GOKUL GLOBAL UNIVERSITY

Approved By Govt. of Gujarat
(Recognized by UGC under Section 22 & 2(f) of 1956)
(Gujarat Private State University Act 4 of 2018)

COURSE STRUCTURE

Bachelor of Engineering

Civil Engineering

Under

Choice Based Credit System (CBCS)

Faculty of Engineeering
Hansaba College of Engineering & Technology
University Campus, State Highway-41, Siddhpur - 384151, Dist. Patan, Gujarat, INDIA
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SR	SEMESTER	SUBJECT CODE	SUBJECT NAME	CREDIT	CATEGORY
1	I	FEB110001	Engineering Mathematics-I	5(3+2+0)	Basic Science Courses
2	I	FEB110202	Elements of Mechanical Engineering	5(4+0+2)	Engineering Science courses
3	I	FEB110003	Communication Skill	4(3+1+0)	Humanities & Social science including management courses
4	I	FEB110304	Elements of Electrical Engineering	5(4+0+2)	Engineering Science courses
5	I	FEB110006	Physics	4(3+0+2)	Basic Science Courses
6	I	FEB110206	Basic Workshop	2(0+0+4)	Engineering Science courses
		FEB110007	Induction Program		Mandatory Course
TOTAL				25	

Semester-I

Semester -II

SR	SEMESTER	SUBJECT CODE	SUBJECT NAME	CREDIT	CATEGORY
1	II	FEB120001	Engineering Mathematics - II	5(4+1+0)	Basic Science Courses
2	II	FEB120102	Elements of Civil Engineering	5(4+0+2)	Engineering Science courses
3	II	FEB120403	Computer Programming With C	5(4+0+2)	Engineering Science courses
4	II	FEB120204	Engineering Graphics	5(3+0+4)	Engineering Science courses
5	II	FEB120105	Environmental Science	0(2+2+0)	Mandatory Course
TOTAL				20	

Semester -III

SR	SEMESTER	SUBJECT CODE	SUBJECT NAME	CREDIT	CATEGORY
1	III	FEB130001	Effective Technical Communication	3 (2+0+2)	Humanities & Social science including management courses
2	III	FEB130002	Indian Constitution	0(2+0+0)	Mandatory Courses
3	III	FEB130101	Engineering Mathematics – III (Transform & Discrete Mathematics)	3 (2+0+2)	Basic Science Courses
4	III	FEB130102	Building Construction Technology	5(4+0+2)	Professional Core Courses
5	III	FEB130103	Engineering Geology	3 (2+0+2)	Professional Core Courses
6	III	FEB130104	Mechanics of Solids	5(4+0+2)	Professional Core Courses
TOTAL				**19**	

Semester -IV

SR	SEMESTER	SUBJECT CODE	SUBJECT NAME	CREDIT	CATEGORY
1	IV	FEB140001	Essence of Indian Traditional Knowledge	0 (2+0+0)	Mandatory Courses
2	IV	FEB140101	Building and Town Planning	4 (2+0+4)	Professional Core Courses
3	IV	FEB140102	Civil Engineering Social & Global Impact	2 (2+0+0)	Humanities & Social science including management courses
4	IV	FEB140103	Fluid Mechanics	3 (2+0+2)	Professional Core Courses
5	IV	FEB140104	Materials, Testing & Evaluation	3 (2+0+2)	Professional Core Courses
6	IV	FEB140105	Structural Analysis I	3 (2+0+2)	Professional Core Courses
7	IV	FEB140106	Surveying	3 (2+0+2)	Professional Core Courses
TOTAL				**18**	

Semester -V

SR	SEMESTER	SUBJECT CODE	SUBJECT NAME	CREDIT	CATEGORY
1	V	FEB150001	Engineering Economics & Management	3 (3+0+0)	Humanities & Social science including management courses
2	V	FEB150101	Hydrology and Water Resources Engineering	4 (3+1+0)	Professional Core Courses
3	V	FEB150102	Soil Engineering-I	4 (3+0+2)	Professional Core Courses
4	V	FEB150103	Structural Analysis II	4 (3+0+2)	Professional Core Courses
5	V	FEB150104	Transportation Engineering-I	4 (3+0+2)	Professional Core Courses
6	V		Department Elective-I	3 (2+0+2)	Professional Elective Courses
Total				22	

Department Elective-I

Sr no.	SUBJECT CODE	SUBJECT NAME	TEACHING SCHEME
1	FEB150105	Air Pollution Control	3 (2+0+2)
2	FEB150106	Infrastructure Planning	3 (2+0+2)

Semester -VI

SR	SEMESTER	SUBJECT CODE	SUBJECT NAME	CREDIT	CATEGORY
1	VI		Open Elective-I		Open Elective Courses
2	VI	FEB160101	Environmental Engineering	4 (3+0+2)	Professional Core Courses
3	VI	FEB160102	Hydraulic Engineering	4 (3+0+2)	Professional Core Courses
4	VI	FEB160103	Soil Engineering-II	4 (3+0+2)	Professional Core Courses
5	VI	FEB160104	Transportation Engineering-II	3 (2+0+2)	Professional Core Courses
6	VI		Department Elective-II	4 (3+0+2)	Professional Elective Courses
Total				**22**	

Open Elective -I

Sr no.	SUBJECT CODE	SUBJECT NAME	TEACHING SCHEME
1	FEB160001	Cyber Security	3 (0+2+2)
2	FEB160002	Remote Sensing and GIS	3 (3+0+0)

Department Elective-II

Sr no.	SUBJECT CODE	SUBJECT NAME	TEACHING SCHEME
1	FEB160105	Concrete Technology & Repair Strategy	4 (3+0+2)
2	FEB160106	Disaster Assessment using Geospatial Techniques	4 (3+0+2)

Semester -VII

SR	SEMESTER	SUBJECT CODE	SUBJECT NAME	CREDIT	CATEGORY
1	VII		OPEN ELECTIVE-II	3 (3+0+0)	Open Elective Courses
2	VII	FEB170101	Professional Practice and Valuation	4 (3+0+2)	Professional Core Courses
3	VII	FEB170102	Structural Design -I	5 (4+0+2)	Professional Core Courses
4	VII		Department Elective-III	3 (2+0+2)	Professional Elective Courses
6	VII	FEB170105	Project-I	4 (0+0+8)	Project
Total				19	

Open Elective-II

Sr no.	SUBJECT CODE	SUBJECT NAME	TEACHING SCHEME
1	FEB170001	Integrated Personality Development	3 (3+0+0)
3	FEB170002	Metro Systems and Engineering	3 (3+0+0)

Department Elective-III

Sr no.	SUBJECT CODE	SUBJECT NAME	TEACHING SCHEME
1	FEB170103	Earthquake Engineering	3 (2+0+2)

2	FEB170104	Urban Transportation Planning	3 (2+0+2)

Semester -VIII

SR	SEMESTER	SUBJECT CODE	SUBJECT NAME	CREDIT	CATEGORY
1	VIII	FEB180101	Construction Management & Equipment	4 (3+0+2)	Professional Core Courses
2	VIII	FEB180102	Structural Design -II	5(4+0+2)	Professional Core Courses
3	VIII		Department Elective- IV	3 (2+0+2)	Professional Elective Courses
4	VIII	FEB180105	PROJECT -II	8 (0+0+16)	Project
Total				20	

Department Elective-IV

Sr no.	SUBJECT CODE	SUBJECT NAME	TEACHING SCHEME
1	FEB180103	Dock Harbour and Airport Engineering	3 (2+0+2)
2	FEB180104	Irrigation Engineering	3 (2+0+2)

ENGINEERING MATHEMATICS-I(FEB110001)

Objective: students are intended to know about the basic concepts and principles of Mathematics as a tool to analyse the Engineering problems. Mathematics has the potential to understand the Core Technological studies.

Credit:5 **L-T-P:3-2-0**

Sr.	Content	Total Hrs	% Weightage
1	Rolle's Theorem, Lagrange's and Cauchy's Mean Value Theorems, Taylor's and Maclaurian's theorems and their examples, Indeterminate forms and L' Hospital Rule, Improper integrals, Convergence and divergence of improper integrals, Beta and Gamma functions and their properties. Applications of definite integrals to evaluate surface areas and volumes of revolutions.	09	15%
2	Convergence and divergence of sequence, tests for convergence of sequence: The Sandwich Theorem, The continuous function theorem and bonded monotonic sequence Convergence and divergence of series, tests for convergence of Series: Comparison test, Cauchy's integral test, De' Alembert's ratio test, Cauchy's root test, Leibniz's rule for alternating series, Power series, Radius of convergence of power series, Taylor's and Maclaurian's series. Fourier Series of periodic functions, Fourier Series of even and odd functions, Half range sine and cosine series, Parseval's theorem.	10	25%
3	Limit and continuity of function of several variables, partial derivatives, directional derivatives, total derivatives, Chain rule, derivatives of implicit functions, Euler's theorem on homogeneous functions, Taylor's and Maclaurin's expansion for function of two variables, Extrema of function of several variables, Application of Lagrange method of undetermined multipliers, Tangent plane and normal line	10	25%
4	Multiple Integration: Double integrals, change of order of integration, Change of variables, Applications: areas and volumes Triple integrals, orthogonal curvilinear coordinates, Simple	08	15%

	applications involving cubes, sphere and rectangular parallelepipeds; Jacobian, Multiple integral by substitution		
5	Algebra of Matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem	**08**	**20%**

Reference Books:

1. Maurice D. Weir, Joel Hass, Thomas' Calculus, Early Transcendentals, 13e, Pearson, 2014.
2. Howard Anton, Irl Bivens, Stephens Davis, Calculus, 10e, Wiley, 2016.
3. James Stewart, Calculus: Early Transcendentals with Course Mate, 7e, Cengage, 2012.
4. Elementary Linear Algebra, Applications version, Anton and Rorres, Wiley India Edition.

