structure of C program, identifiers, basic data types and sizes, Constants, variables, Input-output statements, A sample c program, operators, expressions, type conversions, conditional expressions, precedence of operators and order of evaluation.

Control statements: if, if else, else if ladder and switch statements, while, do-while and for statements, break, continue, go to and labels.

UNIT – II

Arrays- concept, declaration, definition, accessing elements, storing elements, two dimensional and multi-dimensional arrays.

Character Arrays: declaration, initialization, reading, writing strings, string handling functions, pre-processor Directives, and macros.

Applications of Arrays: Linear search, Binary search, Bubble Sort.

UNIT – III

Pointers- concepts, declaring & initialization of pointer variables, pointer expressions, pointer arithmetic, pointers and arrays, pointers and character arrays, pointers to pointers.

Functions: basics, category of functions, parameter passing techniques, recursive functions-comparison with Iteration, Functions with arrays, Standard library functions, dynamic memory management functions, command line arguments.

Storage classes - auto, register, static and extern.

UNIT – IV

Derived types- structures- declaration, definition, and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, unions, typedef.

UNIT – V

Files – concept of a file, text files and binary files, streams, standard I/O, Formatted I/O, file I/O operations, error handling.

Textbook:

1. Reema Thareja, Programming in C, Oxford University Press, 2nd Edition, 2015

Reference books:

1. Jeri R.Hanly, Elliot B.Koffman, Problem Solving and Program Design in C, Pearson Publishers, 7th Edition, 2013
2. E Balagurusamy, Computer Programming, McGraw Hill Education, 8th Edition.
3. C: The Complete Reference, McGraw Hall Education,4th Edition.
4. Pradeep Dey, Manas Ghosh, Programming in C, Oxford University Press, 2nd Edition, 2011.
5. Stephen G.Kochan, Programming in C, Pearson Education, 3rd Edition, 2005.

L	T	P	Cr.
2	1	0	3

B.Tech. (II Sem.)   **20CE03 - APPLIED MECHANICS**

Pre-requisites: Physics

Course Educational Objective:
This course comprises the basic knowledge on equilibrium of planar force systems, determination of sectional properties of various cross sections / composite sections. It describes motion of bodies under frictional forces. In this course the process of finding the internal forces in members aroused from the applied loads using equilibrium conditions is also expounded.

Course Outcomes: At the end of the course, the student will be able to:
   CO1: Determine the resultant force and moment for a given system of forces. (**Apply-L3**)
   CO2: Calculate the unknown forces in members of planar systems by constructing free body diagrams and applying static equilibrium conditions. (**Apply-L3**)
   CO3: Examine the motion/ impeding the motion of bodies on horizontal/inclined planes associated with frictional forces. (**Apply-L3**)
   CO4: Analyze for the internal forces in the members of a pin jointed perfect frames subjected to horizontal, vertical and inclined loads. (**Apply-L3**)
   CO5: Determine the centroid and second moment of area of simple and composite areas. (**Apply-L3**)

UNIT – I: Basic Concepts
   Resultant of Systems Of Forces : Parallelogram law-forces and components- Resultant of Coplanar Concurrent Forces– Moment of Force- principle of moments-Varignon‟s theorem-Application – Couples and Resultant of Force Systems.

UNIT – II: Equilibrium of Systems Of Forces
   Free Body Diagrams- Equations of Equilibrium- Lami‟s Theorem - equilibrium of planar systems

UNIT-III: Friction
   Introduction-Theory of Friction-Angle of friction-Laws of friction-coefficient of friction-cone of friction-impending motion of connected bodies-Ladder friction –Wedge friction

UNIT –IV: Analysis of Perfect Frames
   Types of Frames-Assumptions for forces in members of a perfect frame, Method of joints, Method of sections, Force table, Cantilever Trusses, Structures with one end hinged and the other freely supported on rollers carrying horizontal or inclined loads.

UNIT: V: Centroid and Moment of Inertia
   Centroid: Centroids of simple figures (from basic principles)– Centroids of Composite Figures.
   Centre of Gravity: Centre of gravity of simple bodies (from basic principles) - Centre of gravity of composite plane figures- Pappus theorem.
   Area Moment of Inertia: Definition-Polar Moment of Inertia- Transfer Theorem, Moments of Inertia of composite figures.

   Mass Moment of Inertia: Moment of inertia of masses-Transfer formula for mass moment of inertia-simple problems.

TEXT BOOKS
1. RK Rajput "Engineering. Mechanics" DhanpatRai and Sons, NewDelhi
2. S.S. Bhavikatti and K.G. Rajashekarappa "Engineering Mechanics", New Age International Publishers, NewDelhi.

REFERENCES
1. RK Bansal "Engineering. Mechanics" Laxmi Publishers, New Delhi.
2. Ferdinand L. Singer, "Engineering Mechanics" Published by Harper Collins Publishers, Singapore
3. S. Timoshenko, D.H. Young and J.V. Rao "Engineering Mechanics" TATA McGraw Hill, New Delhi, Revised Fourth Edition.

L	T	P	Cr.
2	0	0	0

B.Tech. (II Sem.)   **20MC01 - CONSTITUTION OF INDIA**

Pre-requisites: Nil

Course Educational 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 constitution bodies like SupremeCourt and High Court Controller and Auditor General of India and ElectionCommission of India.

• To understand the Central and State relation, financial and administrative.

Course Outcomes: At the end of the course, the student shall be able to

CO1: Understand history and philosophy of constitution with reference to Preamble,Fundamental Rights and Duties(**Understand – L2**).

CO2: Understand the concept of Unitary and Federal Government along with therole of President, Prime Minister and Judicial System(**Understand – L2**).

CO3: Understand the structure of the state government, Secretariat, Governor and Chief Ministerand their functions(**Understand – L2**).

CO4: learn local administration viz. Panchayat, Block, Municipality and Corporation (**Understand – L2**).

CO5: learn about Election Commission and the process and about SC, ST, OBCand women(**Understand – L2**).

UNIT – I:

Introduction to Indian Constitution: 'Constitution' meaning of the term, IndianConstitution – Sources and Constitutional History, Features – Citizenship,Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT – II:

Union Government and its Administration Structure of the Indian Union: FederalismCentre – State relationship, President: Role, Power and Position. Prime Minister(PM) and Council of Ministers, Cabinet and Central Secretariat, Lok Sabha, RajyaSabha. The Supreme Court and High Court: Powers and Functions.

UNIT – III:

State Government and its Administration Governor – Role and Position – ChiefMinister (CM) and Council of Ministers. State Secretariat: Organization, Structureand Functions.

UNIT – IV:

A Local Administration -- Role and Importance,Municipalities – Mayor and Role of Elected Representative,Panchayati Raj: Functions of PanchayatiRaj Institution, Zilla Panchayat, Elected Officials and their roles, Villagelevel – Role of Elected and Appointed officials.

UNIT – V:

Election Commission: Election Commission – Role of Chief Election Commissionerand Election Commissionerate State Election Commission: Functions andCommissions for the welfare of SC/ST/OBC and Women.

Reference Books

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall ofIndia Pvt.Ltd., New Delhi.

2. Subash Kashyap, Indian Constitution, National Book Trust.

3. J.A. Siwach, Dynamics of Indian Government and Politics.

4. D.C. Gupta, Indian Government and Politics.

5. H.M.Sreevai. Constitutional Law of India, 4th edition in 3 volumes (UniversalLaw 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), Challengesto Civil Right).

Challenges to Civil Rights Guarantees in India, OxfordUniversity 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-indianconstitution.

* * *

L	T	P	Cr.
0	0	2	1

B.Tech. (II Sem.)   **20FE51 - PROFESSIONAL COMMUNICATION SKILLS LAB**

Pre-requisites : Nil

Course Educational Objective: To improve the proficiency of students in English with an emphasis on better communication in formal and informal situations; Develop speaking skills required for expressing their knowledge and abilities and to face interviews with confidence.

Course Outcomes: At the end of this course, the student will be able to

CO1: Introduce oneself and others using appropriate language and details (**Understand – L2**)

CO2: Comprehend short talks and speak clearly on a specific topic using error free English(**Understand – L2**)

CO3: Report effectively after participating in informal discussions ethically (**Remember –L1**)

CO4: Interpret data aptly, ethically & make oral presentations (**Apply – L3**)

Syllabus: Professional Communication Skills Lab (PCS) shall have two parts:

- **Computer Assisted Language Learning (CALL) Lab** for 60 students with 60 systems, LAN facility and English language software for self- study by learners.
- **Interactive Communication Skills (ICS) Lab** with movable chairs and audio-visual aids with a P.A System, a T. V., a digital stereo – audio & video system and camcorder etc.

Exercise – I

CALL Lab: Understand - Sentence structure

ICS Lab: Practice - Listening: Identifying the topic, the context and specific information
Speaking: Introducing oneself and others

Exercise – II

CALL Lab: Understand - Framing questions

ICS Lab: Practice - Listening: Answering a series of questions about main idea and supporting ideas after listening to audio text
Speaking: Discussing in pairs/small groups on specific topics; Delivering short structured talks using suitable cohesive devices (JAM)

Exercise – III

CALL Lab: Understand - Comprehension practice – Strategies for Effective Communication

ICS Lab: Practice - Listening: Listening for global comprehension and summarizing
Speaking: Discussing specific topics in pairs/small groups, reporting what is discussed

Exercise – IV

CALL Lab: Understand- Features of Good Conversation – Strategies for Effective Communication.

ICS Lab: Practice -Listening: Making predictions while listening to conversations/transactional dialogues with/without video
Speaking: Role – plays – formal & informal – asking for and giving information / directions / instructions / suggestions

Exercise – V

CALL Lab: Understand - Features of Good Presentation, Methodology of Group Discussion
ICS Lab: Practice - Introduction to Group Discussions
Listening: Answering questions, identifying key terms and understanding concepts
Speaking: Formal Oral & Poster presentations on topics from academic contexts without the use of PPT

Lab Manual:

1. Prabhavati. Y & et al, "English All Round – Communication Skills for Undergraduate Learners", Orient BlackSwan, Hyderabad, 2019.

Suggested Software:

1. Digital Mentor: Globarena, Hyderabad, 2005
2. Sky Pronunciation Suite: Young India Films, Chennai, 2009
3. Mastering English in Vocabulary, Grammar, Spelling, Composition, Dorling Kindersley,USA,2001
4. Dorling Kindersley Series of Grammar, Punctuation, Composition, USA, 2001
5. Oxford Talking Dictionary, The Learning Company, USA, 2002
6. Learning to Speak English - 4 CDs. The Learning Company,USA,2002
7. Cambridge Advanced Learners English Dictionary (CD). Cambridge University Press, New Delhi,2008.

	L	T	P	Cr.
B.Tech. (II Sem.) **20FE55 - ENGINEERING PHYSICS LAB**	0	0	3	1.5

Pre - requisites: Nil

Course Educational Objectives: This course enables the students to acquire theoretical ideas, analytical techniques, and graphical analysis, by completing a host of experiments with the procedures and observational skills for appropriate use of simple and complex apparatus.

Course Outcomes: At the end of the course, the student will be able to,
CO1: Analyze the wave characteristics of light(**Understand – L2**).
CO2: Determine the wavelength of laser source and width of slit(**Apply - L3**).
CO3: Estimate the magnetic field using Stewart's and Gee's apparatus and the rigidity modulus of material using Torsional Pendulum(**Understand - L2**).
CO4: Identify the phenomena of resonance in strings(**Understand – L2**).
CO5: Improve report writing skills and individual teamwork with ethical values(**Understand – L2**)

List of Experiments
(Any of the 10 experiments are required to be conducted)

General experiments:

1. Determine the frequency of AC supply by using Sonometer.
2. Verification of Laws of vibrations in stretched strings - Sonometer.
3. Determine the frequency of a tuning fork by using Melde' s arrangement.
4. Study the magnetic field along the axis of a current carrying circular coil using Stewart's& Gee's apparatus and to verify Biot - Savart's law.
5. Determine the rigidity modulus of a given material using Torsional pendulum.
6. Determination of Young's modulus by the method of single Cantilever oscillations.
7. Measurement of magnetic susceptibility by Gouy's method.
8. Determination of ultrasonic velocity in Liquid.
9. Determination of dielectric constant by charging and discharging method.
10. Determination of velocity of sound by Volume resonator method.

Optics lab experiments:

11. Determine the wavelength of a laser radiation.
12. Determine the width of a single slit by forming diffraction pattern.
13. Determine the acceptance angle and numerical aperture of a fiber.
14. Measure the bending losses in the optical fiber cable at different wavelengths.

	L	T	P	Cr.
B.Tech. (II Sem.) **20CS51 - PROGRAMMING FOR PROBLEM SOLVING USING C LAB**	0	0	3	1.5

Pre-requisite : NIL

Course Educational Objective: The objective of the course is to learn the basic elements of C Programming Structures like Data Types, Expressions, Control Statements, and Various I/O Functions and to solve simple mathematical problems using control structures. Design and implementation of various software components, which solve real world problems.

Course Outcomes (CO): *At the end of this course, the student will be able to:*

CO1: Apply control structures of C in solving computational problems. (**Apply - L3**)

CO2: Implement derived data types & use modular programming in problem solving (**Apply- L3**)

CO3: Implement user defined data types and perform file operations. (**Apply- L3**)

CO 4: Improve individual / teamwork skills, communication & report writing skills with ethical values.

# of modules at most 10 can be taught and all the modules should be in line with theory.

Module 1: Introduction to Raptor Tool.

Module 2: Problem solving using Raptor Tool.

Module 3: Exercise Programs on Basics of C-Program.

Module 4: Exercise Programs on Control Structures.

Module 5: Exercise Programs on Loops & nesting of Loops.

Module 6: Exercise Programs on Arrays & Strings.

Module 7: Exercise Programs on Pointers.

Module 8: Exercise Programs on Functions.

Module 9: Exercise Programs on user defined data types.

Module 10: Exercise Programs on Files.

	L	**T**	**P**	**Cr.**
B.Tech. (II Sem.) **20ME54 - COMPUTER AIDED ENGINEERING GRAPHICS**	0	0	3	1.5

PRE-REQUISITES: Engineering Graphics, Mathematics

Course Educational Objective: The course aims to teach developing and drawing of engineering objects using AutoCAD. The student will be taught the fundamentals of AutoCAD and then asked to develop the projections of objects related to straight lines, planes, solids, orthographic and isometric views, development of surfaces using principles of engineering drawing.

Course Outcomes: At the end of the course, the student will be able to-
CO1: Draw simple objects using functional tools in AutoCAD. (**Understand-L2**)
CO2: Develop and draw the positions and views of points, lines, planes and solids using AutoCAD. (**Understand-L2**)
CO3: Develop and draw the orthographic and isometric projections of simple objects using Auto-CAD. (**Understand-L2**)
CO4: Develop and draw the projections of the solids by developing the surfaces using AutoCAD. (**Understand-L2**)

BASIC AUTOCAD COMMANDS
1. Basic drawing commands (line, circle, arc, ellipse, polygon, and rectangle).
2. Edit commands (copy, move, erase, zoom).
3. Array commands (polar array, rectangular array, P-edit, divide, pline, offset).
4. Hatching &line commands (hatching with different angles and different types of lines).
5. Mirror and trim commands (mirror an object, trim, extend a line, chamfer &fillet, explode).
6. Dimensioning & text commands (linear, angular, radius, diameter and text).

PROJECTION OF POINTS, LINES AND PLANES
1. Projection of points (I, II, III, & IV quadrants).
2. Projection of lines parallel to both reference planes.
3. Projection of lines parallel to one reference plane & inclined to other reference plane.
4. Projection of planes: Single stage projections.

PROJECTION OF SOLIDS
1. Projection of solids in simple position and transfer of points.
2. Projection of solids with axes inclined to one reference plane & parallel to other.
3. Sections of solids: Simple sections

ORTHOGRAPHIC PROJECTIONS
1. Conversion of plane figures to orthographic views.
2. Conversion of circular figures to orthographic views.
3. Conversion of combination of plane figures and circular figures to orthographic views.

ISOMETRIC PROJECTIONS

1. Conversion of plane figures to isometric views.

2. Conversion of circular figures to isometric views.

3. Conversion of combination of plane figures and circular figures to isometric views.

DEVELOPMENT OF SURFACES

1. Parallel-line development (prism, cylinder) for objects in simple position**.**

2. Radial-line development (cone, pyramid) for objects in simple position.

TEXTBOOK

1. D.M. Kulkarni, A.P Rastogi, and A.K. Sarkar, "Engineering Graphics with AutoCAD", PHI Learning Private Limited, New Delhi, 2009.

REFERENCE

1. N. D. Bhatt, "Engineering Drawing", 51st Revised and Enlarged Edition, Charotar Publishers, 2012.

20FE10 - **NUMERICAL METHODS AND INTEGRAL CALCULUS** (Common to AE, CE, EEE, ECE, MECH)	**L**	**T**	**P**	**Cr.**
B.Tech.(III Sem.)	2	1	0	3

Pre-requisites : **None**

Course Educational Objective: The main objective of this course is to enable the students learn Numerical Techniques for solving the equations and apply interpolation techniques. They will also learn about the Fourier analysis of single valued functions, Multiple Integrals in different coordinate systems and Vector differentiation.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Estimate the best fit polynomial for the given tabulated data using Interpolation. **L2**

CO2: Apply numerical techniques in solving of equations and evaluation of integrals. **L3**

CO3: Discriminate among Cartesian, Polar and Spherical coordinates in multiple integrals and their respective applications to areas and volumes. **L3**

CO4: Generate the single valued functions in the form of Fourier series and obtain Fourier series representation of periodic function. **L3**

CO5: Evaluate the directional derivative, divergence and angular velocity of a vector function. **L3**

UNIT – I
Interpolation and Finite Differences
Interpolation: Introduction – Finite differences- Forward Differences- Backward Differences-Central differences – Symbolic relations and separation of symbols-Differences of a polynomial-Newton's formula for interpolation – Lagrange's Interpolation formula.

UNIT – II
Numerical Solution of Equations and Numerical Integration
Solutions of Algebraic and Transcendental Equations – Regula Falsi method and Newton Raphson Method in one variable.
Numerical Integration
Trapezoidal rule – Simpson's 1/3 Rule –Simpson's 3/8 Rule.

UNIT – III
Multiple Integrals
Multiple integrals - double and triple integrals (Cartesian, polar, spherical coordinates) – Changing the order of Integration.

UNIT IV
Fourier series
Determination of Fourier coefficients – Fourier series – even and odd functions – Fourier series in an arbitrary interval– Half-range sine and cosine series

UNIT – V
Vector Differentiation
Vector Differentiation: Gradient- Directional Derivatives -Divergence – Solenoidal fields- Curl – Irrotational fields-potential surfaces - Laplacian and second order operators

Text Books:

1. B.S. Grewal, "Higher Engineering Mathematics", 42ndEdition, Khanna Publishers, New Delhi, 2012.
2. B. V. Ramana, "Higher Engineering Mathematics", 1stEdition, TMH Publications, New Delhi, 2010.
3. S. S. Sastry, "Introductory Methods of Numerical Analysis" 5th Edition, PHI Learning Private Limited, New Delhi, 2012.

Reference:

4. M. D. Greenberg, " Advanced Engineering Mathematics", 2nd Edition, TMH Publications, New Delhi,2011.
5. Erwin Krezig, "Advanced Engineering Mathematics" , 8th Edition, John Wiley & sons, New Delhi,2011.
6. W.E. Boyce and R. C. Diprima, " Elementary Differential Equations" , 7th Edition, John Wiley & sons, New Delhi,2011.