Course Outcome:

1. Identify indeterminate forms and can evaluate
2. determine the convergence/divergence of improper integral
3. use beta and gamma functions
4. compute length of curve
5. determine the convergence or divergence of sequences
6. use the sandwich theorem for sequences
7. evaluate the value of geometric series

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	2	2	3	-	1	2	-	3	2	-	2	3
CO-2	3	-	2	1	3	-	1	2	3	1	-	2
CO-3	3	1	3	2	-	1	1	2	-	2	1	3
CO-4	3	2	-	-	3	2	2	-	3	3	2	3
CO-5	-	1	2	2	-	1	-	2	3	1	-	3
CO-6	1	-	-	3	2	1	-	2	2	2	2	3

ELEMENTS OF MECHANICAL ENGINEERING (FEB110202)

Objective: Understanding of basic principles of Mechanical Engineering is required in various field of engineering.

Credit:5 **L-T-P:4-0-2**

Sr.	Content	Total Hrs	% Weightage
1	**Introduction:** Prime movers and its types, Concept of Force, Pressure, Energy, Work, Power, System, Heat, Temperature, Specific heat capacity, Change of state, Path, Process, Cycle, Internal energy, Enthalpy, Statements of Zeroth Law and First law.	4	25%
2	**Energy:** Introduction and applications of Energy sources like Fossil fuels, Nuclear fuels, Hydel, Solar, wind, and bio-fuels, Environmental issues like Global warming and Ozone depletion	3	
3	**Properties of gases:** Gas laws, Boyle's law, Charle's law, Combined gas law, Gas constant, Relation between Cp and Cv, Various non flow processes like constant volume process, constant pressure process, Isothermal process, Adiabatic process, Poly-tropic process	5	
4	**Properties of Steam:** Steam formation, Types of Steam, Enthalpy, Specific volume, Internal energy and dryness fraction of steam, use of Steam tables, steam calorimeters	6	30%
5	**Heat Engines:** Heat Engine cycle and Heat Engine, working substances, Classification of heat engines, Description and thermal efficiency of Carnot; Rankine; Otto cycle and Diesel cycles	5	
6	**Steam Boilers:** Introduction, Classification, Cochran, Lancashire and Babcock and Wilcox boiler, Functioning of different mountings and accessories		
7	**Internal Combustion Engines:** Introduction, Classification, Engine details, four-stroke/ two-stroke cycle Petrol/Diesel engines, Indicated power, Brake Power, Efficiencies	4	20%
8	**Pumps:** Types and operation of Reciprocating, Rotary and Centrifugal pumps, Priming	3	

9	**Air Compressors:** Types and operation of Reciprocating and Rotary air compressors, significance of Multistage	**3**	
10	**Refrigeration & Air Conditioning:** Refrigerant, Vapor compression refrigeration system, vapor absorption refrigeration system, Domestic Refrigerator, Window and split air conditioners	**4**	**25%**
11	**Couplings, Clutches and Brakes:** Construction and applications of Couplings (Box; Flange; Pin type flexible; Universal and Oldham), Clutches (Disc and Centrifugal), and Brakes (Block; Shoe; Band and Disc)	**3**	
12	**Transmission of Motion and Power:** Shaft and axle, Belt drive, Chain drive, Friction drive, Gear drive	**4**	

References Books:

1. Elements of Mechanical Engineering by N M Bhatt and J R Mehta, Mahajan Publishing House
2. Basic Mechanical Engineering by Pravin Kumar, Pearson
3. Fundamental of Mechanical Engineering by G.S. Sawhney, PHI Publication New Delhi
4. Elements of Mechanical Engineering by Sadhu Singh S. Chand Publication
5. Introduction to Engineering Materials by B.K. Agrawal Tata Mcgraw Hill Publication, New Delhi

Course Outcome:

After learning the course the students should be able to

1. To understand the fundamentals of mechanical systems
2. To understand and appreciate significance of mechanical engineering in different fields of engineering
3. Enhancement of fundamental knowledge of Thermodynamics
4. Enhancement of fundamental knowledge of Fluid Mechanics and I.C. Engines
5. Acquiring knowledge of materials and their properties for engineering applications
6. Evaluate properties of steam. Demonstrate various types of boilers and their relative merits and demerits. Learning problem solving in particular domain.

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	3	3	-	2	2	2	2	2	2	-	2
CO-2	3	2	3	-	2	2	3	-	3	3	2	-
CO-3	3	-	-	-	3	2	2	-	2	2	-	-
CO-4	3	2	2	1	2	-	3	2	-	1	-	-
CO-5	3	3	3	2	2	1	2	1	-	-	-	-
CO-6	3	2	3	2	3	2	2	1	1	-	-	-

COMMUNICATION SKILL (FEB110003)

Objective: Objective of this curriculum is to help students refresh their knowledge of English language. It also targets the understanding of grammar, focusing on comprehension, and reading, speaking and writing skills. This would be developed through balanced and integrated tasks.

Credit:2 **L-T-P:3-1-0**

Sr.	Content	Total Hrs	% Weightage
1	Communication skills Process, types and levels of communication. Technical Communication and General Communication. Factors to be considered in technical communication	4	25%
2	Verbal and non-verbal communication (kinesics) Components of Non- verbal Communication (Kinesics) Barriers to effective communication. (Noise in oral and written communication) Communication across cultures.	3	
3	Listening skills - Types of Listening Active Listening V/s Passive Listening Empathetic Listening. Traits of a good listener, barriers in effective listening, Tips for effective listening.	5	
4	Effective presentation strategies. Defining purpose, analysis of audience and locate, organizing contents. Repairing an outline of the presentation. Visual aids, nuances of delivery, Body language and effective presentation.	6	30%
5	Interviews Introduction, General preparations for an interview, Types of questions generally asked at the interviews. Types of interviews, Importance of nonverbal aspects.	5	20%
6	Group Discussions Introduction, Group discussions as a part of the selection process, guidelines for group discussion. Role functions in group discussion.	4	
7	Letter - Writing Business Letters, Structure and types of a	3	

	business letter, Letter of Inquiry, Letters of complaint, regret and adjustment.		
8	Technical reports Introduction, types of reports, structure of reports, objectives and characteristics of reports.	**3**	
9	Technical Proposals Definition, Purpose, Types, Characteristics, Structure, Style and appearance.	**4**	**25%**
10	Effective Reading Skills Purpose of reading, skimming and scanning. Tips for improving comprehension skills.	**3**	
11	Job application Essential parts - Cover Letter and the 'resume'. Types of 'resumes' (Curriculum Vitae) Chronological 'resume', functional 'resume'.	**4**	

Reference Books:

1. Technical English, Dr. M. Hemamalini, Wiley.2014
2. Practical English Usage, Michael Swan, OUP.1995
3. Remedial English Grammar, F.T. Wood, Macmillan. 2007
4. Oxford Language Reference, (Indian Edition) OUP
5. On Writing Well, William Zinsser, Harper Resource Book.2001
6. Study Writing, Liz Hamp-Lyons and Ben Heasly, Cambridge University Press.2006
7. Communication Skills, Sanjay Kumar and Pushp Lata, Oxford University Press.2011
8. Exercises in Spoken English, Parts. I-III. CIEFL, Hyderabad. Oxford UniversityPress
9. The Study of Language, George Yule, CUP, 4th Edition.2010
10. A Course in English Phonetics, T R Kansakar, Orient Longman.1998
11. Spoken English, R K Bansal and J B Harrison, Orient Longman. 2013 Course Outcome: The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Course Outcome:

1. The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.
2. After completion of the course, the students will be able to:
3. Use various forms of vocabulary in varied situations in oral and written communication.
4. Understand the phonetics and the transcription pattern to learn correct pronunciation

5. Comprehend the dynamics of various rules of grammar and check its validation while they speak and write language correctly.
6. Use grammar effectively to make themselves competent Listener, Speaker, Reader and Writer by exposing to various set of situations.

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	-	2	1	3	-	2	3	2	2	2	2
CO-2	3	2	-	-	3	1	-	3	1	-	1	1
CO-3	3	2	2	3	3	2	2	1	3	2	-	3
CO-4	3	-	1	2	2	3	1	3	-	2	-	3
CO-5	3	3	-	1	1	3	3	-	2	-	2	2
CO-6	3	1	3	-	-	1	1	3	1	3	2	3

ELEMENTS OF ELECTRICAL ENGINEERING (FEB110304)

Objective: The course provides introductory treatment of the field of Electrical Engineering & Electronics to the students of various branches of engineering.

Credit:5 **L-T-P:4-0-2**

Sr.	Content	Total Hrs	% Weightage
1	**Introduction of D.C. Circuits :** Introduction, Ohm's Law,Application of Kirchhoff's Law,Nodal Analysis, Mesh Analysis, Series-Parallel Of Resistance, Ideal and Practical Energy Sources, Line Regulation and Load Regulation, Source Transformation, Star-Delta Transformation, Temperature Co-efficient,	**8**	**15%**
2	**Electrostatic &Capacitor:** Electric charge and Laws of electrostatics; Definitions - Electric field, lines of force, electric field intensity, electric flux and flux density; Electrostatic induction; Gauss's law and its application; Dielectric strength; Capacitor; Capacitor in series and parallel, Energy stored in a capacitor.	**6**	**10%**
3	**Electro Magnetics:** Faradays Laws; Lenz's Law; Fleming's Rules; Effect of magnetic field on current carrying conductor; Magnetic circuits; Statically and dynamically induced EMF; Concepts of self-inductance, mutual inductance and coefficient of coupling; Inductance in series and parallel; Hysteresis and Eddy current losses; Energy stored in magnetic fields.	**8**	**15%**

4	**Single Phase A.C. Circuits:** Generation of sinusoidal voltage, Definition of average value, root mean square value, form factor and peak factor; Phasor representation of alternating quantities; Analysis with phasor diagrams of R, L, C, R-L, R-C and R-L-C circuits; Concepts of Real power, Reactive power, Apparent power and Power factor, Series, Parallel and Series - Parallel circuits; Power in AC circuit, Power factor improvement; Resonance in series and parallel circuits, Q-factor, Bandwidth and Selectivity.	**20**	**30%**
5	**Three Phase A.C. Circuits:** Necessity and Advantages of three phase systems, Generation of three phase power, Phase sequence, Balanced supply and Balanced load; Relationship between line and phase values of balanced three phase circuit; Power Measurement in balanced three phase circuits. Measure 3-Phase power bye watt-mater methods.	**8**	**15%**
6	**Batteries and Fuel Cell:** Introduction of Batteries; The Simple cell, E.M.F and internal resistance of a cell; Primary and Secondary cells, Cell capacity; Types & Specifications of Batteries; Charging & Discharging of Battery; Safe disposal of Batteries; Fuel cell: Principle & Types of fuel cell.	**2**	**5%**
7	**Electrical Wiring & Illumination:** Types of wires and cables; Types of Connectors & Switches; System of wiring, domestic and industrial wiring; Simple control circuit in domestic installation. Types of lamps, fixtures & reflectors; Illumination schemes for domestic, industrial & commercial premises; Lumen requirements for different categories.	**2**	**5%**
8	**Safety & protection:** Safety precautions in handling electrical appliances; Electric shock, First aid for electric shock other hazards of electrical laboratories & safety rules; Grounding & Earthling - Importance of grounding and earthing, equipment for grounding, Methods of	**2**	**5%**

	earthling; Circuit protection devices: Fuses, MCB, ELCB & Relays.		

References Books:

1. B.L.Theraja (2012), Electrical Technology,Vol – 1,S. Chand.
2. D.P. Kothari and I.J. Nagrath (2013), Theory and Problems in Basic Electrical Engineering,Prentice Hall, India.
3. Parker Smith (2003), Problems in Electrical Engineering, CBS Publishers
4. Introduction to Electrical Engineering, M S Sarma, Oxford University Press

Course Outcome:

After Completion Of The Course , The Student Will Be Able To-

1. Understand electrical current, potential difference, power and energy, sources of electrical energy, resistance and its behavior with temperature.
2. Use the Ohm's Law and the Kirchhoff's Law and star delta transformation for solving resistive series, parallel and series-parallel circuits.
3. Define Electric field, lines of force, electric field intensity, electric flux, flux density and permittivity. Capacitor, charging and discharging phenomena of capacitors and calculations of capacitance for capacitors connected in series and parallel circuits.
4. Understand Concepts of Real power, Reactive power, apparent power and Power factor and perform calculations of these quantities for series and parallel R-L-C circuits.
5. Understand the importance of safety and the precaution to be taken while working with electrical equipment and accessories. Understand the working principle, usage and construction of circuit protection devices such as fuse, MCB, ELCB & Relays
6. Design simple analog signal processing functions using operational amplifiers.

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	-	-	-	2	3	2	2	2	3	1	1
CO-2	2	2	2	3	2	-	-	1	-	2	-	-
CO-3	2	3	-	2	2	2	2	-	-	2	-	-
CO-4	3	2	3	1	1	-	-	-	-	-	-	-
CO-5	2	2	2	2	-	-	-	-	-	2	-	-
CO-6	-	2	2	2	2		-	1	-	2	3	-

PHYSICS (FEB110005)

Objective: Engineering, being the science of measurement and design, has been offspring of Physics that plays the primary role in all professional disciplines of engineering.

Credit:4 **L-T-P:3-0-2**

Sr.	Content	Total Hrs	% Weightage
1	**MODULE 1: ELECTRONIC MATERIALS** • Free electron theory • Density of states and energy band diagrams, • Kronig-Penny model (to introduce origin of band gap), • Energy bands in solids, • E-k diagram, Direct and indirect bandgaps, • Types of electronic materials: metals, semiconductors, and insulators, • Density of states, Occupation probability, • Fermi level, Effective mass, Phonons.	**8**	**22%**
2	**MODULE 2: SEMICONDUCTORS** • Intrinsic and extrinsic semiconductors • Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics) • Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, • Metal-semiconductor junction (Ohmic and Schottky), Semiconductor materials of interest for optoelectronic devices	**10**	**27%**
3	**MODUL-3 LIGHT SEMICONDUCTOR INTERACTION** • Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; • Joint density of states • Density of states for photons, • Transition rates (Fermi's golden rule) • Optical loss and gain; Photovoltaic effect, Exciton • Drude model.	**06**	**17%**
4	**Module 4: Measurements** • Four-point probe and Van Der Pauw measurements for carrier density,	**06**	**17%**

	• Resistivity and hall mobility • Hot-point probe measurement, capacitance-voltage • measurements, • Parameter extraction from diode I-V characteristics, DLTS, • band gap by UV-Vis spectroscopy, absorption/transmission.		
5	**Module 5: Superconductivity** • Introduction of Superconductivity • Properties of superconductor • Effect of magnetic field • Meissner effect • Pressure effect • Impurity effect • Isotopic mass effect • Mechanism of Superconductivity : BCS Theory • Penetration depth : Magnetic field • Josephson's junction and its application • Application of superconductors	**06**	**17%**

Reference Books:

1. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc.
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc.
3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley
4. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
5. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India
6. Engineering Physics by Dattu R Joshi, McGraw hill Publications.

Course Outcome:

After completion of the course, the students will be able to:

1. Able to understand, necessary parameters of different materials in different domains.
2. Demonstrate the behavior of material in different fields based on their properties.
3. Enhance practical capability and skills for modules using different materials and selection of material for system designs.
4. The student will demonstrate understanding of basic theory, properties and applications of Superconductivity
5. The student will demonstrate understanding the basic principles, properties and applications of

associated with Waves, Motion and Acoustics.

6. The student will demonstrate understanding of basic principles, properties, type and application Lasers.

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	2	2	2	-	1	2	-	-	-	2	1
CO-2	3	2	3	2	-	1	2	-	-	-	2	2
CO-3	3	3	2	2	2	-	2	-	2	1	2	2
CO-4	3	3	2	2	-	2	2	-	-	-	2	1
CO-5	3	2	3	2	2	2	2	-	-	2	2	2
CO-6	3	2	2	2	2	2	2	-	-	2	2	2

BASIC WORKSHOP (FEB110206)

Objective: Understanding of basic principles of Mechanical Engineering is required in various field of engineering.