L	T	P	Cr.
3	0	0	3

B.Tech. (III Sem.)   **20CE05- MECHANICS OF FLUIDS**

Pre-requisites: Applied Mechanics

Course Educational Objective: The course teaches the fluid properties and fundamental relations based on conservation of mass, energy and momentum in fluid flow. Applications of these basic equations are highlighted for flow measurements through orifice meter, venturi meter, Pitot tube, notches etc. Energy losses and Dimensional analysis are also discussed along with applications.

Course Out comes: At the end of the course, the student will be able to:

CO1: Understand the basic properties of fluids, and fundamental aspects of fluid mechanics such as pressure, types of flow, conservation of mass, energy, momentum, energy losses, dimensionless numbers & model laws **(Understand – L2)**

CO2: Determine the pressure at a point using pressure measuring devices and by applying hydrostatic pressure principles, and compute center of pressure for thee given conditions. **(Apply-L3)**

CO3: Determine the flow parameters using Continuity equation, Bernoulli equation and compute the forces acting on pipe bends. **(Apply – L3)**

CO4: Compute the energy losses in pipes and estimate the flow parameters in viscous flows using Hagen – Poiseuille equation. **(Apply – L3)**

CO5: Apply dimensional analysis as a tool in solving problems in the field of fluid mechanics and apply the laws of similarity. **(Apply – L3)**

UNIT – I: PROPERTIES OF FLUIDS
Fundamental properties: Mass density, Specific weight, Specific volume, Specific gravity, Viscosity, Compressibility, Surface tension- capillarity and their influences on fluid motion.
Pressure Measurement: Pressure at a point, Absolute, Atmospheric, gauge and vacuum pressure, Measurement of pressure- Manometers, Simple and Differential manometers.

UNIT-II: FLUID STATICS AND KINEMATICS
FLUID STATICS:
Hydrostatic Forces: Hydrostatic forces on submerged plane- Horizontal, Vertical, Inclined surfaces-Centre of pressure-Derivations and simple problems.

FLUID KINEMATICS:
Flow patterns: Description of fluid flow-Stream line- path line and streak lines and stream tube. Classification of flows: Steady, Unsteady, Uniform, Non-uniform, Laminar, Turbulent, Rotational and Irrotational flows, Stream and Velocity potential functions
Continuity Equation: Equation of continuity for one, two, three dimensional flows in Cartesian coordinates

UNIT- III: FLUID DYNAMICS
Energy Equation: Euler's equation of motion, Bernoulli's equation, simple applications of Bernoulli's equation,
Momentum equation: Flow through pipe bends
Measurement of Flow: Pitot tube, Venturi meter and Orifice meter, Flow over notches.

UNIT- IV: ENERGY LOSSES AND CLOSED CONDUIT FLOW
Energy losses: Reynold's experiment -Laws of Fluid friction – Darcy's equation, Minor losses – pipes in series – pipes in parallel – Total energy line and hydraulic gradient line.
Laminar Flow: Hagen – Poiseuille equation for viscous flow

UNIT–V: DIMENSIONAL ANALYSIS AND HYDRAULIC SIMILITUDE
Dimensional Analysis: Dimensional analysis-Rayleigh's method and Buckingham's π theorem-Applications
Hydraulic similitude: Geometric, Kinematic and Dynamic similarities, Dimensionless numbers, Model laws, Model and prototype relations using Reynolds and Froude Model laws.

TEXT BOOKS
1. R.K. Bansal, "A Textbook of Fluid Mechanics and Hydraulic Machines", Laxmi Publications (p) Ltd.
2. R.K. Rajput "Textbook of Fluid Mechanics and Hydraulic Machinery", Revised edition, S. Chand & Company, Ltd., New Delhi, 2005.

REFERENCES
1. K.R. Arora, "Fluid Mechanics, Hydraulic and Hydraulic Machines", Standard Publishers and Distributors, New Delhi, 2005.
2. A.K. Jain, Fluid Mechanics 2nd edition, Khanna Publishers, Delhi.2001 revised edition, Standard Book Home, New Delhi, 2005.
3. P.N. Modi, and S.M. Seth, "Hydraulics and Fluid Mechanics including Hydraulic Machines", Rajson Publications Pvt Ltd., Standard Book House, New Delhi, 2009.

L	T	P	Cr.
3	0	0	3

B.Tech. (III Sem.) **20CE06 - SOLID MECHANICS**

Pre-requisites: NIL

Course Educational Objective:
The course teaches about mechanical properties of engineering materials such as tensile, compression strength, torsion & bending strength. The behaviour of beam / Column elements with different support conditions and loading system will be discussed.

Course Out comes: At the end of the course, the student will be able to:

CO1: Recall the terminology associated with the structural members viz. bars, beams, column, shafts which are subjected to practical loads **(Remember-L1)**

CO2: Relate the required input parameters for finding the reactions / internal forces in the structural elements subjected to axial, shear, bending and torsional forces **(Understand-L2)**

CO3: Solve for the axial, shear, bending and twisting moment in columns/ Beams/ Shafts/ subjected to longitudinal, transverse and twisting loads and their combinations. **(Apply-L3)**

CO4: Construct the shear, bending moment and stress variation diagrams at every cross section along the length of determinate structures subjected to applied loads. **(Apply-L3)**

CO5: Identify the maximum values of stresses/ moments in structural members of various cross sections subjected to axial/ transverse/ torsional loads. **(Apply-L3)**

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 – composite bars – Temperature stresses.
Strain Energy – Resilience – Gradual, sudden, impact and shock loadings –Simple applications.

UNIT – II
Principal Stresses and Strains: 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.

UNIT – III
Shear Force and Bending Moment: Definition of beam – Types of beams – Concept of shear force and bending moment– S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.D.L., uniformly varying loads and combination of these Loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a Section of a beam.
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.

UNIT- IV

Shear Stresses: Derivation of formula – Shear stress distribution across various beam sections like Rectangular, circular, triangular, I, T angle sections.

Torsion of Circular Shafts: Theory of pure torsion – Derivation of Torsion equations: $T/J = q/r = G\theta/L$ –Assumptions made in the theory of pure torsion – Torsional moment of resistance –Polar section modulus – Power transmitted by shafts – Combined bending and torsion.

UNIT – V

Columns: 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

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.

TEXT BOOKS

1. R.K.Bansal, "Introduction to Strength of Materials", Laxmi publications, 6th edition, 2018.
2. B.C. Punmia, A.K. Jain, A. K. Jain. "Strength of Materials and Theory of Structures", Vols. I & II", 9th Edition, Laxmi Publications (P) Ltd, New Delhi, 2004.

REFERENCES:

1. Bhavikatti. S. S., "Strength of Materials", Vikas Publishing House (P) Ltd., New Delhi, Third Edition, 2013
2. Gere and Timoshenko. "Mechanics of Materials", 6th, PWS Publishing Company, 2009
3. R.K.Rajput, "Mechanics of Structures", S. Chand Publication Revised Edition, 2007.

L	T	P	Cr.
3	0	0	3

B.Tech. (III Sem.)   **20CE07** - **CONCRETE TECHNOLOGY**

Pre-requisites: Building Materials

Course Educational Objective:
The course aims to teach the basic properties of concrete making materials, various tests on concrete and different admixtures to be used in concrete. The course also provides insight on various types of special concrete and their usage, determination of mix proportions as per IS codes.

Course Out comes: At the end of the course, the student will be able to:
CO1: Understand the basic ingredients of concrete, their role in the production of concrete and its behavior in the field.**(Understand-L2)**
CO2: Differentiate thefresh and hardened properties of concrete.**(Understand-L2)**
CO3: Describe the main operations of concreting i.e., selection of materials and its proportional mixing towards mixing, placing, compaction, curing and finishing.**(Understand-L2)**
CO4: Perceiving & broadening the knowledge of new concrete types and concrete mix design methods. **(Understand-L2)**

UNIT-I: CONCRETE MAKING MATERIALS
Portland cement –Chemical composition- Hydration – types of cement-tests & specifications. Aggregates – Classification of aggregate –gradation of aggregate – fineness modulus – Bulking of sand-tests &specifications – Alkali aggregate reaction-Quality of mixing water.

UNIT – II: PROPERTIES OF CONCRETE
Properties of fresh concrete –workability –slump test –compaction factor test –flow table test – segregation – bleeding. Properties of hardened concrete-Water / Cement ratio – Abram's Law – Gel space ratio –strength development –elastic properties of concrete-durability – Creep and Shrinkage - types of shrinkage thermal properties.

UNIT – III: QUALITY CONTROL AND ADMIXTURES IN CONCRETE
Quality Control of concrete-Control techniques –batching –mixing – transporting –placing – compacting –finishing curing–acceptance criteria. Admixtures- Accelerators – retarders – plasticizers- super plasticizers- air entraining agents–workability agents –bonding admixtures – Mineral admixtures – silica fume – fly ash –blast furnace slag.

UNIT – IV: SPECIAL CONCRETES
Light weight concrete – light weight aggregate concrete –no fines concrete –high density concrete – sulphur infiltrated concrete –fibre reinforced concrete –polymer concrete –ready mixed concrete – high strength concrete –High performance concrete- Self compacting concrete-Bacterial concrete – Shotcrete – pre packed concrete-Ferrocement.

UNIT – V: MIX DESIGN

Concept of mix design – objects of mix design- Factors in the choice of mix proportions-Introduction to different methods of mix design- concrete mix design by I. S method.

TEXT BOOKS

1. M.S. Shetty, "Concrete Technology" S. Chand & Co., Ltd., Revised Edition - New Delhi, 2003.
2. Rangwala "Engineering Materials (Material science)" Charotar Publishing House Pvt ltd., Edition-2012.
3. M.L. Gambhir, "Concrete Technology", Revised Edition - Tata McGraw Hill Publishing Co., New Delhi 1998.

REFERENCES:

1. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain. "Building Construction"- Laxmi Publications (P) Ltd.
2. K.T. Krishnaswamy, "Concrete Technology" Dhanpat Rai Publications.

Code book: IS 10262-2019 "Concrete Mix Design"

L	T	P	Cr.
3	0	0	3

B.Tech. (III Sem.)   **20CE08 - ENGINEERING GEOLOGY**

Prerequisite: Nil

Course Educational Objective:

The course introduces the concepts of Geology in civil engineering perspective. The student is exposed to properties of different minerals and rocks. The importance of structural geological features and geophysical principles will be addressed for their interpretation in civil engineering designs.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand and interpret fundamental geological processes and geological formations. **(L2-Understand)**

CO2: Differentiate various properties of minerals and rocks. **(L2-Understand)**

CO3: Illustrate geological structural features. **(L3-Apply)**

CO4: Apply geological principles in civil engineering applications. **(L3-Apply)**

UNIT – I: GENERAL GEOLOGY

Geology in Civil Engineering – Branches of geology – Earth's structure and composition – Continental drift, Plate tectonics, Weathering – types, products and soil profile,– Geological work of Rivers, Wind and Sea -Seismic zones of India.

UNIT – II: MINEROLOGY

Physical properties of Minerals – Crystallographic systems – Silicate structures - Study of following families of rock forming minerals- Quartz, Feldspar, Pyroxene, Amphibole, Mica, Calcite, Gypsum and Clay.

UNIT – III: PETROLOGY

Classification of Rocks – Igneous, Sedimentary and Metamorphic Rocks – Origin, Structure, texture and Classification – Study of physical properties, distribution and occurrence of important rock types viz. Granite, Diorite, Gabbro, Dolerite, Basalt, Limestone, Conglomerate, Breccia, Sandstone, Quartzite, Marble, Gneiss, and Schist etc.

UNIT – IV: STRUCTURAL GEOLOGY

Outcrop, Dip and Strike, Study of common structures associated with rocks such as Folds, Faults, Unconformities and Joints, their classification, types, their relevance, and importance in civil engineering.

UNIT - V: ENGINEERING APPLICATIONS IN GEOLOGY

Importance of Geophysical studies, Brief introduction of principles of geophysical studies - Gravity method, Magnetic methods, Electrical methods, Seismic methods, Radio metric methods and geothermal method.

Geological considerations in construction of Dam, Reservoir, Tunnel.

TEXT BOOKS

1. Parbin Singh., "Engineering and General Geology", Katson Publication House, 2009.
2. ChennaKesavulu N., "Text book of Engineering Geology", Macmillan India Ltd, 2003.

REFERENCES

1. Legget., "Geology and Engineering", 2nd Edition, McGraw Hill Book Company, 2006.
2. Blyth. "Geology for Engineers", 7th Edition, ELBS, 1995.
3. KVGK Gokhale, "Principles of Engineering Geology", B.S Publications, 2005
4. F.G. Bell, "Fundamental of Engineering Geology", Butterworths Publications, Aditya Books Pvt. Ltd., New Delhi, 1992.
5. Krynine& Judd, "Principles of Engineering Geology & Geotechnics", CBS Publishers & Distribution, First Edition, 1998.

L	T	P	Cr.
2	0	0	0

B.Tech. (III Sem.)   **20MC02 - ENVIRONMENTAL SCIENCE**

Pre-requisites: Chemistry of 12th standard or equivalent

Course Objectives:
In this course the student will learn about

- Environmental issues like over population, human health etc related to local, regional and global levels.
- The necessity of resources, their exploitation and sustainable management.
- The interactions of human and ecosystems and their role in the food web in the natural world.
- The global biodiversity, threats to biodiversity and its conservation.
- Environmental problems like pollution, disasters and possible solutions.
- The importance of environmental decision making in organizations through audits.

Course Outcomes:

After the completion of this course, the students will able to

CO1: Identify environmental problems arising due to engineering and technological activities that help to be the part of sustainable solutions.   **L1**

CO2: Evaluate local, regional and global environmental issues related to resources and their sustainable management.   **L2**

CO3: Realize the importance of ecosystem and biodiversity for maintaining ecological balance.   **L2**

CO4: Acknowledge and prevent the problems related to pollution of air, water and soil.   **L3**

CO5: Identify the significance of implementing environmental laws and abatement devices for environmental management.   **L2**

Unit I
Nature and scope of Environmental Problems
- Introduction to Environmental Science
- Population explosion, variations among nations
- Resettlement and Rehabilitation - Issues and possible solutions
- Environmental hazards – causes and solutions. Biological hazards – AIDS, Malaria, Chemical hazards- BPA, PCB, Phthalates, Mercury, Nuclear hazards- Risk and evaluation of hazards.
- Role of Information Technology in environmental management and human health

Unit II
Natural Resources and Conservation
Introduction and classification of Natural Resources
- Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams and their effects on forests and tribal people
- Water resources: Use and over-utilization of surface and ground water, conflicts over water, interlinking of rivers, dams-benefits and problems, Rain water harvesting
- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources

- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, soil salinity
- Energy resources: Growing energy needs renewable, non-renewable and alternate energy resources

Unit III
Ecology and Biodiversity

- Structure and functions of an Ecosystem, Food chains and Food webs, Ecological succession, Ecological pyramids, Biogeochemical cycles
- Biodiversity, Values of biodiversity, Bio geographical classification of India. Endangered and endemic species of India, Threats to biodiversity; Man and wild life conflicts, Conservation of biodiversity: In-situ and Ex-situ conservation methods

Unit IV
Environmental Pollution
Introduction to Environmental Pollution Causes, effects and control measures of:
Air pollution, Water pollution, Noise pollution, Solid Waste Management – Sources, Classification, effects and control measures of Municipal solid waste, Biomedical waste & Hazardous and e-waste, Disaster Management.

Unit V
Environmental Management
- Sustainable development and unsustainability
- Climate disruption, Green house effect, Ozone layer depletion and Acid rain. Stockholm Conference
- Environmental Impact Assessment (EIA)
- Green building
- Environmental Law- Air, Water, Wild life, Forest, and Environmental protection act

Text Books:
1. Anubha Kaushik, C.P.Kaushik, "Perspectives in Environmental Studies", 5nd edition, New age international publishers, Delhi, 2016.
2. G. Tyler Miller, Scott Spoolman, "Introduction to Environmental Studies", 13th Edition, Cengage Learning, New Delhi, 2009.

Reference Books:
1. M. Anji Reddy, "Textbook of Environmental Sciences and Technology", 2nd Edition, BS Publications, Delhi 2011.
2. Deeshita Dave, P. Udaya Bhaskar, "Environmental Studies", 2nd Edition, Cengage Learning, New Delhi, 2012.
3. S.Deswal, A. Deswal, "A Basic course in Environmental Studies", 2nd Edition, Educational & Technical Publishers, Delhi, 2014.
4. R. Rajagopalan, "Environmental Studies (From Crisis to Cure)", 3rd Edition, Oxford University Press, New Delhi, 2012.
5. De, A.K, "Environmental Chemistry", 5th Edition, New Age International (P) Limited, New Delhi, 2003.
6. Dr.K.V.S.G. Murali Krishna, "Environmental Studies", 1st Edition, VGS Techno Series, Vijayawada, 2010.
7. Mahua Basu, S.Xavier, "Fundamentals of Environmental Studies", 1st edition, Cambridge University Press, Delhi, 2016.

L	T	P	Cr.
0	0	3	1.5

B.Tech. (III Sem.)   **20CE54 - SOLID MECHANICS LAB**

Pre-requisites: Building Materials, Strength of Materials

Course Educational Objective:
The course aims at providing hands on practice to observe the behaviour and failure patterns of commonly used construction materials subjected to tensile, compressive, torsion and shear loadings. The course also deals with the relative hardness and impact resistance of metals.

Course Outcomes: At the end of the course, the student will be able to-
CO1: Estimate compressive strength of wood, concrete, brick materials and decide their suitability for the construction purpose **(Evaluate-L5)**
CO2: Determine the tensile strength, hardness/ impact resistance of metals used in construction works comment on their usage **(Evaluate-L5)**
CO3: Determine the Rigidity /Young's modulus of wood/steel materials **(Apply-L3)**

List of Experiments
(Any of the 10 experiments are required to be conducted)
List of Experiments
1. Study of stress-strain characteristics of mild steel bars by UTM.
2. Study of stress-strain characteristics of HYSD bars by UTM.
3. Determination of modulus of elasticity of the material of the beam by conducting bending test on simply supported beam.
4. Determination of modulus of elasticity of the material of the beam by conducting bending test on Cantilever beam.
5. Determination of modulus of elasticity of the material of the beam by conducting bending test on simply supported beam with one end overhang.
6. Determination of modulus of rigidity by conducting torsion test on solid circular shaft.
7. Determination of hardness of the given material by Brinnel's/Vicker's Method.
8. Determination of hardness of the given material by Rockwell hardness test.
9. Determination of impact strength of the given material by conducting Charpy/Izod test
10. Determination of ultimate shear strength of steel by conducting direct shear test.
11. Determination of modulus of rigidity of the material of closely coiled helical spring.
12. Determination of compressive strength of wood/ brick with grain parallel / perpendicular to loading.

TEXT BOOK/REFERENCE Laboratory manual prepared by Civil Engineering Department.

L	T	P	Cr.
0	0	3	1.5

B.Tech. (III Sem.)   **20CE55 - BUILDING MATERIALS AND CONCRETE TECHNOLOGY LAB**

Pre-requisites: Building materials, Concrete technology

Course Educational Objective:
    The course aims to train the students in performing laboratory experiments to find the basic properties of bricks, tiles, cement, aggregates and concrete.

Course Outcomes: At the end of the course, the student will be able to-
CO1: Differentiate bricks and tiles based on physical properties. **(Understand-L2)**
CO2: Determine the properties of concrete making materials. **(Apply-L3)**
CO3: Identify the properties of concrete. **(Remember-L1)**

List of Experiments
(Any of the 10 experiments are required to be conducted)

Tests on Bricks and Tiles:
1. Classification of bricks by determination of Water absorption, shape test, soundness, warping, colour and compressive strength.
2. Determination of Water absorption, soundness, compressive strength of clay tiles.

Tests on Cement:
1. Determination of (a) Normal consistency of cement (b) Fineness of cement using 90 microns IS sieve.
2. Determination of Initial setting and final setting time of cement.
3. Determination of (a) Specific gravity of cement (b) soundness of cement.
4. Determination of Compressive Strength of cement.