Credit:2 **L-T-P:0-0-4**

Sr.	Content	Total Hrs	% Weightage
1	**Introduction:** Workshop layout, Importance of various sections/shops of workshop, Types of jobs done in each shop, General safety rules and work procedure in workshop	**6**	**15%**
2	**Fitting:** Select appropriate fitting tools for the Required application, Prepare the simple jobs as per specification using fitting tools, Safety precautions	**8**	**20**
3	**Tin Smithy:** Demonstration of various tin smithy tools and sheet metal operations such as shearing, bending and joining, Preparation of tin smithy job, Safety precautions	**6**	**15**
4	**Carpentry:** Types, sketch, specification, material, applications and methods of using of carpentry tools-saws, planner, chisels, hammers, pallet, marking gauge, vice, try square, rule, etc, Types of woods and their applications, Types of carpentry hardwires and their uses, Demonstration of carpentry operations such as marking, sawing, planning, chiseling, grooving, boring, joining, etc, Preparation of wooden joints, Safety precautions.	**8**	**20%**
5	**Pipefitting:** Types, specification, material and applications of pipe fittings, Types, specifications, material, applications and demonstration of pipe fitting tools, Demonstration of pipe fitting operations such as marking, cutting, bending, threading, assembling, dismantling, etc, Preparation of pipe fitting jobs	**6**	**15**
6	**Metal joining:** 1Select appropriate equipment and consumables for required application, Prepare the simple jobs as per specification using proper metal joining and cutting method, Safety precautions	**6**	**15**

References Books:

1. Work shop technology by Hajra Chaudhary
2. Work shop technology by Chapmen

Course Outcome:

After learning the course, the students should be able to

1. To acquire skills in basic engineering practice
2. To acquire practical skills in the trades.
3. Understand modern manufacturing operations, including their capabilities, limitations, and how to design economically.
4. Welding and soldering operations
5. Identify and apply suitable tools for machining processes including turning, facing, thread cutting and tapping

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	3	3	-	2	2	2	2	2	2	-	2
CO-2	3	2	3	-	2	2	3	-	3	3	2	-
CO-3	3	-	-	-	3	2	2	-	2	2	-	-
CO-4	3	2	2	1	2	-	3	2	-	1	-	-
CO-5	3	3	3	2	2	1	2	1	-	-	-	-

ENGINEERING MATHEMATICS – II (FEB120001)

Objective: Mathematics is a language of Science and Engineering

Credit:5 **Semester II** **L-T-P:3-2-0**

Sr.	Content	Total Hrs	% Weightage
1	Vector Fields, Vector derivatives, Arc length, Curvature and Torsion, Gradient of Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.	09	25%
2	Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method. Fourier Integral transform, Fourier Cosine Integral and Fourier Sine Integral	10	25%
3	First order ordinary differential equations, Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.	06	10%
4	Ordinary differential equations of higher orders, Second order linear homogeneous differential equations with variable coefficients, Cauchy-Euler equation, Existence and Uniqueness of solution, Linear Dependence and Independence of solution, Wronskian, Non homogeneous Ordinary differential equations, method of undetermined coefficient, method of variation of parameters	11	25%
5	Series solution of Ordinary differential equations, Power series solutions; Legendre's equation, Legendre polynomials, Frobenius method, Bessel functions of the first kind and their properties	09	15%

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley and Sons.
2. Peter O'Neill, Advanced Engineering Mathematics, 7th Edition, Cengage.
3. Dennis G. Zill, 4th edition, Advanced Engineering Mathematics, 4th Edition, Jones and Bartlett Publishers.
4. Maurice D. Weir, Joel Hass, Thomas' Calculus, Early Transcendentals, 13e, Pearson, 2014.

Course Outcome:

After learning the course the students should be able to

1. To apply mathematical tools needed in evaluating vector calculus and their usage like Work, Circulatio and Flux
2. To apply the laplace transform as tools which are used to solve differential equations and fourier integral representation
3. To apply effective mathematical tools for the solutions of first order ordinary differential equations
4. To apply effective mathematical methods for the solutions of higher order ordinary differential equations
5. To implement the solution for engineering problem
6. To use series solution methods and special functions like Bessels' functions

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	-	2	1	3	-	2	3	2	2	2	2
CO-2	3	2	-	-	3	1	-	3	1	-	1	1
CO-3	3	2	2	3	3	2	2	1	3	2	-	3
CO-4	3	-	1	2	2	3	1	3	-	2	-	3
CO-5	3	3	-	1	1	3	3	-	2	-	2	2
CO-6	3	1	3	-	-	1	1	3	1	3	2	3

Element of Civil Engineering (FEB120102)

Credit -05 **L-T-P-: 4-0-2**

Unit	Description in detail	Total Hrs	Weightage
I	**Introduction** **Basic Understanding**: What is Civil Engineering / Infrastructure? Basics of Engineering and Civil Engineering; Broad disciplines of Civil Engineering; Importance of Civil Engineering, Possible scopes for a career. **History of Civil engineering**: Early constructions and developments over time; Ancient monuments & Modern marvels; Development of various materials of construction and methods of construction; Works of Eminent civil engineers **Fundamentals of Building Materials**: Stones, bricks, mortars, timber, sand, Aggregates, Plain Reinforced & Prestressed Concrete, Construction Chemicals; Structural steel, High Tensile Steel, Carbon Composites; Plastics in Construction	**10**	**20%**
II	**Surveying, Leveling and Mapping:** **Introduction:** Definition of Surveying, Aims and applications, Fundamental principles of surveying, Classification of surveying, Plans and maps, Scales, Units of measurement. **Linear Measurement:** Methods, Instruments used in chain surveying, Selection of stations, Chaining, Ranging, Offsetting, Errors in chaining and correction, Conventional symbols. **Angular Measurement:** Instruments used, Types of compass, Types of meridians and bearings, Measurement of bearings, computation of angles. Compass traversing and correction of bearings for local attraction. **Leveling:** Aims and applications, Definition of various terms, Instruments for leveling, Methods of leveling, Recording observations in level-book, Computing reduced levels by HI and rise & fall method, Definition of contour, Characteristics of contours of different terrains and application of contour maps, Introduction to planimeter, introduction to Global positioning system(GPS),	**20**	**40%**
III	**Structural Engineering**: Types of buildings; tall structures; various types of bridges; Water retaining structures; Other structural systems;	**10**	**20%**

	Hydraulics, Hydrology &Water Resources Engineering: Fundamentals of fluid flow, basics of water supply systems; Underground Structures; Underground Structures Multipurpose reservoir projects		
IV	**Traffic & Transportation Engineering**: Investments in transport infrastructure development in India for different modes of transport; Developments and challenges in integrated transport development in India: road, rail, port and harbour and airport sector; PPP in transport sector; Intelligent Transport Systems; Urban Public and Freight Transportation	**05**	**15%**
V	**Industrial lectures**: Case studies of large civil engineering projects by industry professionals, covering comprehensive planning to commissioning	**03**	**05%**

Reference Books :

1. Basic Civil Engineering, Palanichamy, McGraw Hill
2. Basic Civil Engineering, Satheesh Gopi, Pearson Publishers
3. Surveying Vol. I Author: Dr. B. C. Punmia, Ashokkumar Jain, Arunkumar Jain16th Edition Publisher: Laxmi Publication Delhi
4. Elements of Civil Engineering Author: Dr. R.K. Jain and Dr. P.P. Lodha Publisher: McGraw Hill Education, India Pvt. Ltd.
5. Building Construction and Construction Material Author: G.S.Birdie and T.D. Ahuja Publisher: Dhanpat Rai Publishing Company
6. Civil Engg. Drawing Author: S. C. Rangwala Publisher: Charotar Pub. House Anand
7. Building ConstructionAuthor: Dr. B. C. Punmia, Ashokkumar Jain, Arunkumar JainPublisher: Laxmi Pub. Delhi
8. Surveying Vol. I Author: S. K. Duggal Publisher: Tata McGraw Hill Publication New Delhi
9. Engineering Material Author: S.C. RangwalaPublisher: Charotar Pub. House, Anand
10. 10.Irrigation Engineering and Hydraulic Structures Author: SantoshkumarGarg Publisher: Khanna Publishers Delhi
11. Highway Engineering Author: Khanna S. K. and Justo C. E.G. Publisher: Nemchand and Brothers

Course Outcome :

After learning the course the students should be able to:

1. Carry out simple land survey to prepare maps with existing details.
2. Find out area of irregular shaped plane figures.
3. Understand building plan elevation and section.
4. Get acquainted with construction materials.
5. Get acquainted with hydrological cycle and hydraulic structures.

6. Get acquainted with mass transportation systems.

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	-	-	-	3	3	2	3	2	2	1	1
CO-2	3	2	2	1	2	-	-	-	-	-	-	-
CO-3	3	2	2	1	2	-	-	-	-	-	-	-
CO-4	3	2	2	1	2	-	3	-	-	-	-	-
CO-5	3	2	2	1	2	-	-	-	-	-	-	-
CO-6	3	3	3	2	3	-	-	-	-	3	3	-

FEB120403: COMPUTER PROGRAMMING WITH C

Objective: An introduction to computer concepts, logic, and computer programming.