Tests on Aggregates:
1. Determination of Fineness modulus of (a) Fine aggregate (b) Coarse aggregate.
2. Determination of Bulk density and Specific gravity of (a) fine aggregate (b) coarse aggregates.
3. Determination of Bulking of fine aggregate.

Tests on Concrete:
1. Determination of workability of concrete by conducting Slump cone test.
2. Determination of workability of concrete by conducting Compaction factor/Vee-Bee consist meter test.
3. Determination of (a) Cube compressive strength (b) Split tensile strength of concrete.
4. Determination of modulus of elasticity of concrete by conducting compression test on concrete cylinder.
5. Non-destructive test on concrete using Rebound Hammer / Ultrasonic Tester

Text Book/Reference Books:
Laboratory Manual prepared by Civil Engineering Department.

L	T	P	Cr.
0	0	3	1.5

B.Tech. (III Sem.)   **20CE56 - ENGINEERING GEOLOGY LAB**

Pre-requisites: NIL

Course Educational Objective:

      The laboratory course is intended to impart skills in identifying minerals and rocks based on physical properties. Through these practical sessions a student is equipped to interpret geological structural features in civil engineering perspective.

Course Outcomes: At the end of the course, the student will be able to

CO1: Demonstrate the importance of geological principles.**(L3-Apply)**

CO2: Distinguish various types of minerals and rocks based on physical properties and physical observations. **(L2-Understand)**

CO3: Interpret structural patterns of various geological structures. **(L2-Understand)**

LIST OF EXPERIMENTS

1. Description of Minerals by physical properties.

2. Description and Engineering uses of Rocks

3. Description and engineering consideration of Structural Models

4. Microscopic study of minerals and Microscopic study of rocks

5. Interpretation and drawing of sections for geological maps showing tilted beds, faults, unconformities etc.

LAB EXAMINATION PATTERN

1. Description and identification of FOUR minerals

2. Description and identification of FOUR (including igneous, sedimentary and metamorphic rocks)

3. ONE Interpretation of a Geological map along with a geological section.

Text Book/Reference Books

Laboratory Manual prepared by Civil Engineering Department.

	L	T	P	Cr.
B.Tech. (III Sem.) **20ITS1-PROBLEM SOLVING USING PYTHON**	1	-	2	2

Pre-requisite   :   Programming languages like C Language.

Course Educational Objective:

The Objective of Python course is to lead the students from the basics of writing and running

Python scripts in problem solving and also to design and implement the modules and understands

the working of classes and objects in python.

Course Outcomes (COs):*At the end of the course, the student shall be able to*

CO 1:   Identify various programming constructs available in Python and apply them in solving computational problems. (**Apply - L3**)

CO 2:   Demonstrate data structures available in Python and apply them in solving computational problems. (**Apply - L3**)

CO 3:   Implement modular programming, string manipulations and Python Libraries (**Apply - L3**)

CO 4:   Improve individual / teamwork skills, communication & report writing skills with ethical values.

Introduction: Language basics and example problems

Implement Python Script for checking the given year is leap year or not.

Implement Python Script for finding biggest number among 3 numbers.

Implement Python Script for displaying reversal of a number.

Implement Python Script to check given number is Armstrong or not.

Implement Python Script to print sum of N natural numbers.

Implement Python Script to check given number is palindrome or not.

Implement Python script to print factorial of a number.

Implement Python Script to print all prime numbers within the given range.

Modue 1:   Exercise Programs on Lists.

Write a Python script to display elements of list in reverse order.

Write a Python script to find the minimum and maximum elements without using built-in

operations in the lists.

Write a Python script to remove duplicates from a list.

Write a Python script to append a list to the second list.

Write a Python script to count the number of strings in a list where the string length is 2 or more.

Module 2:   Exercise Programs on Tuples.

Write a Python script to create a tuple with different data types.

Write a Python script to find the repeated items of a tuple.

Write a Python script to replace last value of tuples in a list.

Sample list: [(10, 20, 40), (40, 50, 60), (70, 80, 90)]

 Expected Output: [(10, 20, 100), (40, 50, 100), (70, 80, 100)]

Write a Python script to sort a tuple by its float element.

Sample data: [('item1', '12.20'), ('item2', '15.10'), ('item3', '24.5')]

Expected Output: [('item3', '24.5'), ('item2', '15.10'), ('item1', '12.20')]

Module 3:   Exercise Programs on Sets.

Write a Python script to add member(s) in a set.

Write a Python script to perform Union, Intersection, difference and symmetric difference of given two sets.

Write a Python script to test whether every element in S is in T and every element in T is in S.

Module 4:   Exercise Programs on Dictionaries

Write a Python script to sort (ascending and descending) a dictionary by value.

Write a Python script to check whether a given key already exists or not in a dictionary.

Write a Python script to concatenate following dictionaries to create a new one.

Sample Dictionary : dic1={1:10, 2:20} dic2={3:30, 4:40} dic3={5:50,6:60}

Expected Result : {1: 10, 2: 20, 3: 30, 4: 40, 5: 50, 6: 60}

Write a Python script to print a dictionary where the keys are numbers between 1 and 15 (both included) and the values are square of keys.

Write a Python program to map two lists into a dictionary.

Module 5:   Exercise Programs on functions and recursion.

a) Define a function max_of_three() that takes three numbers as arguments and returns the largest of them.

b) Write a program which makes use of function to display all such numbers which are divisible by 7 but are not a multiple of 5, between given range X and Y.

c) Define functions to find mean, median, mode for the given numbers in a list.

d) Define a function which generates Fibonacci series up to n numbers.

e) Implement a python script for factorial of number by using recursion.

f) Implement a python script to find GCD of given two numbers using recursion.

Module 6: Exercise programs on Strings

a) Implement Python Script to perform various operations on string using string libraries.

b) Implement Python Script to check given string is palindrome or not.

c) Implement python script to accept line of text and find the number of characters, number of vowels and number of blank spaces in it.

d)Implement python script that takes a list of words and returns the length of the longest one.

Module 7: Exercise programs on Regular Expressions

a)   Write a Python script to check that a string contains only a certain set of characters (in this case a-z, A-Z and 0-9).

b)   Write a Python script to check whether password is valid or not.

>   Conditions for a valid password are:

>   Should have at least one number.

>   Should have at least one uppercase and one lowercase character.

>   Should have at least one special symbol.

>   Should be between 6 to 20 characters long.

Module8 : Exercise programs on Matplotlib Library

a) Write a Python program to draw a line with suitable label in the x axis, y axis and a title.

b)   Write a Python program to plot two or more lines with legends, different widths and colors.

c) Write a Python program to create multiple plots.

d) Write a Python programming to display a bar chart using different color for each bar.

e) Write a Python programming to create a pie chart with a title.

f)Write a Python program to draw a scatter plot with empty circles taking a random distribution in X and Y and plotted against each other.

	L	**T**	**P**	**Cr.**
20FE09 - **PROBABILITY AND STATISTICS** **(Common to AI&DS, CSE &IT)**	3	0	0	3

B.Tech (IV Sem.)

Pre-requisite(s)   **: None**

Course Educational Objective: The objective of this course is to provide students with the foundations and applications of probabilistic and statistical methods mainly used in varied applications in engineering and science.

Course Outcomes: At the end of the course, the student will be able to

CO1: Understand various probabilistic situations using the various laws of probability and random variables **(Understand - L2)**

CO2: Apply probability distributions like Binomial, Poisson, Normal and Exponential distributions in solving engineering problems (**Apply - L3**)

CO3: Calculate the standard error of sampling distribution and confidence intervals for parameters like mean and proportion based on the sample data. **(Apply - L3)**

CO4: Analyze the data scientifically with the appropriate statistical methodologies to apply the suitable test of hypothesis **(Analyze - L4)**

CO5: Construct the regression lines to predict the dependent variables and calculate the Correlation Coefficient for a bivariate statistical data.**(Apply – L3)**

Unit-1:
Probability and Random variables
Probability, Sample space and events, Additive Rule, Conditional probability, Multiplicative rule, Baye's theorem.
Random variables – Discrete and continuous Random Variables, distribution function. Mathematical Expectation of one-dimensional Random Variable.

Unit-2:
Probability Distributions
Binomial distribution , Poisson distribution , Poisson approximation to Binomial distribution, Exponential distribution, Normal distribution , Normal approximation to Binomial distribution.

Unit-3:
Sampling distribution & Estimation
Population, sample, parameter, statistic, sampling distribution, Standard error, Types of sampling, Sampling distribution of means and sampling distribution of variance,
Parameter estimations –point estimation and interval estimation for mean and proportions.

Unit-4:
Tests of Hypothesis
Hypothesis, Null and Alternate Hypothesis, , Type I and Type II errors, level of significance.
Z-test for means and proportions, t-test for single mean, difference of means, paired t-test, F-test for equality of population variances, χ^2 - test for goodness of fit and independence of attributes.

Unit-5:

Correlation & Regression

Karl Pearson's coefficient of correlation, linear Regression, Regression lines, Regression coefficients, Spearman's Rank correlation coefficient, Spearman's Rank correlation for repeated ranks.

Text books

1. Jay L.Devore "Probability and Statistics for engineering and the sciences." , 8th edition, Cengage Learning India, 2012.
2.S.C.Gupta, V.K.Kapoor, "Fundamentals of Mathematical Statistics", 11thEdition, Sultan Chand and sons, New Delhi,2014.

Reference Books

1. Miller & Freund's "Probability and Statistics for Engineers",8th edition. PHI, New Delhi,2011.
2. B.V. Ramana, "Higher Engineering Mathematics", 1st Edition, TMH, New Delhi, 2010

	L	T	P	Cr.
B.Tech. (IV Sem.) **20CE09** - **HYDRAULICS AND HYDRAULIC MACHINERY SYSTEMS**	3	0	0	3

Pre-requisites: Applied Mechanics, Mechanics of Fluids

Course Educational Objectives:

The course allows the student to get insight into open channel hydraulics, and the various theories dealing with the flow phenomenon of fluid in an open channel. The student is exposed to the basics, components, and working of the hydro machinery, applications of different types of turbines and pumps.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand the various types of flows, specific energy curves, hydraulic jumps and working of hydraulic machines in fluid flows. **(Understand-L2)**

CO2: Apply the basic principles to design the open channels and determine the energy losses due to formation of hydraulic jump. **(Apply-L3)**

CO3: Apply the impulse-momentum equation to determine the force exerted by a jet on different configurations of vanes. **(Apply-L3)**

CO4: Apply the working principle to draw the velocity triangles and determine the efficiencies of hydraulic machines.**(Apply-L3)**

UNIT – I: UNIFORM FLOW

Introduction to open channel flow, Classification of flows in channels; Chezy, Manning's, Bazin, Kutter's formulae- problems. Most economical sections of channels - Rectangular, Trapezoidal and Circular sections-problems.

UNIT – II: NON – UNIFORM FLOW

Concept of specific energy: Specific energy curves; - critical depth, critical velocity, minimum specific energy- problems. Critical flow in rectangular channels - problems.

Gradually Varied Flow: Dynamic equation; Surface Profiles; Computation of surface profiles by single step method; Back water Curves and Draw down curves; Examples of various types of water surface profiles.

Rapidly Varied Flow: Hydraulic jump; Elements and characteristics of hydraulic jump; Types of hydraulic jumps; Location and applications of hydraulic jump; Energy loss in a hydraulic jump.

UNIT-III: 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-IV: HYDRAULIC TURBINES

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 function efficiency. Unit and

specific turbines - unit speed - unit quantity - unit power - specific speed performance characteristics-geometric similarity- cavitation.

UNIT-V: PUMPS
Centrifugal Pumps: Classification, work done, minimum starting speed, losses and efficiencies, specific speed, multistage pumps, specific speed, characteristic curves, NPSH, Cavitation in pumps.
Reciprocating Pumps: Types, working, Work done, coefficient of discharge and slip, effects of acceleration and frictional resistance, indicator diagrams, separation.

TEXT BOOKS
1. R.K. Bansal, "A Textbook of Fluid Mechanics and Hydraulic Machines", Laxmi Publications (p) Ltd.
2. R.K. Rajput "Textbook of Fluid Mechanics and Hydraulic Machinery", Revised edition, S. Chand & Company, Ltd., New Delhi, 2005.

REFERENCES
1. A.K. Jain, Fluid Mechanics 2nd edition, Khanna Publishers, Delhi.2001 revised edition, Standard Book Home, New Delhi, 2005.
2. P.N. Modi, and S.M. Seth, "Hydraulics and Fluid Mechanics including Hydraulic Machines", Rajsons Publications Pvt Ltd., Standard Book House, New Delhi, 2009.
3. K.R. Arora, "Fluid Mechanics, Hydraulic and Hydraulic Machines", Standard Publishers and Distributors, New Delhi, 2005.

L	T	P	Cr.
3	0	0	3

B.Tech. (IV Sem.)   **20CE10 - GEO TECHNICAL ENGINEERING**

Pre-requisites: NIL

Course Educational Objective: The course aims to teach the different properties and classifications of soil. The course coverage includes the various procedures for determining index and engineering properties of soils.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Understand the engineering and index properties of soil.**(Understand-L2)**
CO2: Classify the soils based on ISC system and grain size distribution.**(Understand-L2)**
CO3: Evaluate the permeability, shear strength and consolidation properties of soil.**(Apply-L3)**
CO4: Illustrate the stress distribution of soil subjected to different loading conditions. **(Apply-L3)**

UNIT –I
Types and physical properties of soil
Types of soil – Physical properties of soil and their determination – Important definitions related to three phase diagram and relationships – Field identification of soils – Classification of soils based on grain size distribution – Hydrometer analysis.

UNIT –II
Consistency and plasticity characteristics of Soil
Determination of consistency limits and their significance to the field behaviour of soil – Classification of soils based on grain size and plasticity characteristics of soils.
Soil Compaction
Concept of compaction – Methods of laboratory compaction of soils – Factors affectingcompaction – Zero air voids curve and its significance – Field compaction control.

UNIT –III
Permeability characteristics of soils
Darcy's Law and its validity – Factors affecting permeability – Laboratory determination ofpermeability for cohesive and cohesion less soils – Permeability of layered deposits
Concept of effective stress in soils
Terzaghi's effective stress concept for saturated soil deposits – seepage flow and seepage pressure – Quick sand condition and critical hydraulic gradient

UNIT- IV
Shear strength of soils
Analysis of shear failure – shear and normal stress at a point – Mohr's stress circle – Relationship that can be obtained from Mohr's circle – Mohr's strength theory – Mohr's coulomb failure criterion Laboratory methods of determination of shear strength parameters of cohesive and non-cohesive soils – Direct shear test – Triaxial shear test – Unconfined compression test and Laboratory vane shear test – Advantages of triaxial test over other tests – Classification of shear test based on drainage conditions.

UNIT-V

Stress Distribution in soils

Boussinesq's and Westergaard's theories for point loads and their comparison – Approximate methods of determination of stresses and its validity – Computation of stresses beneath circular and square loaded areas – Concept of pressure bulb – Newmark's chart and its applications.

Compressibility characteristics of soils

Terzaghi's theory of one-dimensional consolidation – Concept of consolidation – Determination of coefficient of consolidation from consolidometer test data by Square root of time method and log time method – Calculation of consolidation settlement.

TEXT BOOKS

1. Arora. K.R, "**Soil Mechanics and Foundation Engineering**", Standard Publishers & Distributors, NaiSarak, Delhi, 1987
2. Murthy.V.N.S, "**A Text book of Soil Mechanics and Foundation Engineering**", KripaTechnical Consultants, Bangalore, 1992

REFERENCES

1. Venkataramaiah, "Geotechnical Engineering", Wiley Eastern Ltd., Madras, 1993.
2. Punmia. B.C, "Soil Mechanics and Foundation Engineering", A.Saurabh and Co.,(P) Ltd., Madras, 1988.
3. Taylor. D.W, "Fundamentals of Soil Mechanics", Asia Publishing house, 1948.
4. Terzaghi and Peck, "Soil Mechanics in Engineering", Asia Publishing house,

L	T	P	Cr.
3	0	0	3

B.Tech. (IV Sem.)   **20CE11 - STRUCTURAL ANALYSIS**

Pre-requisites: Applied Mechanics, Strength of materials.

Course Educational Objectives: In this course, the student is exposed about analytical approach for finding the internal forces, different structural components and their structural behaviour due to applied external loads

Course Out comes: At the end of the course, the student will be able to:
CO1: Show the reactions at the supports and jointsas well as interior forces of Memberssubjected to different loads and Boundary Conditions**(Understand-L2).**
CO2: Solve for the internal forces in determinate structures viz/ namely arches, cables.**(Apply-L3)**
CO3: Identify the appropriate method for determining the deflections of beams**(Apply-L3)**
CO4: Solve for the internal forces in indeterminate structures viz/ namely propped cantilevers/fixed and continuous beams **(Apply-L3)**
CO5: Identify the appropriate method of analysis for computing internal forces, stresses in beams/ Trusses subjected to all practical load combinations**(Apply-L3)**

UNIT - I ARCHES: Three hinged arches, Elastic theory of arches – Eddy's theorem – Determination of horizontal thrust, bending moment, normal thrust and radial shear– Effect of temperature.
CABLES: Introduction- General Cable Theorem- Uniformly Loaded Cable- Anchor Cable

UNIT – II DEFLECTION OF BEAMS: Bending into a circular arc – slope, deflection and radius of curvature – Differential Equation for the elastic line of a beam – Double integration and Macaulay's methods– Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L. uniformly varying load.-Mohr's theorems – Moment Area method – application to simple cases including overhanging beams.

UNIT-III INTRODUCTION TO INDETERMINATE STRUCTURES– Determinacy of static and kinematic indeterminacies for beams, Frames, Trusses
ENERGY THEOREMS: Introduction-Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces - Castigliano's first theorem-Deflections of simple beams and pin jointed trusses-application of Castigliano's second theorem

UNIT-IV FIXED BEAMS – Introduction to statically indeterminate beams with U.D.load central point load, eccentric point load. Number of point loads, uniformly varying load, couple and combination of loads shear force and bending moment diagrams-Deflection of fixed beams effect of sinking of support, effect of rotation of a support.

PROPPED CANTILEVERS: Analysis of propped cantilevers-shear force and bending moment diagrams-Deflection of propped cantilevers.

UNIT-V CONTINUOUS BEAMS : Introduction-Clapeyron's theorem of three moments-Analysis of continuous beams with constant moment of inertia with one or both ends fixed-continuous beams with overhang, continuous beams with different moment of inertia for different Spans Effects of sinking of supports-Shear Force and Bending moment diagrams.

SLOPE DEFLECTION METHOD: Introduction-Sign Conventions-Fundamental Equations-Continuous Beams with and without Sinking of Supports.

TEXT BOOKS

1. R.Vaidyanathan, Dr.P.Perumal, A Text Book on "Structural Analysis-Volume I& II" Laxmi Publications, Forth Edition ,2016
2. S.Ramamrutham, R.Narayan, A Text Book on "Theory of Structures" DhanpatRai Publications, Ninth Edition, 2018

REFERENCES

1. Punmia. B. C., Jain, A. K., and Jain, A. K., A Text Book on " Theory of Structures" Laxmi Publications, New Delhi, 2004
2. R.C.Hibbeler, A Text Book on " Structural Analysis" Pearson Publications, Ninth Edition,2018
3. T.S. Thandavamoorthy, A Text Book on " Structural Analysis" Oxford Publications, Second Edition, 2012
4. Bhavikatti S.S., AText book on "Analysis of Structures"–Vol. I & 2, Vikas publications, Fourth Edition, 2013.

	L	T	P	Cr.
B.Tech. (IV Sem.) **20HS01 – UNIVERSAL HUMAN VALUES 2: UNDERTANDING HARMONY**	3	0	0	3

Pre-requisites: Nil

Course Educational Objective: To become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

COURSE OUTCOMES: At the end of the course, the student will be able to-
CO1: Apply the value inputs in life and profession **(Apply – L3)**
CO2: Distinguish between values and skills, happiness and accumulation of physical facilities, the self, and the Body **(Understand – L2)**
CO3: Understand the role of a human being in ensuring harmony in society **(Understand – L2)**
CO4: Understand the role of a human being in ensuring harmony in the nature and existence.**(Understand – L2)**
CO5: Distinguish between ethical and unethical practices (**Apply – L3**)

UNIT-I:Need, Basic Guidelines, Content and Process for Value Education
'Natural Acceptance' and ExperientialValidation- as the process for self-exploration; Continuous Happiness and Prosperity- A look at basic Human Aspirations; Right understanding, Relationship and Physical Facility, Understanding Happiness and Prosperity

UNIT-II: Understanding Harmony in the Human Being - Harmony in Myself!
Understanding human being as a co-existence of the sentient 'I' and the material 'Body'; Understanding the needs of Self ('I') and 'Body' - happiness and physical facility; Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer);
Understanding the characteristics and activities of 'I' and harmony in 'I'; Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail

UNIT-III: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship
Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship;

Understanding the harmony in the society: Resolution, Prosperity, fearlessness and co-existence as comprehensive Human Goals; Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family, Gratitude as a universal value in relationships.

UNIT-IV: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

Understanding the harmony in the Nature; Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self regulation in nature; Understanding Existence as Co-existence of mutually interacting units in all-pervasive space; Holistic perception of harmony at all levels of existence.

UNIT-V: Implications of the above Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values; Definitiveness of Ethical Human Conduct; Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in professional ethics, Strategy for transition from the present state to Universal Human Order

Text Book:

Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books:

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

	L	T	P	Cr.
B.Tech. (IV Sem.) — **20CE57 - HYDRAULICS AND HYDRAULIC MACHINERY LAB**	0	0	3	1.5

Pre-requisites: Mechanics of Fluids, Hydraulics and Hydraulic Machinery Systems

Course Educational Objective:
      The student is given hands on training in working on fluid flow hydraulic machinery equipment and performs experiments to verify the principles of fluid mechanics and hydraulics based on laws of conservation of mass, energy, and momentum.

Course Outcomes:
CO1: Develop knowledge on the fundamental principles of fluid flow. **(Apply-L3)**
CO2: Apply the laws of conservation of mass, energy, and momentum to solve practical problems in fluid mechanics.**(Apply-L3)**
CO3: Practically visualize the functioning and performance of hydraulic turbines and pumps.**(Understand-L2)**

List of Experiments
(Any of the 10 experiments are required to be conducted)

1. Verification of Bernoulli's theorem.
2. Venturimeter: Determination of Coefficient of discharge.
3. Orificemeter: Determination of Coefficient of discharge.
4. Mouthpieces: Determination of Coefficient of discharge by steady flow method.
5. Determination of friction factor of Pipes.
6. Determination of Coefficient of discharge for rectangular notch / V – notch.
7. Determination of Manning's and Chezy's coefficients in open channel.
8. Measurement of force due to impact of jets on vanes of different types.
9. Performance studies on Pelton turbine.
10. Performance studies on Kaplan turbine.
11. Performance studies on single stage centrifugal pump.
12. Performance studies on Reciprocating pump.

TEXT BOOK/REFERENCES
1. Laboratory manual developed by Civil Engineering Department.

	L	T	P	Cr.
	0	0	3	1.5

B.Tech. (IV Sem.) **20CE58 - GEO TECHNICAL ENGINEERING LAB**

Pre-requisites: Geotechnical Engineering

Course Educational Objective: The course aims to train the students in performing laboratory experiments to find the basic properties soil. The course coverage includes the various field applications of soil.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Identify the tools, equipment required, and experimental procedures used in soil investigations **(Understand-L2)**

CO2: Determine the index and engineering properties of soils **(Apply-L3)**

CO2: Perform field and laboratory tests for soil investigations to compute desired parameters **(Apply-L3)**

CO3: Apply field conditions for computing and analyzing the experimental data. **(Understand-L2)**

List of Experiments
(Any of the 10 experiments are required to be conducted)

1. Determination of water content by oven drying method.
2. Determination of specific gravity by Density bottle method
3. Determination of specific gravity by Pycnometer method.
4. Particle size distribution curve by Mechanical Sieve analysis
5. Particle size distribution curve by Hydrometer analysis.
6. Determination of Atterberg limits
7. Determination of free swell index
8. Determination field unit weight of soil by Core cutter method.
9. Determination field unit weight of soil by Sand replacement method.
10. Determination of coefficient permeability of Coarse-grained soil by Constant head permeameter.
11. Determination of coefficient permeability of Fine-grained soil by Variable head permeameter.
12. Determination of MDD and OMC of given soil by Standard proctor test.
13. Determination of MDD and OMC of given soil by Modified proctor test.
14. Determination of shear strength parameters of given soil by Direct shear test.
15. Determination of shear strength of given soil by Vane shear test.
16. Determination of undrained shear strength of soil by Unconfined compression test

TEXT BOOK/REFERENCES
Laboratory manual developed by Civil Engineering Department.

L	T	P	Cr.
0	0	3	1.5

B.Tech. (IV Sem.)   **20CE59 - ADVANCED SURVEYING LAB**

Pre-requisites: Surveying, Survey Field Work Lab

Course Educational Objective:
The course allows the student to gain practical exposure in taking angular measurements, horizontal distances and vertical heights of objects by using advanced surveying equipment.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Obtain angular measurements in the field using theodolite. **(Apply-L3)**
CO2: Determine the coordinates/elevations/distances of different points in the field using theodolite and total stations. **(Apply-L3)**
CO3: Operate the total station to take out the measurements for desired objectives. **(Apply-L3)**

List of Experiments
(Any of the 10 experiments are required to be conducted)

THEODOLITE
1. Determining the Horizontal and Vertical Angles by the method of repetitionmethod.
2. Finding the distance between two inaccessiblepoints.
3. Determination of Height and distances – Single plane method & Double plane method.

TACHEOMETRY
1. To determine the distance and elevation of a point using tacheometric stadia system.
2. To determine the distance and elevation of a point using tangential tacheometric system.
3. Tacheometric contouring – Radialmethod

TOTAL STATION
1. Study of Instrument – Determination of Distances, Directions andElevations.
2. Determination of Boundaries of a Field and computation ofarea.
3. Finding the distance between two inaccessiblepoints.

SETTING OUT
1. Setting of simple circular curve using tape andtheodolite.
2. Setting of a simple circular curve using TotalStation.
3. Setting out forBuilding.

TEXT BOOK/REFERENCE
Laboratory Manual prepared by Civil Engineering Department

L	T	P	Cr.
1	0	2	2

B.Tech. (IV Sem.)   **20CES1 - PROBLEM SOLVING USING MAT LAB**

Pre-Requisites: Nil

Course Educational Objectives:

    In this course, student will learn about basic operations and functions of MATLAB and apply them for solving civil engineering problems.

Course Outcomes (COs): At the end of this course, students will be able to:

CO1: Understand the basics of MATLAB programming through simple exercises.
    (Understanding – L2)

CO2: Apply the MATLAB fundamentals to solve Civil engineering problems. (Apply – L3)

UNIT-I: MATALB BASICS

Introduction to MATALAB, MATLAB Windows, On-line help, Input-Output, File types, General commands, Built-in functions, Tool boxes.

UNIT-II: MATLAB COMPUTATIONS

Basic Computations: Arithmetic operators, Simple additions, subtractions, multiplications, Divisions, Trigonometric values, Exponential functions and Logarithms.

Advanced computations: Creating and working with arrays, Creating, saving and executing a Script file, Creating and Executing a function file, working with files and directories, Publishing reports.

UNIT-III: MATLAB APPLICATIONS

Matrix operations- addition, subtraction, multiplication, inverse calculations, Creating and printing simple 2D/3D plots, Solving linear equations, Curve fitting – Polynomial curve, Linear fit, Least squares fitting, Interpolation, Simple statistical data analysis, Solving simple ODE problems.

LAB EXERCISES

Note: A minimum of any 12exercises to be performed.

1. Performing simple exercises on Arithmetic operators, Simple additions, subtractions, multiplications, divisions, Trigonometric values, Exponential functions and Logarithms.
2. Performing simple exercises on Creating and working with simple arrays.
3. Performing simple exercises on Creating, saving and executing a Script file, working with files and directories.
4. Performing simple exercises on Creating and printing simple 2D/3D plots.
5. Performing simple exercises on Matrix operations.
6. Performing simple exercises on solving linear equations.
7. Performing simple exercises on Curve fitting – Polynomial curve, Linear fit.
8. Performing simple exercises on Least squares fitting and Interpolation.
9. Performing simple exercises on simple statistical data analysis and solving ODE problems.

Computing solutions for **any three** of the following problems.

10. Determination of Young's modulus for the given data using stress-strain relationship.

11. Computation of discharge coefficient for flow over a rectangular notch.

12. Determination of shear parameters of a soil sample.

13. Plotting of Longitudinal and cross sectional profile of a given data.

14. Determination of specific energy and hydraulic jump for the given flow parameters.

15. Plotting SFD and BMD for the given loading conditions of a simple beam.

TEXTBOOK

RudraPratap, Getting started with MATLAB: *A Quick Introduction for Scientists and Engineers*, 10thEdition, Indian Edition, Oxford University Press, New Delhi, 2006.

	L	T	P	Cr.
B.Tech. (V Sem.) **20CE12 - DESIGN OF REINFORCED CONCRETE STRUCTURES**	2	1	0	3

Pre-requisites: Applied Mechanics, Strength of Materials, Structural Analysis.

Course Educational Objectives:
Learn the design principles of Working stress and Limit state designs as per IS: 456-2000, Identify the procedures of shear design parameters, Understand the design aspects of beams, slabs and columns as per IS: 456-2000.

Course outcomes: At the end of the course, the student will be able to:

CO1: Understand the fundamental procedures and guidelines given in relevant IS Codes for design of various RCC elements such as beams, columns, foundations, slabs, shear reinforcement, under Working stress and Limit State methods (Understand-L2)

CO2: Design the RCC beams using both working stress and limit state methods (Apply-L3)

CO3: Design the shear reinforcement and Columns subjected to axial load, uni-axial and bi-axial moments using Limit state of collapse theory (Apply-L3)

CO4: Design the different types of shallow foundations, the one way and two-way slabs with different end conditions using appropriate design guidelines (Apply-L3)

UNIT–I:DESIGN OF BEAMS
Principles of Limit State method of design –characteristic load and strength – Partial safety factor – stress block parameters-Limit State of collapse–flexure–balance and under reinforced–design of singly and doubly reinforced rectangular section–L/d ratio for deflection calculation–cover for durability and fire resistance.

Concept of Working Stress Method – analysis and design of flexural member using working stress method – design of singly and doubly reinforced section. Deflection calculation – short term and long term deflection

UNIT –II: DESIGN OF SHEAR REINFORCEMENT
Limit State of collapse – shear and torsion - design of a rectangular section for shear, shear-torsion and bending-torsion. Design for development length – end anchorages. Reinforcement details in beam for flexure, shear and torsion– serviceability requirements.

UNIT – III: DESIGN OF SLABS
Design of slabs - one way and two way – simply supported, continuous and restrained, using coefficients given in IS code Reinforcement details in one way and two way slabs – serviceability requirements.

UNIT – IV:DESIGN OFCOLUMNS
Limit State of Collapse – compression; design of columns for axial load – square, rectangular and circular cross section with lateral and spiral ties–Reinforcement details for columns.

Design of short and long columns for uni-axial and biaxial eccentricities using interaction charts– Reinforcement details for columns– serviceability requirements.

UNIT – V:DESIGN OF SHALLOW FOUNDATIONS

Design of shallow foundation–square, rectangular, isolated footing of uniform thickness and sloped footing.

TEXTBOOKS

1. B.C.Punmia,AshokKumarJain,ArunKumarJain"ComprehensiveRCCDesign",LaxmiPublications(P)Ltd, New Delhi, 2015.
2. N.Krishnaraju,"AdvancedReinforcedConcretedesign",CBSPublishers&Distributors,NewDelhi, 2005.

REFERENCES

1. P.C.Varghese,"LimitStateDesignofReinforcedConcrete",PrenticeHallofIndiaPvt.,Ltd.,New Delhi, 2008.
2. P.C.Varghese,"AdvancedReinforcedConcreteDesign",PrenticeHallofIndiaPvt.,Ltd.,NewDelhi, 2002.
3. Design of Reinforced Concrete Structures, NPTEL video lectures.

ISCODES :

1. IS456-2000
2. SP – 16 (Interaction charts- rectangular & circular sections)

NOTE: These IS codes are permitted in the End Examinations

	L	T	P	Cr.
B.Tech. (V Sem.) **20CE13 - HYDROLOGY AND WATER RESOURCES ENGINEERING**	3	0	0	3

Pre-requisites: Applied Mechanics, Mechanics of Fluids, Hydraulics and Hydraulic Machinery Systems

Course Educational Objectives:

The course allows the student to get the fundamentals of hydrology and its importance in development of water resources. The student is exposed to the different types of irrigation methods, significance of soil-water-plant relationship, and design of irrigation channels.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand the basic concepts and factors affecting in hydrology such as Hydrologic cycle, Precipitation, Rain gauges, Runoff, Abstractions, Hydrographs, ground water geology and its occurrence. (Understand-L2)

CO2: Compute the average rainfall occurring in an area and estimate the abstractions for a given data (Apply-L3)

CO3: Estimate the groundwater potential based on available data, develop different hydrographs and analyze them for the required information (Apply-L3)

CO4: Understand the fundamental and functional components of Irrigation, Irrigation canals and Canal lining (Understand – L2)

CO5: Estimate the water requirements, irrigation efficiencies using fundamental principles of Irrigation, and sizing of irrigation channels using Lacey's, & Kennedy theories. (Apply-L3).

UNIT I

Introduction: Engineering hydrology and its applications, Hydrologic cycle.

Precipitation: Types and forms of precipitation, types of rain gauges, rain gauge network, estimation of missing rainfall data, average rainfall over a basin.

Abstractions: Evaporation, factors affecting evaporation - Evapotranspiration, factors affecting evapotranspiration - Infiltration, factors affecting infiltration.

UNIT-II

Runoff: Factors Affecting Runoff, Components of Runoff, Runoff estimation by Infiltration Indices.

Ground Water: Occurrence, Types of Aquifers, Darcy's Law, Dupuit's Equation- Steady Radial Flow to Wells in Confined and Unconfined Aquifers, Yield of an Open Well-Recuperation Test.

UNIT-III

Hydrograph Analysis: Components of Hydrograph, Separation of Base Flow, Effective Rainfall, Direct Runoff Hydrograph, Unit Hydrograph, Assumptions, Limitations and Applications of Unit Hydrograph. Derivation of Unit Hydrograph, Unit Hydrographs of Different Durations, Principle of Superposition and S-Hydrograph Methods.

UNIT-IV

Irrigation: Necessity and Importance of Irrigation, advantages and ill effects of Irrigation, types of Irrigation, methods of application of Irrigation water, principal crops and crop seasons, crop rotation. Soil-water-plant relationship, estimation of consumptive use, duty and delta, factors affecting duty,depth and frequency of Irrigation, irrigation efficiencies.

UNIT-V

Irrigation Channels: Classifications of canals, Cross–section of an irrigation channel; Balancing depth; Kennedy's theory – Design of channels, Lacey's regime theory - Design of channels, Drawbacks in Kennedy's theory; Defects in Lacey's theory; Comparison of Kennedy's theory and Lacey's theory. Lining of irrigation channels – necessity, advantages and disadvantages; Types of lining; Design of lined canal.

TEXT BOOKS:
1. Punmia.B.C, "Irrigation and Water Power Engineering," Standard Publishers, New Delhi, 1997.
2. Santhosh Kumar Garg, "Irrigation Engineering and Hydraulic Structures," Khann Publishers, New Delhi, 2003

REFERENCES
1. Sharma R.K., "Irrigation Engineering and Hydraulic Structures", Oxford and IBH Publishing company, New Delhi, 1994.
2. Modi.P.N., "Irrigation Water Resources and Water Power Engineering", Standard Book House, Delhi, 1995.
3. Subramanya.K., "Engineering Hydrology", Tata McGraw Hill, New Delhi , 1999
4. JayaramiReddy.P., "Hydrology", Tata McGraw Hill, New Delhi , 1999

L	T	P	Cr.
2	1	0	3

B.Tech. (V Sem.)   **20CE14 - ENVIRONMENTAL ENGINEERING**

Prerequisites: Applied Chemistry, Environmental Studies

Course Objectives:

The course deals with concepts of water demand, water and wastewater quality parameters, design of -water treatment units, -wastewater treatment units, -sludge handling in wastewater/sewage treatment

Course Outcomes: At the end of the course, the student will be able to:

CO1: Estimate the water demand for the community and assess the significance of water/wastewater, sludge quality parameters and fundamental aspects of water and wastewater treatment, sludge handling (Understand - L2)

CO2: Evaluate the various unit operations and design the elements in sedimentation/coagulation - based water treatment systems (Apply - L3).

CO3: Illustrate the working of filtration and disinfection systems and design them for water treatment systems (Apply - L3)

CO4: Analyze the various unit operations and design the primary treatment units for wastewater treatment (Apply - L3)

CO5: Analyze the salient operational considerations in secondary biological systems and sludge handling systems and design them for wastewater treatment (Apply - L3)

UNIT - I: WATER DEMAND AND WATER QUALITY

Water demand: Importance and need for protected water supply, Water demands, Factors affecting per capita demand, Types of water demand, Fluctuations in demand, Population forecasting, Different methods.

Water quality: Sources of water, Quality of water - Physical, chemical and bacteriological parameters

UNIT - II: WATER TREATMENT - SEDIMENTATION AND COAGULATION

Treatment of water: Objectives of water treatment - Methods of treatment - Screening – Concept of aeration of raw water

Sedimentation: Types of settling – Stoke's Law, Surface Overflow Rate, Estimation of settling efficiencies of particles, Design of continuous flow plain sedimentation tanks

Sedimentation aided with coagulation: Concept and Mechanism, Types of coagulants, Optimum coagulant dosage - Jar test, Flash Mixer, Flocculator, Sedimentation tank, Design parameters, Clariflocculator, Designs.

UNIT - III: WATER TREATMENT – FILTRATION & DISINFECTION

Filtration: Filtration mechanism, Slow sand filters, Rapid sand filters, Design and Operation, Comparison of SSF and RSF

Disinfection: Objective - Forms of disinfection, Chlorination, Types and application of chlorination

UNIT - IV: SEWAGE QUALITY & PRIMARY TREATMENT

Sewage quality: Systems of sanitation, Characteristics of sewage, Physical and chemical quality of sewage, BOD curve, BOD equation, Problems

Primary Treatment: Treatment of sewage, Primary treatment – Screening, Grit chamber, Skimming tanks, Primary sedimentation tank, Design problems.

UNIT - V: SECONDARY TREATMENT & SLUDGE HANDLING
Secondary treatment of sewage:

Activated sludge process: Biological growth, Mechanism, Complete mix and Diffused aeration methods of activated sludge process - Design considerations in ASP, Major parameters of design, Design.

Biological filtration of sewage: Trickling filters, Design of low rate and high-rate trickling filters

Septic tanks: Objectives- Construction details, Design parameters, Design, Soak pit.

Sludge handling:

Sludge characteristics, Sludge digestion, Mechanism, Factors affecting anaerobic digestion, Design of digester, Disposal of digested sludge, Sludge drying beds, Simple problems.