Credit:5 **L-T-P:4-0-2**

Unit	Description in detail	Hours	Weightage
I	**Introduction to Computer and Programming:** Introduction, Architecture and functions of various components of computer, Concepts of Hardware and software, Types of software, Compiler and interpreter, Concepts of Machine level, Assembly level and high level programming, Algorithms, Flowchart, Programming Languages, Types of Languages **C Fundamentals:** Features of C Language, Basic Structure of C Program, Character Set, C Tokens, Keywords and Identifiers, Constants, Variables, Data Types, Declaration of Variables, Declaration of Storage Classes ,Operators and Expressions, Managing Input and Output Operations	**10**	**20%**
II	**Control Structure in C:** Simple if Statement nested if, if-else, Nesting of if Else, The Else if Ladder, switch-case, Looping constructs: for, while, do-while, Nesting Looping , break and continue, goto statement. **Arrays and String:** One-dimensional arrays, Multi-dimensional arrays, String variables, Arithmetic Operations on Characters, Comparison of Strings, Table of Strings, String Storage, Built-in-string functions	**10**	**23%**
III	**Functions:** Concepts of user defined functions, prototypes, definition of function, parameters, parameter passing, calling a function, recursive function, Macros, Pre-processing **Recursion:** Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort , Merge sort.	**9**	**22%**
IV	**Pointers:** Introduction, Understanding of pointers, Accessing the address of a variable, Declaring and initializing pointers, Accessing a variable through its pointers, Pointers expressions, Pointer increments and scale factor, Pointers and arrays, Pointers and Character Strings, Pointers on pointers, Pointer as function argument, Functions returning pointer, Pointers to functions, Pointers and structures.	**8**	**19%**

	Dynamic Memory Allocation: Introduction to Dynamic memory allocation, malloc, calloc and realloc		
V	**Structure and Unions:** Introduction, Structures definition, Giving values to members, Structure initialization, Comparison of structure variables, Arrays of structures, Arrays within structure, Structure and function, Unions, Size of structures, Bit fields. **File Management:** Introduction, Defining and opening a file, Closing a file, Input/output operations on files, Error handling during I/O operations, Random access to files, Command line arguments.	**8**	**16%**

Reference Books:

1. Programming in ANSI C by Balagurusamy, 7th Ed., Tata McGraw Hill
2. Programming with C, Second edition, by Gottfried, Tata McGraw-Hill Publishing
3. Company Limited.
4. Let Us C by YashvantKanetkar, 12th Ed., BPB Publication
5. Programming in C by Ashok N. Kamthane, 2nd Ed., Pearson Education
6. Let us C, Yashavant P. Kanetkar, BBP Publications, Delhi
7. “Computer programming”, Pearson Education, 2007 by Ashok N. Kamthane.
8. Computer Concepts and Programming in C, R.S. Salaria, Khanna Publishing.

Course Outcome:

After learning the course the students should be able to:

1. Understand the fundamentals and structure of a C programming language
2. Apply the loops, arrays, functions and string concepts in C to solve the given problem
3. Apply the pointers and text input output files concept to find the solution for the given applicatio
4. Use the Enumerated, Data types, Structures and Unions

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)											
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO-1	1	-	-	-	-	-	-	-	-	-	-	-
CO-2	-	3	1	-	-	-	-	-	-	-	-	-
CO-3	-	3	1	-	-	-	-	-	-	-	-	-
CO-4	1	3	-	-	-	-	-	-	-	-	-	-

(FEB120204) ENGINEERING GRAPHICS

Objective: Engineering Graphics is the language of communication for Engineers. Engineering Graphics course provides tools and techniques of communication for various fields of Engineering.

Credit:5 **L-T-P:3-0-4**

Sr.	Content	Total Hrs	% Weightage
1	**INTRODUCTION TO ENGINEERING GRAPHICS**: Scope of Engineering Drawing in all Branches of Engineering, Uses of Drawing Instruments and Accessories, Introduction to Drawing Standards BIS-SP-46, Representative Fraction, Types of Scales (Plainand Diagonal Scale), Dimensioning Terms and Notations, Types of Arrowheads, Lines, Lettering, Numbering and Dimensioning.	**03**	**5%**
2	**ENGINEERING CURVES**: Classification of Engineering Curves, Application of Engineering Curves, Constructions of Engineering Curves - Conics, Spirals, Involutes and Cycloids with Tangents and Normal.	**06**	**10%**
3	**PROJECTIONS OF POINTS AND STRAIGHT LINES**:- Introduction to principal planes of projections, Notation System- Points in First, Second, Third and Fourth quadrants, Projections of line Parallel to Two and Perpendicular to one of the principal planes, Line parallel to one and inclined to two principal planes, Line inclined to all the three principal planes, True length of the line and its inclination with the reference planes	**08**	**15%**
4	**PROJECTIONS OF PLANES**: Projections of various planes -Polygonal, Circular and Elliptical shape inclined to one of the Reference Plane and inclined to two Reference Planes; Concept of Auxiliary Plane of Projections.	**06**	**10%**
5	**PROJECTIONS OF SOLIDS AND SECTIONS OF SOLIDS**:		**15%**

	Classifications of Solids, Projections of right and regular solids with their axis Parallel to Two and Perpendicular to one of the principal planes, axis parallel to one and inclined to two principal planes, axis inclined to all the three principal planes. Section of solids and the true shape of the section	**08**	
6	**DEVELOPMENT OF SURFACES**: Methods of Development of Lateral Surfaces of Right Regular Solids, Parallel Line Development and Radial Line Development, Applications of Development of Surfaces.	**08**	**15%**
7	**ORTHOGRAPHIC PROJECTIONS**: Projections on Principal Planes from Front, Top and Sides of the Pictorial view of an Object, First Angle Projection and Third Angle Projection method; Full Sectional Orthographic Views -Side and Front, Offset Cutting views.		**15%**
8	**ISOMETRIC VIEW/DRAWING AND ISOMETRIC PROJECTIONS**: Isometric Scale, Conversion of orthographic views into isometric projection, isometric view or drawing		**15%**

References Books:-

1. ENGINEERING GRAPHICS, P. J. Shah; S. Chand & Co., New Delhi Publications.
2. Engineering Drawing N.D. Bhatt & V.M. Panchal; Charotar Publishing House
3. Engineering Graphics – I and II ByArunoday Kumar Tech – Max Publication, Pune
4. A text book of Engineering Drawing By R.K.Dhawan, S.Chand & Company Ltd., New Delhi.
5. A text book of Engineering Drawing By P.S.Gill, S. K. Kataria & sons, Delhi.

Course Outcome:-

After Learning the course the students shall be able to:

1. To know and understand the conventions and the method of engineering drawing.
2. Identify the Drawing Symbols, Conventions used in Engineering Drawing
3. Construct the Different types of Engineering Curves.
4. To improve their visualization skills so that they can apply these skill in developing new products.
5. Apply Descriptive Geometry Principles to Solve Engineering Problems Involving

Points, Lines, Planes and Solids

6. To improve their technical communication skill in the form of communicative drawings

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	3	3	-	2	2	2	2	2	2	-	2
CO-2	3	2	3	-	2	2	3	-	3	2	2	-
CO-3	3	-	-	-	3	2	2	-	2	2	-	-
CO-4	3	3	3	1	2	-	2	2	-	1	-	-
CO-5	3	3	3	2	2	1	2	1	-	-	-	-
CO-6	3	2	3	2	2	1	2	1	1	1	-	-

ENVIRONMENTAL SCIENCE (FEB120105)

Objective: To inculcate the environmental values translating into pro-conservation actions. Honourable Supreme Court of India has made it 'mandatory' to introduce a basic course on environment at the undergraduate level.

Credit:0 **L-T-P:2-2-0**

Sr.	Content	Total Hrs	% Weightage
1	**Introduction to Environment:** Definition and Components of Environment, Relationship between the different components of Environment, Man and Environment relationship, Impact of technology on Environment, Environmental Degradation, Multidisciplinary nature of the Environment studies, its scope and importance in the present day Education System	02	07%
2	**Ecology and Ecosystems:** Introduction: Ecology- Objectives and Classification , Concept of an ecosystem- structure and functions of ecosystem Components of ecosystem- Producers, Consumers, Decomposers Bio-Geo- Chemical Cycles- Hydrologic Cycle, Carbon cycle, Energy Flow in Ecosystem, Food Chains, Food webs ,Ecological Pyramids **Natural Resources:** a. Renewable and Nonrenewable resources, exploitation and conservation, Role of individual in conservation of natural resources.	04	14%

3	**ENVIRONMENTAL POLLUTION:** a) Water Pollution: Introduction – Water Quality Standards, Sources of Water Pollution, Classification of Water pollutants, Effects of water pollutants b) Air Pollution: Composition of air, Structure of atmosphere, Ambient Air Quality Standards, Classification of air pollutants, Sources of common air pollutants like PM, SO 2 ,NO X , Auto exhaust, Effects of common air pollutants c) Noise Pollution: Introduction, Sound and Noise, Noise measurements, Causes and Effects d) Solid Waste: Generation and management e) Bio-medical Waste: Generation and management f) E-waste: Generation and management	**12**	**41%**
4	**GLOBAL ENVIRONMENTAL ISSUES:** Sustainable Development, Climate Change, Global Warming and Green House Effect, Acid Rain, Depletion of Ozone layer, Carbon Footprint, Cleaner Development Mechanism (CDM), International Steps for Mitigating Global Change	**05**	**17%**
5	**BASIC CONCEPT OF GREEN BUILDING AND SMART CITIES** Green Building: Introduction, Objectives, Fundamental Principles, Benefits of Green Building, Examples of Green Building Smart Cities: Concept	**04**	**14%**
6	**CONCEPT OF 4R's** Principles, Application of 4R's	**02**	**7%**

References Books:-

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha Second edition, 2013 Publisher: Universities Press (India) Private Ltd, Hyderabad.
2. Basics of Environmental Studies by Prof Dr N S Varandani, 2013 Publisher: LAP –Lambert Academic Publishing, Germany
3. Environmental Studies by Anindita Basak, 2009 Publisher: Drling Kindersley(India)Pvt. Ltd Pearson
4. Textbook of Environmental Studies by Deeksha Dave & S S Kateva , Cengage Publishers.