TEXT BOOKS
1. B.C. Punmia, A.K. Jain and A.K. Jain, "Water Supply Engineering", Laxmi Publications.2nd Edition1995, Reprint 2005.
2. B.C. Punmia, A.K. Jain and A.K. Jain, "Wastewater Engineering", Laxmi Publications, 2nd Edition 1998, Reprint 2014.

REFERENCES
1. S.K. Garg, "Water Supply Engineering", Khanna Publishers, 26th revised Edition, New Delhi. 2010.
2. S.K. Garg, "Sewage disposal and Air Pollution Engineering", Khanna Publishers New Delhi. 36th Edition, 2017.
3. H.S. Peavy, D. Rowe, and G. Tchobanoglous, "Environmental Engineering", McGraw Hill Publishers, New Delhi. 1985.
4. K.N. Duggal, "Elements of Environmental Engineering", S.Chand& Company Limited, New Delhi, 2007.
5. P. N. Modi, "Sewage Treatment Disposal & Wastewater Engineering", Standard Book House, 2016.
6. Manual on Sewerage and Sewage treatment, CPHEEO, Ministry of urban affairs and employment, Govt. of India, New Delhi, 2001
7. Water and Wastewater Engineering, NPTEL video lectures and web notes

	L	T	P	Cr.
B.Tech. (V Sem.) **20CE15 - REMOTE SENSING & GEOGRAPHICAL INFORMATION SYSTEMS** **(PROGRAM ELECTIVE-I)**	3	0	0	3

Pre-requisites: Nil

Course Educational Objective:
The course is designed to understand the techniques of Remote Sensing and GIS Technology for civil engineering applications.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Interpret the concepts of Photogrammetry and its applications such as determination of heights of objects on terrain. (Understand-L2)

CO2: Illustrate the Electromagnetic spectrum and utilize the energy interactions of EMR with atmosphere and earth surface features for GIS data generation. (Understand-L2)

CO3: Analyze the methods of map projections and understand coordinate systems on GIS Software packages to produce high resolution thematic maps.(Understand-L2)

CO4: Apply the concepts of vector and raster data model for representation of topological earth features and its importance.(Understand-L2)

CO5: Apply the RS & GIS techniques for solving civil engineering applications(Apply-L3)

UNIT-I: INTRODUCTION TO PHOTOGRAMMETRY
Principle and types of aerial photograph, Geometry of aerial photographs, Image displacements, Comparison of aerial photograph and map, Relief displacement in aerial photography, Stereoscopic-Types of stereoscope, Measurements of height from photographs. **Aerial mosaics–**Introduction, Planning for mosaics, Mosaic compilation, Annotation, and reproduction.

UNIT-II: REMOTE SENSING
Basic concept of remote sensing, remote sensing advantages and limitations, remote sensing process; electromagnetic spectrum, energy interactions with atmosphere and with earth surface features (soil, water, vegetation), satellite orbits, sensor resolutions, Indian satellites and sensors characteristics, Introduction to digital data, elements of visual interpretation techniques.

UNIT-III: GEOGRAPHIC INFORMATION SYSTEM
Introduction to GIS, Components of a GIS, Application areas of GIS, Data types- Spatial data, Attribute data,Spatial data representation, Relationships of spatial objects, GIS functions. Geographic coordinate system: Types of Maps, Uses of Maps, Characteristics of Maps, map projections: types of Map Projections.

UNIT-IV: SPATIAL DATA
Vector Data Model: Representation of simple features, advantages, and disadvantages.
Raster Data Model: Elements of the raster data model, advantages, and disadvantages.
Spatial Data Analysis: Introduction, Overlay function, Vector overlay function, Raster overlay function, Network analysis, Network tracing, Network allocation.

UNIT-V: CIVIL ENGINEERING APPLICATIONS

Land cover and land use, Agricultural, Forestry, Geology, Geomorphology, Urban applications, Transportation Engineering, Hydrology, Flood zone declination and mapping, Ground water prospects and recharge, Reservoir storage estimation.

TEXT BOOK

1. Kang – Tsung Chang, "Introduction to geographic information system", Tata McGraw- Hill Education Private Limited, 2007.
2. Srivastava G.S – "An Introduction to Geoinformatics" McGraw Hill Education (India) Private Limited, 2014

REFERENCES

1. Sujit Choudhury, Deepankar Chakrabarti, Suchandra Choudhury, "An Introduction to Geographic Information Technology" I.K. International Publishing House Pvt. Ltd. 2009.
2. Shivangi Somvanshi, Maya Kumari, "A Introduction to Remote Sensing and Its Applications", S.K. Kataria& Sons 2014.
3. BasudebBhatta, "Remote sensing and GIS" Oxford University press, 2011.
4. S. Kumar, "Basics of Remote sensing and GIS", Laxmi Publications, 2016.
5. Remote sensing and Geographical Information Technology, NPTEL video lectures and web notes

	L	T	P	Cr.
B.Tech. (V Sem.) **20CE16 - TOWN PLANNING AND ARCHITECTURE (PROGRAM ELECTIVE-I)**	3	0	0	3

Pre-requisites: Nil

Course Educational Objectives:

      The course aims to study the historical background of town planning and analyze the modern town-planning and zoning system. The principles of planning asper building bye-laws and history of architecture with different ages are addressed. The basic principles of architecture are introduced.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Enumerate the historical back ground of town planning (Remembering-L1)
CO2: Perceive the modern town-planning and zoning system (Understanding-L2)
CO3: Describe the principles of planning as per building bye-laws(Understanding-L2)
CO4: Categorize the history of architecture with different ages(Understanding-L2)
CO5: Describe the principles of architecture. (Understanding-L2)

UNIT-I: HISTORICAL BACKGROUND OF TOWN PLANNING
Town planning in India –Town plans of mythological Manasa- Town plans of ancient towns: Harappa, Mohenjodaro, Pataliputra, Delhi, Acropolis (Greece), Jerusalem, Mecca, Rome, London.

UNIT-II: MODERN TOWN PLANNING
Zoning- Roads and road traffic- Housing- Slums, Parks, Play grounds- Public Utility Services- Surveys and maps for planning- Neighbor -hood Planning. Standards of Town planning: Planning new towns, planning standards and specifications, national and regional planning, town planning and legislation-planning regulations and limitations.

UNIT-III: PRINCIPLES O FPLANNING
Principles of planning-site selection, site orientation-aspect, prospect, grouping, circulation, privacy, furniture requirements, services and other factors.
Post-classic Architecture: Introduction of post-classic architecture contribution of eminent architects to modern period

UNIT-IV: HISTORY OFARCHITECTURE
Western Architecture: Egyptian, Greek, Roman Architectures- Orders. Indian Architecture: Vedicage, Indus valley civilization– Buddhist period: Stambas, Stupa, Toranas, Chaityas, Viharas – Hindu temples: Dravidian and Indo Aryan Styles-Temple of Madurai, Bhuvaneshwar,

UNIT-V: ARCHITECTURAL DESIGN
Principles of designing – Composition of Plan – relationship between plan and elevation- building elements, form, surface texture, mass, line, color, tone- Principles of Composition: Unity, contrast, proportion, scale, balance, circulation, rhythm, character, expression, Smart Cities.

TEXTBOOKS:

1. Rangwala,"Townplanning:,CharotarPublishinghousePvt.Ltd.,28threvisededition,2015.
2. Hiranmay Biswas," Principles of town planning and architecture"; Vayu Education of India";1st Edition

REFERENCE:

1. N.Kumaraswamy and A.Kamerwararao, "Building planning and drawing",Charotar publishing house Pvt .Ltd, 7threvised edition.
2. "Urban and Regional Development Plans Formulation & Implementation Guidelines – 2014",Ministryof Urban Development, New Delhi.

L	T	P	Cr.
3	0	0	3

B.Tech. (V Sem.)

20CE17 - SAFETY ENGINEERING
(PROGRAM ELECTIVE-I)

Pre-requisites: NIL

Course Educational Objective:
The course aims to provide study on the safety measures to be taken at construction field and industrial areas. The course also provides an insight into the fundamentals of ergonomics for a better workplace and impacts and mitigation of fire accidents.

Course Out comes: At the end of the course, the student will be able to:
CO1: Remember the concepts of safety measures undertaken in a manufacturing organization and in project construction. (Remember-L1)
CO2: Describe the safety and control measures for industries. (Understand-L2)
CO3: Understand the concepts of Ergonomics for improvement in workplace. (Understand-L2)
CO4: Interpret the controlling measures during fire accidents (Understand-L2)

UNIT-I: SAFETY BASICS
Concepts: Safety background, principles of safety management, development and growth of safety movement, safety principles, policy, safety inspection, planning, safety measures in manufacturing industry, employee participation in safety, safety and productivity, regulatory agencies and statutory bodies dealing with safety in India and abroad, safe rigging practice and standard crane signals.

UNIT – II: CONSTRUCTION SAFETY
Safety appliances- in transport, road safety, ladder- types, safety practices and checklist; scaffoldings approaches, excavations, road work, machinery, hoists, Electricity- checklist for temporary electrical connections, shuttering and shoring, hazards of construction site, Personal Protective Equipment (PPE), safety with lifting machines, safety procedures for working at height, checklist for working at height, construction safety management checklist.

UNIT – III: INDUSTRIAL SAFETY
Types of accidents in Industry, effects of accidents on human body, accident prevention Environmental factors in industry Industrial hazards- classification of hazards, hazard management program, Machine Guarding Industrial Fatigue- types of fatigue, effects of fatigue, circadian rhythms, factors affecting fatigue, managing and mitigation of fatigue.

UNIT – IV: ERGONOMICS
Origin and development of ergonomics, Boundaries for ergonomics, ergonomics considerations, principles, objectives, role of an ergonomist, identification of ergonomics problems, ergonomics and workplace- workplace contributing factors, ergonomic improvement, identify poor posture and risks, ergonomics education and training.

UNIT – V: FIRE SAFETY
Stages of fire, fire triangle, fire tetrahedron, smoldering, ignition process, fire properties of materials used in construction, testing for resistance to fire, passive fire protection, fire escapes

routes and refuge, detectors types based on effects, Selection of detectors, alarm systems, fire alarm systems and control panels, principles of operations, types of fire extinguishers, water based fixed fire protection systems.

TEXT BOOKS:
1. A.K Gupta "Industrial safety and Environment"; University science press publication 2nd Edition.
2. Akhil Kumar Das "Principles of Fire safety Engineering"; PHI learning Private limited publications; 2016.
3. R.K Mishra "Construction Safety"; AITBS Publishers, 2nd Edition, 2017.

REFERENCES:
1. L.M. Deshmukh" Industrial safety management"; Publishers: Tata Mcgraw Hill,New Delhi; 1st Edition.
2. Birendra Mohan "Fire Protection and Prevention", UBS Publishers & Distributors Pvt Ltd. 2011 Edition.

L	T	P	Cr.
0	0	3	1.5

B.Tech. (V Sem.)   **20CE60 - ENVIRONMENTAL ENGINEERING LAB**

Prerequisites: Applied Chemistry Lab

Course objectives:

This course deals with the laboratory approaches of determining certain major parameters related to water and wastewater quality and analyzing the laboratory data with respect to permissible limits and field conditions.

Course Out comes: At the end of the course, the student will be able to:

CO1: Understand the underlying principles of operation, perform the different laboratory techniques for examining the raw water quality parameters and comment on the results obtained (Apply-L3)

CO2: Understand the underlying principles of operation and perform the different laboratory techniques for examining the wastewater quality parameters and comment on the results obtained. (Apply-L3)

List of Experiments
(Any of the 10 experiments are required to be conducted)

1. Determination of pH value and Conductivity.
2. Determination of Turbidity and TDS of water sample.
3. Determination of Total, temporary and permanent hardness of water sample.
4. Determination of Calcium hardness of water sample.
5. Determination of Chloride concentration of water sample.
6. Determination of Acidity of water sample.
7. Determination of Alkalinity of water sample.
8. Determination of Dissolved Oxygen of water sample.
9. Determination of Optimum dose of coagulant.
10. Determination of Settleable solids using Imhoff cone in sewage sample.
11. Determination of Suspended, fixed and volatile solids in sewage sample.
12. Determination of Total, fixed and volatile solids in sewage sample.
13. Determination of Fluorides in water sample.
14. Determination of Sulphates in water sample.

TEXTBOOK/REFERENCES

Laboratory Manual developed by Civil Engineering Department.

		L	T	P	Cr.
B.Tech. (V Sem.)	**20CE61 - GIS AND COMPUTER APPLICATIONS LAB**	0	0	3	1.5

Pre-requisites: Remote Sensing and GIS applications, Core Civil Engineering Subjects, C Programming

Course Educational Objective:
 The course is designed to introduce GIS software and apply GIS software to simple problems in civil engineering problems. It also involves in developing coding in C language for civil engineering problems and analyzing the results.

Course Outcomes:
At the end of the course the student will be able to
CO1: Digitize and create thematic map and extract important features using GIS software.(Apply-L3)
CO2: Analyze and Interpret the maps created using GIS for specific applications.(Apply-L3)
CO3: Develop coding for civil engineering problems and analyze the results.(Apply-L3)

List of Experiments
(Any of the 10 experiments are required to be conducted: Any 4 from Part-A & Any 6 from Part-B)

PART-A: EXCERCISES IN GIS
1. Digitization of Map/Topo sheet
2. Creation of thematic maps.
3. Estimation of features and interpretation
4. Developing Digital Elevation model
5. Simple applications of GIS in Civil Engineering.

GIS SOFTWARES:
1. Arc GIS/QGIS

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PART-B: EXCERCISES IN COMPUTER APPLICATIONS
1. Design of sedimentation tank.
2. Determination vertical stress distribution in soil.
3. Design of Triangular-, Rectangular- and trapezoidal notch.
4. Design of Open Channel.
5. Determination of engineering properties of soils.
6. Design of singly reinforced beam.
7. Design of compression member.
8. Design of Pavement.

TEXT BOOK/REFERENCES
Laboratory manual developed by Civil Engineering Department.

	L	T	P	Cr.
B.Tech. (V Sem.) **20CES2 - COMPUTER AIDED BUILDING DRAWING LAB**	1	0	2	2

Pre-requisites: Computer based engineering drawing lab and Building materials.

Course Educational Objective: The course aims to draw different types of doors, windows and trusses using AutoCAD. The student is asked to develop and draw plan, elevation and section for different types of buildings. The student will draw a few 3D civil engineering elements.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Sketch the different sign conventions used in building drawing (Apply-L3)
CO2: Draw different views of buildings with a suitable scale (Apply-L3)
CO3: Develop 3-D view of building and staircase. (Apply-L3)

List of Experiments
(Any of the 10 experiments are required to be conducted)

1. Conventional symbols
2. English bond and Flemish bond
3. Fully Panelled Door &Window
4. Panelled and glazed door with wooden panel
5. King post and Queen post trusses
6. Single floor residential building - Plan, Elevation and Cross section
7. Storied residential building- Plan, Elevation and Cross section
8. Public building- Plan, Elevation and Cross section
9. Institutional building- Plan, Elevation and Cross section
10. Foundations- Footings
11. Steel roof truss
12. 3D view of a single floor residential building
13. 3D view of a dog legged stair case
14. 3D view of a spiral stair case

REFERENCES
1. K. Kumaraswamy and A. KameswaraRao "Building Planning and Drawing", Charotar Publications, 2014.
2. Shah M.G. Kale C.M. &Patki S.Y., "Building Drawing with an Integrated Approach to Built Environment", 4th edition, Tata McGraw Hill Publishing Co. Ltd. New Delhi – 2002.

IS Codes
1. IS: 962 – 1967 Code of Practical for Architectural and Building Drawing
2. IS: 4021 – 1983 Specification for Timber Door, Window and Ventilator Frames
3. IS: 6523 – 1983 Specification for Precast Reinforced Concrete Door and Window Frames

	L	T	P	Cr.
B.Tech. (VI Sem.)　　　**20CE18 - HIGHWAY ENGINEERING**	3	0	0	3

Pre-requisites: NIL

Course Educational Objective:

The course aims to explore the students with elements of highway engineering like geometric elements, sight distances and gradients, properties of various highway materials and construction. The student will be able to design the various types of pavements and can easily control traffic generate on the highways.

Course Out comes: At the end of the course, the student will be able to:

CO1: Understand the basic parameters of highway planning, geometric elements of highway and traffic studies (Understand-L2)

CO2: Determine the geometric elements of highway alignment and pavement like flexible and rigid pavement. (Apply-L3)

CO3: Identify the suitability of appropriate highway materials based on their properties (Understand-L2)

CO4: Design the pavement thickness and elements of highway (Apply-L3)

CO5: Understand the fundamentals of highway maintenance and traffic management (Understand-L2)

UNIT-I: HIGHWAY PLANNING AND ALIGNMENT

History of road development in India – Jayakar committee recommendations - Institutions for Highway planning design and implementation at different levels – Road patterns - Engineering Surveys for Alignment –IRC classification of urban and rural roads –Preparation of detailed Project report-- Highway cross sectional elements – Right of way, Carriage way, Camber, Kerbs, Shoulders and Footpaths.

UNIT-II: GEOMETRIC ELEMENTS

Geometric Standards – Super elevation, widening of pavements and Transition curves – Ruling, Limiting, Exceptional and Minimum Gradients – Sight Distance – Factors affecting Sight Distance – PIEV Theory – Stopping Sight Distance (SSD) – Overtaking Sight Distance (OSD) – Sight Distance at Intersection Geometric Design of Hill Roads.

UNIT-III: HIGHWAY MATERIALS AND CONSTRUCTION

Sub grade soil - Aggregates - Bituminous materials – Desirable properties – California Bearing Ratio Test and Field Density Test for soil – Crushing, Abrasion and Impact Test for aggregates – Penetration, Ductility, Viscosity, Binder content and Softening point Test for bitumen Construction of Earth, Gravel, WBM, Bituminous and Cement Concrete roads as per IRC and MORTH specifications.

UNIT-IV: HIGHWAY DESIGN AND MAINTENANCE

Design principles of Flexible and Rigid Pavements – Design of Flexible pavement (CBR method, IRC Recommendations – Problems) Design of Rigid Pavement (IRC Recommendations – Problems), Defects in flexible pavements – surface defects, cracks, deformation, disintegration – symptoms, causes and treatments. Failures in rigid pavements – scaling, shrinkage, warping, structural cracks, spalling of joints and mud pumping – special repairs.

UNIT-V: TRAFFIC ENGINEERING AND MANAGEMENT

Basic Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies- Data Collection and Presentation-Speed studies- Data Collection and Presentation- Parking Studies and Parking characteristics- Road Accidents-Causes and Preventive measures- Accident Data Recording – Condition Diagram and Collision Diagrams - Road Traffic Signs – Types and Specifications – Road Markings-Need for Road Markings-Types of Road Markings.

TEXT BOOKS

1. S.K. Khanna, and Justo, "Highway Engineering", Nem Chand and Bros, Roorkee, 10th edition, 2014.
2. L.R. Kadiyali, "Traffic Engineering and Transport Planning", Khanna Publishers, 8th Edition, 2013.

REFERENCES

1. Kadiyali,L.R.,"Principles and Practice of Highway Engineering", Khanna Publishers Ltd. New Delhi, 4th Edition, 2004.
2. G. Venkatappa Rao, "Principles of transportation and Highway Engineering", Tata McGraw Hill Publishing Co. Ltd. New Delhi, 2000.
3. Introduction to Transportation Engineering, NPTEL video lectures and web notes.

	L	T	P	Cr.
B.Tech. (VI Sem.) **20CE19 - DESIGN OF STEEL STRUCTURES**	2	1	0	3

Pre-requisites: Strength of Materials-I, Strength of Materials-II, and Structural Analysis

Course Educational Objectives:
      This course serves as introduction to the concepts of structural steel design using IS 800 design code. It deals with the design of individual members and connections, such as, the design of tension members, compression members, beams, and beam columns; roof trusses and bolted, welded, and connections. The primary objective is to equip the students with the tools necessary for designing steel structures and to familiarize them with there levant national design codes.