5. Environmental Sciences by Daniel B Botkin & Edward A Keller Publisher: John Wiley & Sons.
6. Environmental Studies by R. Rajagopalan, Oxford University Press
7. Environmental Studies by Benny Joseph, TMH publishers
8. Environmental Studies by Dr. Suresh K Dhameja, 2007 Published by: S K Kataria & Sons New Delhi
9. Basics of Environmental Studies by U K Khare, 2011 Published by Tata McGraw Hill

Course Outcome:-

After learning the course the students should be able to:

1.Identify the types of pollution in society along with their sources and have idea how to deal with them.

2.Realize the global environmental issues

3.Conceptualize the principles of Green Buildings and Smart cities.

4.Implement the concept of recycle and reuse in all fields of engineering.

5.Student will understand Ecology and Ecosystem of nature.

6.Understand Renewable and Nonrenewable resources and how to use & save them.

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	2	2	2	-	2	3	2	1	1	2	2
CO-2	3	3	1	-	-	1	3	2	2	-	1	1
CO-3	3	2	2	1	1	1	3	2	-	-	2	2
CO-4	3	2	2	-	2	2	2	2	-	1	2	2
CO-5	3	-	-	-	-	1	3	1	-	-	1	1
CO-6	3	2	-	-	-	1	3	2	-	-	1	1

EFFECTIVE TECHNICAL COMMUNICATION (FEB130001)

Sr.	Content	Total Hrs	% Weightage
1	**Dynamics of Communication:** Definition and process Kinesics Proxemics Paralinguistic features Importance of Interpersonal and Intercultural Communication in today's organizations	06	20%
2	**Technical Writing:** Report writing, Technical proposal**,** Technical description**,** Business letters(sales, order, complaint, adjustment, inquiry,recommendation, appreciation, apology, acknowledgement,cover letter)Agenda of meeting, Minutes of meeting, Resume writing	08	25%
3	**Technical Communication:** Public speaking, Group discussion Presentation strategies, Interview skills, Negotiation skills,Critical and Creative thinking in communication Interfacing Concepts, Ports, Interfacing Of I/O Devices, Interrupts In 8085,Programmable Interrupt Controller 8259A, Programmable PeripheralInterface 8255A	06	20%
4	**Ethics in Engineering:** Scope of engineering ethics Accepting and sharing responsibility Responsible professionals and ethical corporations Resolving ethical dilemmas Making moral choices	10	12%
5	**Etiquettes:** Telephone etiquettes, Etiquettes for foreign business TripsVisits of foreign counterparts Etiquettes for small talks Respecting privacy Learning to say NO Time management **Self-development and Assessment:**Change, Grow, Persist, Prioritize, Read, Learn, Listen, Record,Remember, Asses, Think, Communicate, Relate, Dream	08	23%

Reference Books:

1. Raman and Sharma, Technical Communications, OUP, New Delhi, 2017
2. Lata and Kumar, Communication Skills, OUP, New Delhi, 2018
3. Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw Hill, New York, 2014
4. Mohapatra and Sreejesh S., Case Studies in Business Ethics and Corporate Governance, Pearson, UP, 2013
5. Ramesh and Ramesh, The Ace of Soft Skills, Pearson, UP, 2019
6. Sherfield, Montgomery and Moody, Cornerstone: Developing Soft Skills, UP, 2009

Course Outcome:

After learning the course the students should be able to:DS

1. Define and discuss dynamics of Verbal and Non Verbal aspects of Communication
2. Write various formal documents of technical and professional communication
3. Communicate in diverse formal situations taking place in organizations
4. Illustrate and examine the knowledge of ethical aspects of engineering
5. Demonstrate and explain social and professional etiquettes
6. Plan self-development and practice self-assessment

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	-	-	-	2	-	-	-	2	2	3	-	3
CO-2	-	-	-	2	-	1	-	1	-	3	1	3
CO-3	-	-	-	-	-	1	-	1	1	3	1	3
CO-4	-	-	-	-	-	1	1	3	2	3	1	3
CO-5	-	-	-	-	-	1	1	1	1	3	1	2
CO-6	-	1	1	1	-	1	-	-	2	3	-	3

INDIAN CONSTITUTION (FEB130002)

Credit -00 **L-T-P-: 2-0-0**

Unit	Description in detail	Total Hrs	Weightage
I	**Meaning of the constitution law and constitutionalism :** Meaning of the constitution law and constitutionalism **History of Indian Constitution :** Background, Timeline of Formation of IC, Constituent Assembly, Membership, Drafting, Provision of Preamble, Implementation **Salient features and characteristics of the Constitution of India** Structures – Parts, Schedules & Articles, Appendix, Influence of other constitution, Special characteristics	**5**	**18%**
II	**Fundamental Rights** History, Right to Freedom, Right to Equality, Right against Exploitation, Right to Freedom of Religion, Right to Education & Culture, Right to Constitutional Remedies **Right to Equality under Article –14** Background, Provisions given under the article, Case – studies **Right to certain Freedom under Article 19** Background, Provisions given under the article, Case – studies	**6**	**21%**
III	**Scope of the Right to Life and Personal Liberty under Article 21** Background, Provisions given under the article, Case – studies **Fundamental Duties and its legal status** Background, Article 51-A, Implementations, Case – studies **The Directive Principles of State Policy – Its importance and Implementation** Background, Part 4, , Article – 36, 41, 43, 44, 45,48, 48A, 51, Implementations	**5**	**18%**
IV	**Federal structure and distribution of legislative and financial powers between the Union and the States (PART - I)** Political, Economic and Constitutional relations between the Union and States, Union List over the State List and the Concurrent List **Parliamentary Form of Government in India –The constitution powers and status of the President of India** History of Parliament, Houses of Parliament, Powers Article 53, Powers and Duties : Legislative, Executive, Judicial, Appointment, Financial, Diplomatic, Military, Pardoning, Emergency, Selection & Election Process **Powers and Procedure for Amendments in Indian Constitution** Background, Types, Procedure, Responsible Article	**7**	**25%**
V	**History of amendments in Indian Constitutional** Key amendments in Indian constitution	**5**	**18%**

	Emergency Provisions: National Emergency, President Rule, Financial Emergency Background, Types, Procedure, Responsible Article **Local Self Government –Constitutional Scheme in India** Background, Brief History : GVK Rao Committee, L.M Singhvi Committee, Timeline of Formation, Present scenario, Functions		

Reference Books :

1. Constitutional Law of India, Dr. J.N. Pandey, Central Law Agency
2. Introduction to the Consitution of India, Durga Das Basu, LexisNexis.
3. Indian Constitutional Law, M.P. Jain, LexisNexis
4. V.N.Shukla's Constitution of India, Mahndra Pal Singh, Eastern Book Company Constitutional Law – I Structure, Udai Raj Rai, Eastern Book Company

Enhance human values, create awareness about law enactment and importance of Constitution.

Course Outcomes:-

After completion of the course, the students will be able to:

1. Enhance human values, create awareness about law enactment and importance of Constitution
2. To Understand the Fundamental Rights and Fundamental Duties of the Indian Citizen to instil morality, social values, honesty, dignity of life and their social Responsibilities
3. Create Awareness of their Surroundings, Society, Social problems and their suitable solutions while keeping rights and duties of the citizen keeping in mind.
4. Understand distribution of powers and functions of Local Self Government.
5. Understand the National Emergency, Financial Emergency and their impact on Economy of the country.
6. Explain the importance of Traditional knowledge in Agriculture and Medicine.