Course outcomes: At the end of the course, the student will be able to:

CO1: Identify the different structural steel elements such as steel members, loads on steel members, various steel connections, beams, tension and compression members, purlins, columns, truss elements, their relevant guidelines listed in appropriate Code books and their connection details (Understand-L2)

CO2: Design the different types of connections in steel members, compression and tension members.(Apply-L3)

CO3: Design the beams, column bases and built-up columns (Apply-L3)

CO4: Design the roof trusses and their components (Apply-L3)

UNIT-I:DESIGN OF STEEL CONNECTIONS
Introduction: Fundamental Concepts of design of structures, Different types of rolled steel sections available to be used in steel structures. I.S specifications, Stress Strain relationship for steel.

Bolted Connections: Failure of a joint, Strength and efficiency of a joint and Design of Bearing type bolted joints subjected to axial load, Eccentric bolted connections.

Welded Connections: Types of welds, stresses in welds, Design of welded joints subjected to axial load, Eccentric welded connections.

UNIT-II: DESIGN OF TENSION AND COMPRESSION MEMBERS
Design of Tension Members : Introduction, types of tension members, net sectional areas, design of tension members, lug angles and splices.

Design of Compression Members: Introduction, effective length and slenderness ratio, various types of sections used for columns, design of eccentrically loaded compression members.

UNIT-III:DESIGN OF BEAMS
Introduction, types of sections, general design criteria for beams, design of laterally supported and unsupported beams, Design of built-up sections, Curtailment of flange plates, web buckling, web crippling.

UNIT-IV: BUILT UP COLUMNS AND COLUMN BASES
Built-Up Columns: Necessity, design of builtup columns, laced and battened columns including the design of lacing and battens.

Column Bases: Introduction, types of column bases, design of slab base and gusseted base, design of gusseted base subjected to eccentrically loading.

UNIT-V: ROOF TRUSSES

Types of trusses, Economical spacing of roof trusses, loads on roof trusses, Estimation of wind load on roof trusses as per IS:875. Design of members of roof truss and joints, Design of purlins.

TEXTBOOKS

1. N.Subramanian,"DesignofSteelStructures",OxfordUniversityPress,2nd Edition,2011.
2. S.K.Duggal, "DesignofSteelStructures",TataMcGrawHill,NewDelhi,3rdEdition,2017.

REFERENCES

1. S.S.Bhavikatti,"DesignofSteelStructures",I.K.InternationalPublishingHousePvt.Ltd,4rdEdition, 2014.
2. V.L.Shah and Veena Gore; "Limit State Design of steelstructuresIS:800-2007"-, StructuresPublications,1st edition.
3. Design of Steel Structures, NPTEL video lectures and web notes

ISCODES

1. IS-800–2007
2. IS-875(Part-III)
3. Steel Tables.

These codes and steel tables are permitted in the examinations.

L	T	P	Cr.
2	1	0	3

B.Tech. (VI Sem.)   20CE20 - ESTIMATION AND QUANTITY SURVEYING

Pre-requisites: Construction Management, DRCS-I, DRCS-II, Transportation Engineering-I, Transportation Engineering–II, Building Materials and Construction, and Foundation Engineering.

Course Educational Objective:
The course aims to provide the basic principles of estimating the quantities in building, roads and canals. The course also provides details about the procedures and practices for writing specifications, preparation of analysis of rates and procedural aspects of valuating the property.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Understand the different items of work in Estimation of buildings, Deductions, Depreciations/Net values, RCC works and Roads. (Understand-L2)
CO2: Estimate the quantities of buildings, RCC works, Roads and canals. (Apply-L3)
CO3. Compute the rates of items of work and write the specifications of the civil works. (Apply-L3)
CO4: Analyze and document the value of property as per the prevailing regulations and PWD procedures. (Apply-L3)

UNIT - I
Estimate of Buildings:
Methods of estimating; Main items of work; Deduction for openings; Degree of accuracy; Units of measurement.
Methods of Building Estimates:
Individual wall method; Centre line method; Arch masonry calculation; Estimate of steps.
Estimate Of Residential Building:
Estimate of a building from line plan.

UNIT- II
Estimate of RCC Works and Roads:
Standard hooks and cranks; Estimate of RCC slab; RCC beam; RCC T–beam slab and RCC column with foundation.
Road Estimating:
Estimate of earthwork; Estimate of pitching of slopes; Estimate of earthwork of road from longitudinal sections; Estimate of earthwork in hill roads.

UNIT- III
Canal Estimate:
Earthwork in canals–different cases; Estimate of earthwork in irrigation channels.
Specifications:
Purpose and method of writing specifications; General specifications. Detailed Specifications for Brick work; R.C.C; Plastering; Mosaic Flooring; R.R.Stone Masonry.

UNIT- IV

Analysis of Rates:

Task or out – turn work; Labour and materials required for different works; Rates of materials and labour; Preparing analysis of rates for the following items of work: i) Concrete ii) RCC Works iii) Brick work in foundation and super structure iv) Plastering v) CC flooring vi) White washing. Standard Schedule of Rates.

PWD Accounts and Procedure of Works:

Organization of Engineering department; Work charged establishment; Contract; Tender; Tender notice; Tender Schedule; Earnest money; Security money; Measurement book; Administrative approval; Technical sanction; Plinth area; Floor Area; Carpet area; Approximate Estimate; Plinth area estimate; Revised Estimate; Supplementary estimate.

UNIT-V

Valuation:

Cost; Price & value; Methods of valuation; Out goings; Depreciation; Methods for estimating cost depreciation; Valuation of building.

Miscellaneous Topics:

Gross income; Net income; Scrap value; Salvage value; Obsolescence; Annuity; Capitalized value; Years purchase; Life of structures; Sinking fund; Standard rent; Process of fixing standard rent; Mortgage.

TEXT BOOKS

1. B.N. Dutta "Estimating & Costing in Civil Engineering", U. B. S. Publishers & Distributors, New Delhi. 2002.
2. S. C. Rangwala "Valuation of Real properties", Charotar Publishing House, 9thEdition, 2015.

REFERENCES

1. M Chakraborthy, "Estimating, Costing Specification and Valuation", 2006.

L	T	P	Cr.
3	0	0	3

B.Tech. (VI Sem.)   **20CE21 - ADVANCED DESIGN OF REINFORCED CONCRETE STRUCTURES (PROGRAM ELECTIVE-II)**

Pre-requisites: Applied Mechanics, Strength of Materials, Structural analysis, and Design of Reinforced Concrete Structures.

Course Educational Objectives:
This course deals with design of deep foundations, different types of slabs, stair case and retaining walls along with water tanks.

COURSE OUTCOMES: At the end of the course, the student will be able to-
CO1: Understand the prevailing IS Code provisions for the design of Pile grouping and Foundations, different Slabs, Stairs, Cantilever Retaining Walls, and Water Tanks (Understand – L2).
CO2: Design the different components under Pile Foundations (Apply-L3).
CO3: Design the different components of different slabs and Stairs (Apply-L3).
CO4: Design the different components of cantilever retaining walls and Water tanks. (Apply-L3).

UNIT-IDESIGNOFPILE FOUNDATIONS
Pile Foundation-Introduction-Types- IS-Code Provisions-Pile Design and Pile grouping.

UNIT-IIDESIGNOFSLABS
Yield line theory–Design of circular, flat and grid slabs with different boundary conditions subjected to UDL.

UNIT-III DESIGNOFSTAIRS
Design of stairs spanning horizontally– Design of doglegged stair.

UNIT-IVDESIGN OF CANTILEVER RETAINING WALLS
Types of retaining walls, Forces on retaining walls; Stability requirements; Design and detailing of cantilever type retaining wall.

UNIT-VDESIGNOF WATER TANKS
Introduction–RCC Rectangular and Circular water tanks–design of surface and underground water tanks.

TEXTBOOKS
1. Punmia B.C, Ashok Kumar Jain ,Arun Kumar Jain "Comprehensive RCC Design "Laxmi publications(P)Ltd, New Delhi, 1998
2. Krishnaraju.N, "Advanced Reinforced Concrete design", CBS Publishers & Distributors, New Delhi,1988.

REFERENCES

1. P.C Varghese, "Limit State Design of Reinforced Concrete", Prentice Hall of India Pvt., Ltd., New Delhi, 2008
2. P.C Varghese, "Advanced Reinforced Concrete Design", Prentice Hall of India Pvt., Ltd., New Delhi, 2005.
3. Ashok K. Jain, "Reinforced Concrete Limit State Design", 4th Edition Nem Chand & Bros, Roorkee, 2012.
4. Advanced Structural Design and Design of Concrete Structures, NPTEL web notes.

ISCODES:

1. IS456-2000: Plain and reinforced concrete
2. IS2911: Pile Foundation-Under reamed piles
3. IS456, IS 3370, IS 800 and SP-16 Interaction charts are permitted in the Exam

L	T	P	Cr.
3	0	0	3

B.Tech. (VI Sem.) 　　　**20CE22 - CONSTRUCTION MANAGEMENT**
(PROGRAM ELECTIVE-II)

Pre-requisites: Building Materials and Constructions

Course Educational Objective:
　　　This course aims to get exposure to management of various projects and financial facilities, and to plan and organize for any project. The course also provides proper utilization of equipments, materials and labor, the procedure of scheduling, the programming of any project by network analysis.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Identify the project characteristics, planning, organization and various stages of a project. (Remember-L1)
CO2: Develop the abilities in project scheduling, controlling & evaluation techniques like PERT, CPM etc. while dealing with a project (Apply-L3)
CO3: Discern the principles of material management, equipment and labour management, inventory and productivity. (Understand-L2)
CO4: Describe the fundamental elements of contracts and material procurement. (Understand-L2)

UNIT-I: CONSTRUCTION PROJECT MANAGEMENT: Introduction – Project Life Cycle – Major Types of construction – Selection of professional services – Construction contractors – Financing of constructed facilities – Legal & Regulatory requirements – Role of project managers

UNIT-II: PROJECT PLANNING & ORGANIZATION: Development of project plan, objective and conception– Programming – Scheduling – Project Organization – Project budget fund flow statement – Controlling system

UNIT-III: LABOUR, MATERIAL & EQUIPMENT UTILIZATION: Introduction – Labour Productivity – Factors affecting job site productivity – Materials Management – Material procurement & Delivery – Inventory control – Plant & Equipment management

UNIT-IV: NETWORK ANALYSIS: Introduction – Basic concepts of network analysis – CPM and PERT – Use of CPM & PERT Techniques – Problems, prospects and applications of CPM & PERT – Introduction to software applications in project Management

UNIT-V: CONTRACTS: Introduction – Types of Contract – Contract document – Specifications – Important conditions of contract – Tender and tender document – Deposits by the contractor – Arbitration – M. Book, R.A Bills & Advances – Muster Roll – e-Procurement.

TEXT BOOKS

1. S. Sanga Reddy and Meyyappan, "Construction Management", Kumaran Publications, 2009 Edition.
2. B.C. Punmia, "Project Planning and Control with PERT and CPM", Laxmi Publications, New Delhi, 1987.

REFERENCES

1. K.K. Chitkara, "Construction Project Management", Tata McGraw Hill Publishing Co, Ltd., New Delhi, 1992.
2. L.S. Srinath, "PERT & CPM: Principles and Applications", Affiliated East-West Press, 3rd Edition, 2001.
3. Construction Planning and Management & Construction and Contract Management, NPTEL.

	L	T	P	Cr.

B.Tech. (VI Sem.)

20CE23 - LOW COST ECO FRIENDLY BUILDING TECHNIQUES
(PROGRAM ELECTIVE-II)

L	T	P	Cr.
3	0	0	3

Pre-requisites: Nil

Course Educational Objectives:
The course provides the knowledge on traditional and eco-friendly materials, Eco friendly and cost effective technologies, Eco-friendly building materials, rural housing approaches in disaster prone areas.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Recall the concepts of traditional building materials and identify the appropriate eco-friendly building materials for construction. (Remember-L1)
CO2: Understand the current developments of building technologies in foundations, walls and roofs. (Understand-L2)
CO3: Describe prefabrication techniques and assess the wind effects on low rise buildings. (Understand-L2)
CO4: Illustrate the construction of houses in rural areas and disaster-prone areas. (Understand-L2)

UNIT-I:
Traditional Building Materials:
Introduction-housing scenario in India, Traditional building materials-stabilized soil bricks, improved mud and thatch, burnt and un burned bricks, laterite-lime bricks, sand-lime blocks, stone block masonry units, bamboo, hollow cement blocks, light weight concrete blocks, wood-cement products, fly ash bricks, cementitious binder from rice husk, lime based binders.

UNIT-II:
Eco-Friendly Building Materials:
Basics and practical applications of locally available building materials- Soil, Fly ash, Ferrocement, Lime, Fibers, Stone Dust, Red mud, Gypsum, Alternate Wood, Polymer-ADOBE, Light Clay, Straw-Bale, Bamboo, Agro-Industrial Waste, Innovative materials developed by CBRI, SERC, Structural Properties of Alternate Building Materials, Earthen Finishes, Earth Plasters, Earth Floors.

UNIT-III:
Improved Building Technologies
Foundations:
Introduction, types of soli, types of foundations, permissible settlements, soil investigations.
Walls:
Introduction, stabilized earth wall construction, building blocks (lato blocks) from lateritic soil, brick masonry walls, cellular concrete blocks, hallow concrete blocks, shell type houses made of hallow clay blocks, pre-cast concrete panels.
Roofs:
Introduction, catenary hollow clay blocks/brick shell roofs, pre cast reinforced concrete-channel units-cored units, roofing system with cellular unit, cellular light weight concrete roofing system.

UNIT-IV:
Pre-fabrication:
Introduction, advantages of pre-fabrication, areas where prefabrication techniques can be introduced, joints in pre cast concrete structures.
Wind effects on low rise buildings:
Introduction, wind structure interaction concepts, codal provision, housing in cyclone prone areas, cyclone resisting core units.

UNIT-V:
Rural housing:
Introduction, traditional practice of rural house construction, appropriate rural housing technology, mud housing technology, mud roofs, characteristics of mud, fire retardant treatment for trench roof.
Housing in disaster prone areas:
Introduction, traditional houses in disaster prone areas, types of damages failures of non engineered buildings, repair and rehabilitation of earthquake damaged non engineered buildings, recommendations for feature construction.

TEXT BOOKS:
1. A.G.Madhav rao, D.S.Ramach and ramurthy, "Appropriate technologies for low cost housing", Oxford & IBH Publishing, 1996.
2. A K Lal, "Handbook of Low-Cost Housing", New Age Publishing, 1995.

REFERENCES:
1. N. Kumara Swamy and A. Kameswara Rao, "Building Planning and Drawing", Charotar Publications, 2013.
2. S K Duggal, "Building materials", New Age International Publishers. 2012.

	L	T	P	Cr.
B.Tech. (VI Sem.) **20CE62 - QUANTITY ESTIMATION AND PROJECT MANAGEMENT LAB**	0	0	3	1.5

Prerequisite: Estimation and Quantity Surveying.

Course Educational Objective:

The course enables to learn about software tools for calculating the quantities and estimating the cost of different structures. It also provides managing the project by using software tools.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Compute and document the quantities for different items of civil engineering using software tools. (Apply-L3)

CO2: Implement the project for execution of civil engineering projects through systematic planning. (Apply-L3)

List of Experiments

(Any of the 10 experiments are required to be conducted)

CYCLE-1: Quantity Surveying *(At least **FOUR** of the following using software such as MS Excel/ Qty./Road Estimate/Super Rate analysis etc.)*

1. Quantity estimation of a single storey residential building (different items).

2. Cost estimation of a single storey residential building.

3. Quantity estimation of a B.T.Road (different items).

4. Cost estimation of a B.T.Road.

5. Quantity estimation of a Canal (different items).

6. Cost estimation of a Canal.

CYCLE-2: *(At least **THREE** of the following by using software such as MS Excel)*

1. Quantity estimation of RCC roof slab and preparing schedule of bars

2. Quantity estimation of RCC beam and preparing schedule of bars

3. Quantity estimation of RCC Column with foundation footing and preparing schedule of bars

4. Quantity estimation of RCC retaining wall and preparing schedule of bars.

CYCLE-3: Project Management *(Any **THREE** of the following using software such as MS Project / Primavera etc.)*

1. Preparing the Project management report for a single storey residential building/Road/Canal by using the Bar Chart/Mile stone chart.

2. Preparing the Project management report for a single storey residential building by using the network technique (PERT/CPM).

3. Preparing the Project management report for a B.T.Road by using the network technique (PERT/CPM).

4. Preparing the Project management report for a Canal by using the network technique(PERT/CPM).

Text Book/Reference Books:

Laboratory Manual prepared by Civil Engineering Department.

L	T	P	Cr.
0	0	3	1.5

B.Tech. (VI Sem.)   **20CE63 - HIGHWAY ENGINEERING LAB**

Pre-requisites:

Course Educational Objective:
The course aims to identify the properties of different materials used in highway construction and makes students to identify the grades of materials.

Course Outcomes: At the end of the course, the student will be able to-
CO1: Categorize and analyze the properties of road aggregates (Apply-L3)
CO2: Determine and analyze the properties of bitumen (Understand-L2)
CO3: Determine the suitability of aggregates and bitumen for pavement designs (Understand-L2)

List of Experiments
(Any of the 10 experiments are required to be conducted)

TESTS ON ROAD AGGREGATES:
1. Aggregate Crushing value.
2. Aggregate Impact Test.
3. Specific Gravity and Water Absorption.
4. Attrition Test.
5. Abrasion Test.
6. Shape tests.

TESTS ON BITUMINOUS MATERIALS:
1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Flash and fire point tests.
5. Bitumen content by centrifugal extractor.
6. Specific gravity of bitumen.
7. Viscosity of bitumen.

Textbook/Reference Books:
Laboratory Manual prepared by Civil Engineering Department.

L	T	P	Cr.
0	0	3	1.5

B.Tech. (VI Sem.) **20CE64 - COMPUTER AIDED ANALYSIS AND DESIGN LAB**

Pre-requisites: Reinforced concrete structures, Design of steel structures, Auto CAD

Course Educational Objective: To impart hands-on experience in design and preparation of structural drawings for concrete / steel structures normally encountered in Civil Engineering practice.

Course outcomes: At the end of the course, the student will be able to-
CO1: Apply structural analysis software to analyze and design the beams, 2D and 3D frames (Apply-L3)
CO2: Design the retaining walls and foundations using STAAD Pro (Apply-L3)
CO3: Draw the details of RCC and steel structural elements suing AutoCAD. (Apply-L3)

List of Experiments
(Any of the 10 experiments are required to be conducted)

Part-A
Any **four** experiments using AutoCAD (2 from DRCS, 2 from DSS)
DRCS
1. Reinforcement particulars of T-beams and L-beams.
2. Reinforcement detailing of continuous beams.
3. Reinforcement particulars of columns.
4. Detailing of One way, two way and continuous slabs.

DSS
1. Detailing of Compound beams including curtailment of flange plates.
2. Detailing of Column including lacing and battens.
3. Detailing of steel roof trusses including particulars at joints.
4. Detailing of beams including curtailment of flange plates.

Part-B
SOFTWARE: STAAD Pro or Equivalent
Note: A minimum of **6 no**. shall be done and recorded
1. Analysis and Design of different beams.
2. 2-D Frame Analysis and Design
3. 3-D Frame Analysis and Design
4. Design and analysis of multi-storied building
5. Analysis of plane/space truss
6. Design of a different types of Retaining Walls
7. Foundation Design
8. Wind Analysis of tall towers / buildings.

TEXT BOOKS
1. N. Subramanian, Design of Steel Structures, Oxford University Press, 2016.
2. Varghese, "Limit State Design of Reinforced Concrete", Prentice Hall of India Pvt., Ltd., New Delhi, 2002

REFERENCES
1. S.K.Duggal, Design of Steel Structures –Tata McGraw Hill, New Delhi, 2017.
2. Unni Krishnan Pillai and Devdas Menon, "Reinforced concrete design", Tata McGraw Hill Publishing company Ltd, New Delhi, 1998

L	T	P	Cr.
1	-	2	2

B.Tech. (VI Sem.)　　　　**20HSS1 - SOFT SKILLS COURSE**

Course Educational Objectives:
The Soft Skills Laboratory course equips students with required behavioral, interpersonal & Intrapersonal skills, communication skills, leadership skills etc. It aims at training undergraduate students on soft skills leading to enhanced self-confidence, esteem, and acceptability in professional circles.

Course Outcomes (COs): At the end of the course, student will be able

CO1: To Develop self-awareness and personality traits for professional growth
(Understand – L2)
CO2: Work effectively in multi-disciplinary and heterogeneous teams through knowledge of teamwork, Inter-personal relationships, conflict management and leadership quality.
(Apply – L3)
CO3: Communicate through verbal/oral communication with good listening skills and empathy
(Apply – L3)
CO4: Apply skills required to qualify in recruitment tests, Interviews & other professional assignments (Apply – L3)

Personality Development Skills
 Role of language in Personality – How language reflects, impacts Personality – Using gender-neutral language in MNCs – being culturally-sensitive-Personality Traits - Grooming & Dress code
Activities: Group Discussion/Role play/Presentations (authentic materials: News papers, pamphlets and news clippings)

Impactful Communication
Activities : Extempore / Story Telling/ Group Discussion (Case studies/Current affairs etc.)/ Elocution on Interpretation of given quotes/ Critical Appreciation and Textual Analysis/ Writing reviews on short story/videos/book/Social Media profiling/ Pronunciation Practice

Professional Skills:
Career Planning- job vs. career- goal setting- SWOT analysis-Time management – self-management – stress-management.
Activities: SWOT analysis of the self/Goal setting-Presentation/Writing Report/Listening exercises/Effective Resume-Writing and presentation/ Interview Skills: Mock interviews/Video samples.

REFERENCES :
1. Edward Holffman, "Ace the Corporate Personality", McGraw Hill,2001
2. Adrian Furnham, Personality and Intelligence at Work, Psyc 2. hology Press, 2008.
3. M.Ashraf Rizvi, "Effective Technical Communication", 1 st edition, Tata McGraw Hill, 2005
4. Ace of Soft skills Gopalaswamy Ramesh, Pearson Education India, 2018
5. Soft Skills for the Workplace, Goodheart-Willcox Publisher · 2020.
6. How to Win Friends and Influence People, Dale Carnegie · 2020

L	T	P	Cr.
3	0	0	3

B.Tech. (VII Sem.)   **20CE24 - PRE-STRESSED CONCRETE**
(PROGRAM ELECTIVE –III)

Prerequisites: DRCS -I

Course Objectives: The course deals with understanding of the basic concepts of Prestressing, and the principles involved in the various methods of pre stressing systems. The course also addresses evaluation of the losses in pre tensioned and post tensioned members, transfer of prestresses in pre tensioned members, Analysis and design of members subjected to flexure, Shear and Torsion.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Describe the basic concepts and general mechanical behavior of prestressed concrete, available IS Codes, and various methods of prestressing. (Understand - L2)
CO2: Perform analysis and compute various types of losses (Apply - L3).
CO3: Design the prestressed members for flexural resistance (Apply - L3)
CO4: Design the prestressed members for shear and torsional resistance. (Apply - L3)
CO5: Estimate the transfer of prestresses in pre tensioned members as per Codal provisions (Understand - L2)

UNIT - I: BASIC CONCEPTS OF PRESTRESSING
Introduction to prestressed concrete: Advantages and Applications of Prestressed Concretes, High Strength Concrete- Permissible Stresses, Shrinkage, Creep, Deformation Characteristics, High strength Steel- Types, Strength, Permissible Stresses- Relaxation of Stress, Stress Corrosion- Durability, Fire Resistance, Cover Requirements.

UNIT - II: PRESTRESSING SYSTEMS
Introduction and Methods of prestressing: Introduction, Tensioning devices, Pre-tensioning Systems, Post tensioning Systems, Basic Assumptions in Analysis of prestress and design, Analysis of prestress, Resultant Stresses at a section- pressure line- Concepts of load balancing- Stresses in Tendons, Cracking moment.

UNIT - III: LOSSES OF PRESTRESSING
Introduction to losses of prestress: Loss of Pre-stress in pre-tensioned and post tensioned members due to various causes – Elastic shortening of concrete, shrinkage of concrete, creep of concrete, Relaxation of steel, slip in anchorage, differential shrinkage- bending of members and frictional losses-Total losses allowed for design.

UNIT - IV: DESIGN FOR FLEXURAL RESISTANCE
Types of flexural failure – Code Procedures-Design of sections for flexure- Control of deflections Factors influencing-Prediction of short term and long term deflections.

UNIT - V: DESIGN FOR SHEAR AND TORSION
Shear and Principal Stresses- Design of Shear reinforcements- Codal Provisions- Design for Torsion, Design for Combined bending, shear and torsion.
TRANSFER OF PRESTRESS IN PRE TENSIONED MEMBERS:- Transmission length- Bond stresses- end zone reinforcement- Codal provisions- Anchorage zone, Stresses in Post tensioned members- Stress distribution in end block- Anchorage Zone reinforcement.

TEXT BOOKS

1. N. Krishnaraju, "Prestressed Concrete", Tata McGraw Hill Publishing Co.,Ltd., New Delhi,2015.
2. N.Rajagopalan, "Prestressed Concrete", Narosa Publishing House, New Delhi, 2010.

REFERENCES

1. P Dayaratnam, "Prestressed Concrete Structures", Oxford and IBH, New Delhi, 2017.
2. James R.Libby, "Modern Prestressed Concrete", Design principles and Construction methods Van Standard Rainford Co., New York, 2007.
3. Lin.T.Y, and Ned. H.Burns, "Design of Prestressed Concrete Structures", John Wiley & Sons, New York, 2010.
4. M.C Sinha and S.K Roy. "Fundamentals of Prestressed Concrete", S.Chand & Company Ltd, New Delhi, 2011.
5. Arthur H.Nilson, "Design of Prestressed Concrete", John Wiley & Sons, New York, 1978.
6. Prestressed Concrete Structures, NPTEL video lectures.

IS Codes

1. IS 1343: 2012 Code of Practice for Pre Stressed Concrete
2. IS 3370(Part 3): 2013 Code of Practice for Concrete Structures for the Storage of Liquids-Part 3 Prestressed Concrete
3. IS 3370(Part 4): 2013Code of Practice for Concrete Structures for the Storage -Part 4

NOTE : These codes are permitted in the End Examinations

	L	**T**	**P**	**Cr.**
B.Tech. (VII Sem.) 20CE25 - ENVIRONMENTAL POLLUTION CONTROL	3	0	0	3

B.Tech. (VII Sem.)   20CE25 - ENVIRONMENTAL POLLUTION CONTROL (PROGRAM ELECTIVE –III)

Prerequisites: Environmental Studies

Course Objectives: This course deals with importance of meteorology on air pollution, dispersion of air pollutants, air pollution control techniques, impacts of noise pollution on society and reduction of noise pollution. The course also addresses the solid waste management in the society, impacts of hazardous waste flow in society and application of environmental management principles to develop solutions to major environmental problems.

Course Outcomes
CO1: Describe the fundamentals aspects associated with the generation of air, noise, and solid waste pollution in the society (Understand – L2).
CO2: Illustrate the technical aspects of hazardous waste generation and environmental management issues (Understand-L2).
CO3: Compute the air pollutant levels from various sources, their dispersions, and calculate the sizing of air pollution control equipment (Apply-L3).
CO4: Compute the noise pollution levels from various sources and apply the basic principles to control noise pollution (Apply-L3).
CO5: Compute the solid waste generation from various sources and calculate the properties, sizing for treatment and disposal options from solid waste (Apply-L3).

UNIT-I: AIR POLLUTION – METEOROLOGY & DISPERSION
Air pollution: Concept – Primary and secondary pollutants, Properties, Units of measurement-Simple problems
Meteorology and Dispersion: Effect of Pressure, Temperature, Wind, Valley effect, Sea-land effect, Wind rose, Lapse rates, Inversion, Plume behavior - Determination of stack height-Simple problems for estimation of stack height, Plume rise and dispersion-Gaussian plume dispersion model – Calculations.

UNIT-II: AIR POLLUTION CONTROL TECHNIQUES
Control techniques: *For particulate air pollutants*: Dry collection – Gravity chamber, Cyclone, ESP, Bag Filter, Wet Collection – Venturi scrubber, Spray tower, Cyclone scrubber-Simple problems. *For gaseous air pollutants:* Absorption, Adsorption, Combustion, Condensation - Ambient Air quality standards.

UNIT-III: NOISE POLLUTION
Noise Pollution – Sound and Noise, Sources of Noise, Basic definitions – Power, Intensity, Decibels, Equivalent Noise levels, Sound Intensity Level, Sound Pressure level, Weighting Networks, Octave band, Impacts of Noise, Noise rating systems, Noise level Standards-Simple calculations for - estimating equivalent noise levels, Addition of sound levels, Averaging Sound pressure levels, Simple control methods.

UNIT-IV: SOLID WASTE MANAGEMENT
Solid Waste Management – Regulations in India, Sources, Composition and Properties of solid waste, Collection and Handling, Door to door collection services, Principles of separation and processing, Concept of recycling and recovery of solid wastes, Solid Waste Disposal methods – Composting, Incineration, Land filling, Gas generation and Leachate Control - Simple calculations for estimation of moisture content, density, Energy content, methane generation, landfill area.

UNIT V: HAZARDOUS WASTE & ENVIRONMENTAL MANAGEMENT

Regulations in India of - Hazardous Waste, Biomedical Waste, Plastic Waste, E-Waste-Classification, Control and Disposal methods - Indian Scenario

Concept of Treatment Storage and Disposal Facility and Common Effluent Treatment Plants

Environmental Impact Assessment & Environmental Audit – Necessity, Objectives, Advantages and Limitations.

TEXT BOOKS
1. S.K. Garg, "Sewage Disposal and Air Pollution Engineering", Khanna Publishers, 29th Edition, New Delhi, 2014.
2. Suresh K. Dhameja, "Environmental Science and Engineering", S.K. Kataria & Sons Publications, New Delhi; 2009.

REFERENCES
1. K.V.S.G. Muralikrishna, "Air Pollution and Control", University Science Press, 2015.
2. H.S. Peavy, D.R. Rowe and G. Tchobanoglous, "Environmental Engineering", McGraw Hill Publications, Singapore, 1985.
3. Environmental Management & Impact Assessment, NPTEL Video Lectures.
4. Solid & Hazardous Waste Management, NPTEL Video Lectures
5. Environmental Air Pollution, NPTEL Video lectures and web notes

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B.Tech. (VII Sem.)   **20CE26 - BUILDING SERVICES**
                              (PROGRAM ELECTIVE –III)

Prerequisites: Building Materials

Course Objectives:
This subject covers the various aspects of pumps and machinery involved and the principles of electrical and air conditioning facilities involved in building service aspects.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Identify the services like lift, elevators, conveyors and escalators, etc. &plan various types of mechanical services as per requirements of building (Understand-L2)
CO2: Explain the electrical services requirement and Layout of a building (Understand-L2)
CO3: Analyze the basic principles of illumination for different types of buildings. (Understand-L2)
CO4: Analyze the refrigeration principles & applications for different types of buildings. (Understand-L2)
CO5: Describe the damage caused by fire & exercise due care for fire safety. (Understand-L2)

UNIT - I: MACHINERIES
Hot Water Boilers – Lifts and Escalators – Special features required for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC/AC motors – Generators – Laboratory services – Gas, water, air and electricity

UNIT - II: ELECTRICAL SYSTEMS IN BUILDINGS
Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations

UNIT - III: PRINCIPLES OF ILLUMINATION & DESIGN
Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis of light – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilisation factor – Depreciation factor – MSCP – MHCP – Lans of illumination – Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colour rendering.
Design of modern lighting – Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.

UNIT - IV: REFRIGERATION PRINCIPLES & APPLICATIONS
Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapour – Subcooled liquid – Pressure temperature relationship for liquids – Refrigerants – Vapour compression cycle – Compressors – Evaporators – Refrigerant control devices – Electric motors – Starters – Air handling units – Cooling towers – Window type and packaged air-conditioners – Chilled water plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings – Protection against fire to be caused by A.C. Systems

UNIT - V: FIRE SAFETY INSTALLATION

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers

TEXT BOOKS
1. E.R.Ambrose, "Heat Pumps and Electric Heating", John and Wiley and Sons, Inc., New York, 1968.
2. William H.Severns and Julian R.Fellows, "Air-conditioning and Refrigeration", John Wiley and Sons, London, 1988.

REFERENCES
1. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 1968.
2. A.F.C. Sherratt, "Air-conditioning and Energy Conservation", The Architectural Press, London, 1980.
3. R.G.Hopkinson and J.D.Kay, "The Lighting of buildings", Faber and Faber, London, 1969.
4. Philips Lighting in Architectural Design, McGraw-Hill, New York, 1964.
5. National Building Code.

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3	0	0	3

B.Tech. (VII Sem.)   **20CE27 - WATERSHED MANAGEMENT**
(PROGRAM ELECTIVE –IV)

Pre-requisites: Applied Mechanics, Mechanics of Fluids, Hydraulics and Hydraulic Machinery Systems, Hydrology and Irrigation Engineering

Course Educational Objective: The course is designed to understand the concept of watershed management, watershed characteristics and concepts of watershed modelling.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Determine watershed parameters and analyse watershed characteristics to take appropriate management action. (Understand-L2)
CO2: Quantify soil erosion and design control measures. (Understand-L2)
CO3: Recommend suitable harvesting techniques for better watershed management. (Understand-L2)
CO4: Describe the land grading techniques for proper land management. (Understand-L2)
CO5: Discuss theappropriate models for watershed management.   (Understand-L2)

UNIT-I: WATER SHED CHARACTERISTICS
Introduction: Concept of watershed development, objectives of watershed development, need for watershed development, Integrated and multidisciplinary approach for watershed management.
Characteristics of Watersheds: Size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics, basic data on watersheds.

UNIT-II: PRINCIPLES OF EROSION
Types and causes of erosion, factors affecting erosion, estimation of soil loss due to erosion- Universal soil loss equation. Measures to Control Erosion: Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, check dams, rock-fill dams, brushwood dam, Gabion.

UNIT-III: WATER HARVESTING
Techniques of rainwater harvesting- rainwater harvesting from roof top, surface flow harvesting, subsurface flow harvesting, stop dams, farm ponds and dugout ponds, percolation tanks.

UNIT-IV: LAND MANAGEMENT
Land use and Land capability classification, management of forest, agricultural, grassland and wild land, land grading operation, Reclamation of saline and alkaline soils.

UNIT-V: WATERSHED MODELLING
Data of watershed for modelling, application and comparison of watershed models, model calibration and validation, advances of watershed models.

TEXT BOOKS:
1. M.M Das and M.D Saikia, "Watershed Management", PHI Learning Pvt. Ltd, 2012.
2. JVS Murthy, "Watershed Management", New Age International Publishers, 2017.

REFERENCES:
1. VVN Murthy, Madan K. Jha "Land and Water Management Engineering", Kalyani Publications, 2013.
2. R. Suresh, "Watershed Hydrology" Standard Publishers, 1997.
3. Watershed Management, NPTEL video lectures and web notes.

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B.Tech. (VII Sem.)   20CE28 - RAILWAYS AND AIRPORT ENGINEERING
(PROGRAM ELECTIVE –IV)

Pre-requisites: NIL

Course Educational Objective: The course aims to introduce the different transportation systems available around the world. It further addresses the aspects of analyzing the different components of railways, airways and water ways.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Describe the basic terminology used in railways, airport, and harbour engineering (Understand-L2)
CO2: Identify the key aspects to be considered in the track junctions, Signals and interlocking system of railways (Understand-L2)
CO3: Categorize the technical issues related to planning and design of airports (Understand-L2).
CO4: Illustrate the importance of providing different components of harbor and ports (Understand-L2).

UNIT-I: RAILWAY PLANNING AND PERMANENT WAY
Role of Indian Railways in National Development - Alignments – Role of Remote Sensing, GIS and GPS - Permanent way – Specification of Components Gauges - Typical cross sections – Monorail, Embankments and cuttings – Construction, renewal and maintenance of permanent way – Rail joints and welding ofrails.

UNIT-II: TRACK JUNCTIONS
Points and crossings – Devices and layouts - Most commonly employed layouts – Special fittings and safety devices – Station and yard – Different types and their typical layouts – General equipment's – Track junction – Movable diamond crossing

UNIT-III: SIGNALS AND INTERLOCKING
Signals – Different types and their working – Location of signals – Principles and mechanism of interlocking – Safety devices – Different system of control on movement of trains Introduction to modern trends in Indian railways in the design of high speed tracks.

UNIT-IV: AIRPORT ENGINEERING
Importance of Airports in National Transportation Sector – Airport Planning - Standards for planning of airports as per ICAO – Site selection survey, Airport Zoning, Runway, Orientation, Geometric design, Different types, pattern and layout Taxiways and Aprons, Holding Aprons, Planning and layout of Terminal Buildings, Hangars and Parking area.

UNIT-V: HARBOUR ENGINEERING
Harbours and Ports – Requirement and classification, surveys, Breakwaters and pier heads, Docking platforms, Piers, wharves, jetties and quays – Fender mooring accessories, Entrance channels.

TEXT BOOKS
1. S.C. Saxena. and S. Arora, "A Text Book of Railway Engineering", Dhanpat Rai Publications Pvt., Ltd, New Delhi, 2005
2. S.K. Khanna, M.G. Arora, and S.S. Jain, "Airport Planning and Design", Nem Chand and Bros, Roorkee, 2001.

REFERENCES

1. S.P. Bindra, "A course work in Docks and Harbour Engineering", Dhanpat Rai Publications Pvt., Ltd, New Delhi, 2003
2. S.P. Bindra, "A course in bridge, tunnel and railway engineering", Dhanpat Rai Publications Pvt., Ltd, New Delhi, 1996
3. Ahuja and Birdi, "Roads, railways, bridges and tunnels engineering", Standard Book House, New Delhi, 2000
4. R. Srinivasan, "Dock, Harbour and Tunnel Engineering", Charotar Publishing House, Anand, 1989
5. S.C. Rangwala, "Principles of Railway Engineering", Charotar Publishing House, Anand, 2000.
6. Transportation Engineering-II, NPTEL video lectures.

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B.Tech. (VII Sem.)   **20CE29 - GREEN BUILDINGS**
                           (PROGRAM ELECTIVE –IV)

Prerequisites: Building Materials

Course Objectives:
This course aims to provide study of appropriate materials for constructing a green building and planning for energy and resource conservation in green building. The course also provides the practices of optimum use of the renewable energy resources, the principles of the designing the building using climatic factors and planning for effective green building rating system.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Explain the basic terminology used, different types, benefits of a green building and its rating concept (Understand – L2).
CO2: Assess the impact of climate on a building and identify the appropriate materials for constructing a cost-effective green building (Understand – L2)
CO3: Plan the various options for energy and resource conservation in a green building. (Understand – L2)
CO4: Identify the ways for optimal use of renewable energy resources in the green building (Understand – L2)

UNIT - I: GREEN BUILDINGS CONCEPT
Definition of Green Buildings, typical features of green buildings, benefits and environmental impacts of Green Buildings, Brown field and green field development, sustainable site selection and planning of buildings to maximize comfort, day lighting, ventilation.