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	2	2	2	3	2	2	-	-	2	2	2
CO-2	3	-	-	-	-	1	-	-	-	-	1	1
CO-3	3	2	2	2	2	-	2	-	-	2	-	-
CO-4	3	-	-	2	-	2	-	-	-	2	-	-
CO-5	3	2	-	1	1	-	3	-	-	-	2	-
CO-6	3	2	2	-	-	1	1	-	-	3	2	2

ENGINEERING MATHEMATICS – III (FEB130401)

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1	**Basic Probability:** Experiment, definition of probability, conditional probability, independent events, Bayes' rule, Bernoulli trials, Random variables, discrete random variable, probability mass function, continuous random variable, probability density function, cumulative distribution function, properties of cumulative distribution function, Two dimensional random variables and their distribution functions, Marginal probability function, Independent random variables	08	20%
2	**Some special Probability Distributions:** Binomial distribution, Poisson distribution, Poisson approximation to the binomial distribution, Normal, Exponential and Gamma densities, Evaluation of statistical parameters for these distributions.	10	22%
3	**Basic Statistics** Moments, Expectation, dispersion, skewness, kurtosis, expected value of two dimensional random variable, Linear Correlation,, correlation coefficient, rank 10 22% correlation coefficient, Regression, Bounds on probability, Chebyshev's Inequality	10	22%
4	**Applied Statistics** Formation of Hypothesis, Large sample test for single proportion, Difference of proportions, Single mean, Difference of means, and Difference of standard deviations, t- Test for single mean, difference of means, t-test for correlation coefficients, F- test for ratio of variances, Chi-square test for goodness of fit , independence of attributes	10	22%
5	**Curve fitting by the Numerical Method** Curve fitting by of method of least squares, fitting of straight lines, second degree parabola, general curves	04	14%

Reference Books:

1. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall

2. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India.
3. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.
4. D. C. Montgomery and G. C. Runger, Applied Statistics and Probability for Engineers, Wiley.
5. J. L. Devore, Probability and Statistics for Engineering and the Sciences, Cengage Learning.

Course Outcomes:-

After completion of the course, the students will be able to:

1. understand the terminologies of basic probability, two types of random variables and their probability functions
2. observe and analyze the behavior of various discrete and continuous probability distribution understand the central tendency, correlation and correlation coefficient and also regression
3. apply the statistics for testing the significance of the given large and small sample data by using t- test, F- test and Chi-square test
4. understand the fitting of various curves by method of least squar
5. understand the central tendency methods and apply it in computer problems

Course Outcomes	Expected Mapping with Programme Outcomes *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	2	1	1	2	2	2	-	2	2	-	1
CO-2	3	2	2	1	2	2	2	-	2	1	-	-
CO-3	3	2	-	1	1	-	2	-	2	-	-	-
CO-4	3	2	-	1	1	-	3	-	2	1	-	-
CO-5	3	2	2	1	1	-	2	-	2	-	-	-
CO-6	3	3	1	1	1	-	2	-	2	2	-	-

BUILDING CONSTRUCTION & TECHNOLOGY(FEB130101)

Credit -05 **L-T-P-: 4-0-2**

Unit	Description in detail	Total Hrs	Weightage
I	**Introduction:** Overview of construction practices, theory and methods. **Subsurface Investigation:**	**12**	**24%**

	Objectives, methods of boring like wash boring, percussion etc., **Shallow Foundations:** Necessity, types, Setting out, Excavation, Construction, Failures of foundation and Remedial measures.		
II	**Masonry Construction:** A) Stone masonry: Technical terms, lifting appliances, joints, types – random (un-coursed) rubble, coursed rubble, dry rubble masonry, Ashlar masonry- Ashlar fine, chamfered fine. B) Brick masonry: Technical terms, bonds in brick work- English bond, single & double Flemish bond, garden wall bond, raking bond, Dutch bond. C) Composite masonry: Stone facing with brick backing, brick facing with concrete backing. D) Hollow concrete blocks and construction E) Cavity walls: Brick cavity walls, position of cavity at foundation, roof and at opening levels. F) Lintels & arches: Lintels – types, construction. Arches – technical terms, types – brick arches, rough, axed, stone arches, flat – semicircular. G) Plain and Reinforced Concrete Construction: Pre-cast and cast-in-situ Construction.	**08**	**18%**
III	**Doors and Windows:** **A) Doors:** Location, technical terms, size, types, construction, suitability. **B) Windows**: Factors affecting selection of size, shape, location and no. of windows, types, construction, suitability, fixtures and fastenings. **C) Ventilators**: Ventilators combined with window, fanlight. **Stairs and Staircases:** Definition, technical terms, requirements of good stair, fixing of going and rise of a step, types of steps, classification, example – stair Planning, elevators, escalators.	**10**	**22%**
IV	**Floorings:** Introduction, essential requirements of a floor, factors affecting selection of flooring material, types of ground floors, brick, flag-stone, tiled cement concrete, granolithic, terrazzo, marble, timber flooring, upper floor-timber, timber floor supported on RSJ flag stone floor resting on RSJ, jack arch floor, reinforced concrete floor, ribbed floor, pre-cast concrete floor. **Roofs and Roof Coverings:** Introduction, requirements of good roof technical terms, classification, types of roof coverings for pitched roof. A.C. sheet roofs – fixing of A.C. sheets, laying of big six sheets, G.I. Sheets roofs, slates, flat roof – advantages, dis-advantages, types of flat terraced roofing. **Wall Finishes:** Plastering, pointing and painting	**12**	**24%**

V	**Coffer Dams:** Definition, uses, selection of coffer dams, types of coffer dams, design features of coffer dams; leakage prevention, economic height **Caissons:** Definition, uses, construction material, types of caissons, loads on caisson, design features of caissons, floating of caissons, cutting edges, sinking of caisson, tilting of caisson, caisson diseases.	**06**	**12%**

Reference Books :

1. Building Construction by Dr. B. C. Punamia
2. Building Construction by SushilKumar
3. Building Construction by Gurcharan Singh
4. Building Construction by S. C. Rangwala
5. Building Construction by P.C Varghese, Prentice-Hall of India, New Delhi
6. Indian Standard Institution, National Building Code of India, ISI, 1984, New Delhi

Course Outcome :

After learning the course the students should be able to:

1. Discuss sub surface soil strata investigation.
2. Construct various types of shallow foundation.
3. Execute various types of masonry.
4. Construct various structural and non-structural building components.
5. Erect various temporary works for new and existing buildings.
6. Apply special treatments like water resistance, thermal insulation acoustical construction.
7. Select appropriate method of construction.
8. Explain causes of failure and remedial measures for foundations
9. Explain the green buildings and suggest how to convert existing building into green building.

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	1	1	1	3	-	-	2	-	1	-	1	1
CO-2	2	1	3	1	-	2	1	-	2	-	2	-
CO-3	2	2	2	-	-	2	2	-	1	-	2	-
CO-4	1	2	2	1	2	3	1	1	-	-	2	-

CO-5	2	2	3	-	2	2	-	-	1	-	1	-
CO-6	1	2	2	2	2	2	3	-	1	-	2	1
CO-7	1	2	3	2	2	2	1	1	-	1	2	1
CO-8	2	3	2	1	-	2	2	1	-	-	2	1
CO-9	1	2	2	2	-	2	3	1	-	1	2	2

ENGINEERING GEOLOGY (FEB130103)

Credit -03 **L-T-P-: 2-0-2**

Unit	Description in detail	Total Hrs	Weightage
I	**Introduction:** Definition of geology, Branches of geology and Scope of geology	**03**	**12%**
II	**Physical Geology:** Branches and scope of Geology; Surface processes and landforms: Weatheringand Erosion; Introduction to geological agents(river, wind, oceans, glaciers, groundwater) and their actions (erosion, transport and deposition). Interior of the Earth: internal structure of earth, study of core, mental and crust of the Earth. Processes responsible for volcanism(Process of volcanic eruption, types of volcanoes and volcanic hazard) and earthquake(Causes of earthquake occurrence, Distribution (seismic zoning), Seismo-tectonic setup of India, seismic hazard: Tsunamis, Active fault rupture, liquefaction). Plate Tectonics: Introduction to the concept of plate tectonics, mechanism responsible for plate movement, types of plate boundaries, processes and features associated with plate boundaries. Continental drift and sea floor spreading.	**05**	**26%**
III	**Mineralogy and Petrology:** Physical properties of minerals, major rock forming minerals, occurrence and use of minerals. Introduction to major rock types(Igneous, sedimentary and metamorphic rocks); their genesis, classificationand structures; engineering properties of rocks, advantages and disadvantages of different rock types at construction.	**05**	**12%**
IV	**Structural geology:** Introduction to primary and secondary geological structures. Study of geological faults, folds, joints and active faulting. Their origin, types and engineering consideration. Geological mapping: study of Strike and dip using models and numerical problems, preparation of geological cross section **Hydrogeology:** Hydrological cycle and groundwater	**08**	**31%**
V	**Geology in Civil Engineering:** Geological investigationsduring planning for tunnels, dams-reservoirs-runways-roads and buildings. Landslideand mass movement: Introduction, types, mitigation and prevention of landslide and mass movement. Remote sensing and Geographical Information System (GIS): Introduction to remote sensing and GIS, use of remote sensing and GIS in geological investigations and geological hazard mitigation	**05**	**19%**

Reference Books :