UNIT - II: CLIMATE DESIGN
Local climatic conditions – solar radiation, temperature, humidity, wind speed and direction-impact of deforestation and climate change on built environment, desirable conditions, Fresh air requirements, standards, sick building syndrome and indoor air pollutants.

UNIT - III: GREEN MATERIALS
Recycling of building materials, Advantages in usage of natural local materials such as bamboo, timber, rammed earth, stabilized mud blocks, hollow blocks, lime & lime-pozzolana cements, materials from agro and industrial waste, ferro-cement and ferro-concrete, alternative roofing systems, various paints reducing the heat gain of the building, etc.

UNIT-IV: ENERGY AND RESOURCE CONSERVATION
Building envelope – its parts and types, Active and passive energy systems, need for energy conservation, Various forms of energy used in buildings, energy used in transportation and construction processes- Building automation and building management systems. Principles of thermal design - means of thermal –light and lighting-building acoustics- energy efficient lighting, Ventilation and indoor air quality. Water conservation systems in buildings- planning for storm water drainage, water harvesting in buildings – recycling of sewage, waste to energy management in residential complexes or gated communities, Modular wastewater treatment systems for built environment

UNIT-V: RENEWABLE ENERGY AND GREEN BUILDING RATING SYSTEMS
Wind and Solar Energy Harvesting, Potential of solar energy in India and world, construction and operation of various solar and wind energy based appliances, Geothermal energy usage in buildings,

Case studies. Introduction to Leadership in Energy and Environment Design (LEED), Green rating systems for Integrated Habitat Assessment – GRIHA, IGBC ratings, Salient features of Green buildings constructed in India.

TEXT BOOKS:
1. K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao, "Alternative building materials and technologies", New Age International, 2014.
2. N. Kumara Swamy and A. Kameswara Rao, "Building Planning and Drawing", Charotar Publications, 2013.

REFERENCES
1. Abe Kruger and Carl Seville, "Green Building: Principles and Practices in Residential Construction", Demar Cengage Learning, 2012.
2. G.D. Rai, "Non-Conventional Energy Resources", Khanna Publishers; 18th edition, 2017.
3. Koenigsberger O H, "Manual of Tropical Housing and Building", 1st edition, Orient Longman Publishers, Chennai, 2003.
4. Odom P. Eugene, "Ecology and Environment", 2nd edition, Oxford and IBH Publishers, New Dehi, 2005.

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B.Tech. (VII Sem.) **20CE30 - REPAIR AND REHABILITATION OF STRUCTURES (PROGRAM ELECTIVE – V)**

Prerequisites: Concrete Technology

Course Objectives:
The course deals with concepts of various distress and damages to concrete, masonry structures - importance of maintenance of structures - various types and properties of repair materials - damage assessment to the structures using various NDT tests - various repair techniques of damaged structures, corroded structures. The course also consists of Retrofitting components in addition to adapting new techniques in construction practices

Course Outcomes: At the end of the course, the student will be able to:
CO1: Illustrate the causes for distress and deterioration of structures (Understand – L2)
CO2: Describe the various Non Destructive Tests for condition assessment of structures (Understand – L2)
CO3: Select appropriate repair material and rehabilitation strategy (Understand – L2)
CO4: Conduct survey and apply suitable repair methods for cracks (Understand – L2)

UNIT - I: DISTRESS IN CONCRETE AND CONDITION SURVEY
Introduction: Present repair practices, distress identification and repair management - Causes of distress in concrete structures-Holistic Models for deterioration of concrete, Permeability of concrete, aggressive chemical agents, durability aspects
Condition Survey: Objectives, different stages-Preliminary inspection, planning stage, visual inspection, consideration for repair strategy, need for rehabilitation of structures.

UNIT - II: DETERIORATION OF CONCRETE STRUCTURES
Introduction: Physical processes of deterioration like Freezing and Thawing, Wetting and Drying, Abrasion, Erosion, Pitting, Chemical processes like Carbonation, Chloride ingress, Corrosion – Mechanism – Effect - preventive measures., Alkali aggregate reaction, Sulphate attack, Acid attack, temperature and their causes, -
Cracks: Cracks in concrete, type, pattern, quantification, measurement & preventive measures.

UNIT - III: NON-DESTRUCTIVE EVALUATION TESTS
Introduction: Rebound hammer test-Ultrasonic pulse velocity tests, penetration resistance, pull out tests.
Chemical tests: Carbonation tests and chloride content, Corrosion potential assessment cover meter survey, half-cell potentiometer test, resistivity measurement.

UNIT - IV: SELECTION OF REPAIR MATERIALS
Various repair materials, Criteria for material selection, Methodology of selection, Health and safety precautions for handling and applications of repair materials, polymer modified mortars and concrete, Gas forming grouts, Epoxy bonding agents, Protective coatings for Concrete and Steel, FRP Sheets.

UNIT - V: REPAIR AND REHABILITATION STRATEGIES
Crack repair: Various methods of crack repair, Grouting, Routing and sealing, Stitching, Autogenous healing, Overlays, Repair to active cracks, Repair to dormant cracks.
Rehabilitation strategies: RCC jacketing, Ferro cement jacketing, fiber wrap technique,strengthening of columns and beams, Case studies of RCC buildings subjected to distress - Identification and estimation of damage.

TEXT BOOKS

3. Concrete Structures-Repair, Rehabilitation and Retrofitting, B.Bhattacharjee, CRS Publishers and Distributors, 2017
4. P. C. Varghese, Maintenance, Repair & Rehabilitation and Minor Works of Buildings", PHI Learning Pvt. Ltd., 2014.

REFERENCES

8. Concrete Structures-Protection, Repair and Rehabilitation, R.Dodge Woodson, Elsevier, 2009.
9. B.L. Gupta and Amit Gupta, „Maintenance & Repair of Civil Structures", Standard Publication, Edition 2009.
10. V. K. Raina, "Concrete Bridge Practice Construction, Maintenance & Rehabilitation", Edition 2012.
11. CPWD Handbook on Repair and Rehabilitation of RCC buildings, Govt. of India Press, New Delhi, 2014.
12. ACI 546R-14, Guide to Concrete Repair, American Concrete Institute, 2014
13. Failures and repair of concrete structures by S.Champion, John Wiley and Sons, 1961.

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B.Tech. (VII Sem.)

20CE31 - ENVIRONMENTAL HYDRAULICS AND ADVANCED WATER TREATMENT (PROGRAM ELECTIVE – V)

Prerequisites: Environmental studies, Mechanics of Fluids, Water and Wastewater Engineering

Course Objectives: This course deals with the designing of water distribution systems, hydraulic design of sewers and sewer appurtenances, sewage disposal and self-purification streams, advanced water and wastewater treatment techniques.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Understand the fundamentals of water distribution system, sewer design and its appurtenances (Understand – L2).
CO2: Comprehend the basic concepts of self-purification systems, advanced water, wastewater and industrial wastewater treatment (Understand-L2).
CO3: Design the water distribution and sewer design systems (Apply-L3).
CO4: Analyze and solve the problems related to natural purification systems (Apply-L3).
CO5: Apply the basic principles of advanced water, wastewater and industrial wastewater treatment to develop solutions (Understand-L2).

UNIT-I: WATER DISTRIBUTION SYSTEM

Distribution of water: Objectives - Methods of distribution, Layouts of distribution networks, Distribution reservoirs, Storage capacity of reservoir, Design and calculation of hydraulic parameters of pipe flow, Nomogram, Analysis of pipe networks –Pipes in series, Pipes in parallel, Equivalent Pipe method, Hardy Cross method (one loop simple flows), Appurtenances in distribution system, Pipe laying and testing.
Pumps: Pumps for lifting water and sewage – Necessity, Locations, Principles, Working, efficiency, Problems.

UNIT-II: SEWER DESIGN & SEWER APPERTUNANCES
Sewer design: Estimating quantity of sewage - Factors affecting, Dry weather flow, Estimating storm runoff by rational formula, Hydraulic design of sewers, storm sewers.
Sewer appurtenances: Types, Precautions while entering sewers, Ventilation of sewers, Plumbing system, Traps and Pipes, Types of traps, Systems of plumbing -Single stack system, One pipe system, Two pipe system, Sanitary fittings, Sewer materials.

UNIT-III: DISPOSAL OF SEWAGE AND SELF PURIFICATION OF STREAMS

Sewage disposal: Options, Disposal in water bodies, Sewage Disposal in lakes, sea, Disposal on land, Effluent irrigation and sewage farming, Sewage sickness.
Self purification of natural streams: Dilution, Zones of pollution in a river, Oxygen deficit, Deoxygenation and reoxygenation, Oxygen Deficit curve, Streeter - Phelps equation, Problems

UNIT-IV: ADVANCED WATER AND WASTEWATER TREATMENT
Advanced water treatment: Ion balance diagram, Water Softening – Lime soda process, DM process, Activated carbon treatment, Defluoridation techniques.
Desalination: Reverse osmosis process, Electro dialysis, Solar Evaporation.
Advanced wastewater treatment: Modifications in ASP, Ponds and lagoons, Oxidation ponds, aerated lagoon, oxidation ditches, Rotating biological contactors, UASB, Nitrification-Denitrification.

UNIT-V: INDUSTRIAL WASTEWATER TREATMENT

Industrial wastewater treatment: Necessity, Basic terminology and purposes of – Equalization, Neutralization, Volume reduction, Strength reduction, Physical, chemical, biological treatment options, Pollutants from industry and their impacts, Treatment plant layout options for Dairy/Sugar/Paper industry –anyone, Case study.

TEXT BOOKS

1. B.C. Punmia, A.K. Jain and A.K. Jain, Water Supply Engineering, Laxmi Publications. 2nd Edition 1995, Reprint 2005
2. B.C.Punmia, A.K. Jain and A.K. Jain, Wastewater Engineering, Laxmi Publications, 2ndEdition 1998, Reprint2014.

REFERENCES

1. S.K. Garg, "Water Supply Engineering", Khanna Publishers, Eleventh Edition, New Delhi.1999.
2. S.K. Garg, "Sewage disposal and Air Pollution Engineering", Khanna Publishers New Delhi. 2001
3. G.S. Birdie and J.S. Birdie, "Water Supply and Sanitary Engineering" Dhatpat Rai Publishing Company New Delhi,1998.
4. K.N. Duggal, "Elements of Environmental Engineering", S.Chand & Company Limited, New Delhi,2000.
5. P N Modi, "Sewage treatment disposal & Wastewater treatment", Standard Book House,2016.
6. Manual on sewerage and sewage treatment, CPHEEO, Ministry of urban affairs and employment, Govt. of India, New Delhi,2001
7. Water and Wastewater Engineering, NPTEL video lectures and web notes

	L	T	P	Cr.
B.Tech. (VII Sem.) **20CE32 - FOUNDATION ENGINEERING (PROGRAM ELECTIVE – V)**	3	0	0	3

Pre-requisites: Geo technical Engineering-1

Course Educational Objective: The course aims to teach the different conditions of site investigation for soil exploration. The course coverage includes the various procedures for determining the bearing capacity of various soils and get acquainted with the principles of soil mechanics in design of retaining walls.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Describe the different types of site investigation methods for different site conditions. (Understand-L2)
CO2: Determine the safe bearing capacity and pile group capacity (Apply-L3).
CO3: Explain the different earth pressure theories (Understand-L2).
CO4: Illustrate the different conditions for stability analysis of slopes and retaining walls (Apply-L3).
CO5: Describe the various types of foundations and their suitability (Understand-L2).

UNIT –I: SITE INVESTIGATION AND SELECTION OF FOUNDATIONS
Objective of site investigation – Methods of investigation – Planning of Site investigation – Depth of soil exploration – Significant depth – Spacing of bore holes – Standard penetration test and its significance in soil exploration – Correction to Standard penetration values –Soil sampling techniques – Sampling Disturbance – Methods of obtaining undisturbed samples – Requirements of an undisturbed sample. Functions and requisites of foundation – Different types of shallow foundations and situations under which they are adopted.

UNIT –II: SHALLOW FOUNDATIONS AND BEARING CAPACITY OF SOILS
Bearing Capacity of soils – Factors affecting Bearing capacity of soil – Terzaghi's and Meyerhof's bearing capacity theories- General principle of Design of Shallow Foundations – Plate bearing test and its limitations –Settlement of foundation – Causes of total and differential settlement of foundations in sand and clays – Methods of controlling settlement – Code provisions – Conventional procedure for proportioning of footing for equal settlement.

UNIT –III: DEEP FOUNDATIONS AND GROUP CAPACITY OF PILES
Deep Foundations: Pile foundation – Consideration leading to the selection of pile foundation – Functions of piles – Types of piles – Friction pile, End bearing pile – Pile grouping – Estimation of individual pile capacity by Static and Dynamic approaches.
Group Capacity of Piles: Pile group efficiency – Downward drag phenomenon on piles and its significance in the design of pile foundations – Pile load test (Constant rate penetration test only) and its interpretation – Impact of pile driving (within the site and neighbouring area)

UNIT- IV: EARTH PRESSURE THEORIES AND RETAINING WALLS
Earth Pressure Theories: Rankine's and Coulomb's earth pressure theories and their comparison – Earth pressure at rest – Active and Passive earth pressures for cohesive and non cohesive soils and their determination by analytical methods only (No graphical procedures)
Retaining Walls: Different types of Retaining Walls – Design principles of Cantilever and Counterfort Retaining walls (Structural Design not included).

UNIT-V: SPECIAL FOUNDATIONS AND STABILITY OF SLOPES

Special Foundations: Caisson Foundation – Necessity of selection – Types of Caisson foundation – Design principles of Caisson foundation (Structural Design not included). Foundation in filled up grounds – Foundation on expansive soil – Use of under-reamed pile foundations – Introduction of Machine foundations.

Stability of slopes: Stability analysis of finite earth slopes – Factors of safety – Taylor's stability number and its significance –Different conditions of slope stability analysis.

TEXT BOOKS

1. K.R. Arora, "Soil Mechanics and Foundation Engineering", Standard Publishers & Distributors, Nai Sarak, Delhi, 1987
2. B.C. Punmia, A. K. Jain, and A. Jain. "Soil Mechanics and Foundation Engineering", Laxmi Publications, 16th edition, New Delhi, 2006.

REFERENCES

1. V.N.S. Murthy, "A Text book of Soil Mechanics and Foundation Engineering", Kripa Technical Consultants, Bangalore, 1992
2. C. Venkataramaiah, "Geotechnical Engineering", Wiley Eastern Ltd., Madras, 1993.
3. A. Gopalranjan and A.S.R. Rao. "Basic and Applied Soil Mechanics", New Age Publications, 2nd Edition, New Delhi, 2000.
4. Joseph E. Bowles, "Physical and Geotechnical Properties of Soils", McGraw Hill Publishing Co., New York, 1994.

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B.Tech. (VII Sem.) 20HS02 - MANAGEMENT SCIENCE FOR ENGINEERS	3	0	0	3

Course Description:

In this course, students will learn fundamental concepts and contributions of management. This course also teaches human resources practices which play a vital role in the organisation it gives knowledge about use of improve quality of work and project management.

Course Objectives:

1. To make students understand management, its principles, contribution to management, organization, and its basic issues and types
2. To make students understand the concept of plant location and its factors and plant layout and types, method of production and work study importance
3. To understand the purpose and function of statistical quality control.And understand the material management techniques
4. To make students understand the concept of HRM and its functions
5. To make students understand PERT & CPM methods in effective project management and need of project crashing and its consequence on cost of project

Course Outcomes:

CO1: Understand management principles to practical situations based on the organization structures**. (L2)**

CO2: Design Effective plant Layouts by using work study methods. **(L2)**

CO3: Apply quality control techniques for improvement of quality and materials management. **(L3)**

CO4: Develop best practices of HRM in corporate Business to raise employee productivity. **(L2)**

CO5: Identify critical path and project completion time by using CPM and PERT techniques. **(L3)**

UNIT I

Introduction: Management - Definition, Nature, Importance of management Functions of Management - Taylor's scientific management theory, Fayal's principles of management, Contribution of Elton mayo,Maslow, Herzberg, Douglas MC Gregor, Basic Concepts Of Organisation- Authority, Responsibility Delegation of Authority, Span of control, Departmentation and Decentralization - Organisation structures(Line organization, Line and staff organization, Functional organization, Committee organization, Matrix organization)

UNIT II

Operations Management: Plant location, Factors influencing location,Principles and types of plant layouts - Methods of production (job, batch and mass production), Work study - Basic procedure involved in method study and Work measurement

UNIT III

 Statistical quality control –Concept of Quality & Quality Control-functions ,Meaningof SQC - Variables and attributes - X chart, R Chart, C Chart, P Chart,(simple Problems) Acceptance sampling, Sampling plans, Deming's contribution to quality.

Materials management –Meaning and objectives,inventory control-Need for inventory control, Purchase procedure, Store records, EOQ, ABC analysis, Stock levels

UNIT IV

Human Resource management (HRM): Concepts of HRM, Basic functions of HR manager:Man power planning, Recruitment, Selection, Training and development, Placement, Wage and salary administration, Promotion, Transfers Separation, performance appraisal, Job evaluation and merit rating.

UNIT V

Project management: Early techniques in project management - Network analysis: Programme evaluation and review technique (PERT), Critical path method (CPM), Identifying critical path, Probability of completing project within given time, Project cost analysis, project crashing (simple problems)

Text Books:

Dr. A.R.Aryasri, Management Science, TMH, 10th edition, 2012

References:

1. Koontz & weihrich – Essentials of management, TMH, 10th edition, 2015
2. Stoner, Freeman, Gilbert, Management, 6th edition Pearson education, New Delhi, 2004
3. O.P. Khana, Industrial engineering and Management L.S.Srinath, PERT & CPM

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B.Tech. (VII Sem.) **20CES3 - IOT APPLICATIONS IN CIVIL ENGINEERING**

Pre-requisites: Python Programming lab

Course Educational Objectives: In this course, student will be exposed to implement interfacing of various sensors with Arduino/Raspberry Pi to transmit data wirelessly between different devices.

COURSE OUTCOMES (COs): At the end of the course, students are able to
CO1: Understand the basics of Microcontroller, Arduino-Uno, RaspberryPi and Internet of Things (Understand-L2)
CO2: Apply the steps of the design methodology in developing IoT Applications using Arduino-Uno, RaspberryPi (Understand-L2)
CO3: Design the interfacing of various sensors with Arduino and Raspberry Pi (Apply-L3)

Syllabus:

1. Introduction to 8051 Microcontroller, AT mega 328P - Arduino Uno and Raspberry Pi
2. Programming the Microcontroller, Arduino and Raspberry Pi
3. Stepper Motor Control with 8051 Microcontroller
4. Interfacing of LED, DHT11-humiditysensor and PIR sensor with Arduino and RaspberryPi using Python Program
5. Traffic Light Simulator using Arduino and RaspberryPi.
6. Water flow sensor with an Arduino board.
7. Ultrasonic sensor using Arduino board
8. RaspberryPi Motion Sensor Alarm using PIR Sensor
9. RaspberryPi based Smart Phone Controlled Home Automation
10. DC Motor Control with RaspberryPi
11. Stepper Motor Control with RaspberryPi
12. Interfacing DS 18B20 Temperature Sensor with RaspberryPi

TEXTBOOK:
1. Raj Kamal, Internet of Things - Architecture and Design Principles, McGraw Hill Publication, 2017.
2. Zach Shelby, Carsten Bormann: "The Wireless Embedded Internet", Wiley, 1st Edition.

REFERENCES:
1. Arshdeep Bahga and Vijay Madisetti, Internet of Things – A Hands-on Approach, University Press, 2015
2. Reema Thareja, "Python Programming using Problem Solving Approach", Oxford Press.