1. Engineering Metrology and Measurement, N V Raghavendra and Krishnamurthy, Oxford University Press,
2. Engineering Metrology and Measurements, Bentley, Pearson Education.
3. Theory and Design for Mechanical Measurements, 3 rd. Edition, Richard S Figliola, Donald E Beasley, Wiley India.
4. Metrology and Measurement, Anand Bewoor & Vinay Kulkarni McGraw-Hill
5. Engineering and General Geology, Parbin Singh, 8th Edition (2010), S K Kataria & Sons.
6. Text Book of Engineering Geology, N. Chenna Kesavulu, 2 nd Edition (2009),
7. Macmillan Publishers India.
8. Geology for Geotechnical Engineers, J.C. Harvey, Cambridge University Press (1982)

Course Outcome :

After learning the course, the students shall be able to:

1. Know soil formation, types of soils, types of soils found in various parts of India.
2. Determine the index properties and interrelationships between various soil parameters.
3. Understand the different types of soil classification systems. Classify field soils as per particle size and atterberg's indices.
4. Know types of soil water found in nature, it's permeability characteristics and seepage determination.
5. Site characterization and how to collect, analyze, and report geologic data using
6. standards in engineering practice

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	2	1	1	1	1	2	1	1	-	-	-
CO-2	2	2	2	1	2	2	1	-	-	-	-	-
CO-3	3	3	2	2	2	1	1	-	-	1	-	1
CO-4	3	2	1	2	2	1	1	-	1	-	1	-
CO-5	3	2	2	1	2	1	1	-	-	-	-	-
CO-6	3	3	1	2	3	-	1	-	-	-	-	-

MECHANICS OF SOLIDS (FEB130104)

Credit -05 L-T-P-: 4-0-2

Unit	Description in detail	Total Hrs	Weightage
I	**Introduction** Definition of space, time, particle, rigid body, deformable body. Force, types of forces, Characteristics of a force, System of forces,Composition and resolution of forces. Fundamental Principles of mechanics: Principle of transmissibility, Principle of superposition,Law of gravitation, Law of parallelogram of forces, Newton's Lawsof Motion **Fundamentals of Statics** Coplanar concurrent and non-concurrent force system:Resultant, Equilibrant, Free body diagrams.Coplanar concurrent forces: Resultant of coplanar concurrent forcesystem by analytical and graphical method, Law of triangle of forces, Law of polygon of forces, Equilibrium conditions for coplanar	**14**	**25%**
II	**Applications of fundamentals of statics Statically determinate beams:** Types of loads, Types of supports, Types of beams;Determination of support reactions, Relationship between loading,shear force & bending moment, Bending moment and shear forcediagrams for beams subjected to only three types of loads :i)concentrated loads ii) uniformly distributed loads iii) couples and theircombinations; Point of contra flexure, point & magnitude of maximum bending moment, maximum shear force **Stresses in Beams:** Flexural stresses – Theory of simple bending, Assumptions, derivation of equation of bending, neutral axis, determination of bending stresses, section modulus of rectangular & circular (solid & hollow), I,T,Angle, channel sections Shear stresses – Derivation of formula, shear stress distribution across various beam sections like rectangular, circular, triangular, I, T,angle sections.	**11**	**25%**

III	**Centroid and moment of inertia and mass moment of inertia Centroid:** Centroid of lines, plane areas and volumes, Examples related to centroid of composite geometry, Pappus – Guldinus first and second theorems. **Moment of inertia of planar cross-sections:** Derivation of equation of moment of inertia of standard lamina using first principle, Parallel & perpendicular axes theorems, polar moment of inertia, radius of gyration of areas, section modulus. Examples related to moment of inertia of composite geometry. **Torsion:** Derivation of equation of torsion, Assumptions, applicationof theory of torsion equation to solid hollow circular shaft, torsionalrigidity	**14**	**25%**
IV	**Simple stresses & strainsBasics of stress and strain**: 3-D state of stress (Concept only)Normal/axial stresses: Tensile & compressive **Tangential Stresses:** Shear and complementary shearStrains: Linear, shear, lateral, thermal and volumetric.Hooke's law, Elastic Constants: Modulus of elasticity, Poisson's ratio,Modulus of rigidity and bulk modulus and relations between themwith derivation.Application of normal stress & strains: Homogeneous and composite bars having uniform & stepped sections subjected to axial loads andthermal loads, analysis of homogeneous prismatic bars undermultidirectional stresses	**10**	**20%**
V	**Principle stresses**: Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress, ellipse of stress and their applications. **Physical & Mechanical properties of materials: (laboratory hours)** Elastic, homogeneous, isotropic materials; Stress –Strain relationships for ductile and brittle materials, limits of elasticity and proportionality, yield limit, ultimate strength, strain hardening, proof stress, factor of safety, working stress, load factor, Properties related to axial, bending, and torsional & shear loading, Toughness, hardness, Ductility This portion, Brittleness **Simple Machines: (laboratory hours)** Basics of Machines, Definitions: Velocity ratio, mechanical advantage, efficiency, reversibility of machines. Law of Machines, Application of law of machine to simple machines such as levers, pulley and pulley blocks,	**04**	**05%**

	wheel and differential axle, Single purchase, double purchase crab, screw jacks. Relevant		

Reference Books :

1. Engineering Mechanics statics by R. C. Hibbeler, McMillan Publication.
2. Engineering Mechanics by R S Khurmi
3. Engineering Mechanics by S S Bhavikatti
4. Mechanics for Engineers - Statics Fourth Edition, by F. P. Beer and E. R. Johnson
5. Engineering Mechanics, 2nd ed. — MK Harbola
6. Introduction to Mechanics — M K Verma
7. An Introduction to Mechanics — D Kleppner & R Kolenkow
8. Principles of Mechanics — JL Synge & BA Griffiths
9. Mechanics — JP Den Hartog
10. Engineering Mechanics - Dynamics, 7th ed. - JL Meriam
11. Engineering Mechanics by Shames I. H., P H I India.
12. Mechanics of Structure Vol. I S. B. Junnarkar & H. J. Shah
13. Mechanics of Materials E. P. Popov
14. Strength of Materials G. H. Ryder
15. Mechanics of Materials Timoshenko and Gere
16. Mechanics of Materials Beer and Johnston.

Course Outcome :

1. Apply fundamental principles of mechanics, equilibrium and statics to practical problems of engineering.
2. Determine centroid and moment of inertia of a different geometrical shape and its use in engineering problem.
3. Apply the law of statics friction in simple applications
4. Determine different types of stresses and strains developed in the member subjected to axial, bending, shear, torsion & thermal loads.
5. Differentiate behavior and properties of different engineering materials.
6. Apply the basics of simple machines and their working mechanism

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	3	3	1	2	1	-	1	1	1	-	-
CO-2	3	2	3	1	1	1	-	1	-	-	-	-
CO-3	2	2	1	1	1	-	-	-	-	-	-	-
CO-4	3	3	2	2	-	-	-	2	-	-	-	-
CO-5	2	3	1	1	-	-	-	1	-	-	1	-
CO-6	3	2	1	-	2	1	1	1	-	1	-	-

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE (FEB140001)

Sr.	Content	Total Hrs	% Weightage
1	Basic Structure of Indian Knowledge System (i) वेद, (ii) उन्नवेद (आयुवेद, धनुवेद, गन्धवेद, स्थान्त्यआदद) (iii) वेदाग (शिक्षा, कल्न, ननरुत, व्याकरण, ज्योनतष, छंद), (iv) उन्नाइग (धर्म,शास्त्र,मीमांशा,पुराण,तर्कशास्त्र)	24	60%
2	Modern Science and Indian Knowledge System.	06	15%
3	Yoga and Holistic Health care	06	15%
4	Case Studies	04	10%

Reference Books:

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, BharatiyaVidyaBhavan, Mumbai, 5th Edition, 2014
2. Swami Jitatmanand, Modern Physics and Vedant, BharatiyaVidyaBhavan
3. Fritzof Capra, Tao of Physics
4. Fritzof Capra, The wave of Life
5. V N Jha (Eng. Trans,), Tarkasangraha of Annam Bhatta, InernationalChinmay Foundation, Velliarnad, Amaku,am
6. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta
7. GN Jha(Eng. Trans.) Ed. R N Jha, Yoga-darshanam with VyasaBhashya, VidyanidhiPrakasham, Delhi, 2016
8. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, VidyanidhiPrakasham, Delhi, 2016
9. P R Sharma (English translation), ShodashangHridayam

Course Outcome:

After learning the course the students should be able to

1. Ability to understand, connect up and explain basics of Indian Traditional knowledge modern scientific perspective

2. Identify the concept of Traditional knowledge and its importance.Explain the need and importance of protecting traditional knowledge.

3. Explain the need and importance of protecting traditional knowledge

4. Illustrate the various enactments related to the protection of traditional knowledge.

5. Interpret the concepts of Intellectual property to protect the traditional knowledge

6. Explain the importance of Traditional knowledge in Agriculture and Medicine.

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)											
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO-1	3	-	-	-	2	3	2	2	2	3	1	1
CO-2	2	2	2	1	2	-	-	1	-	2	-	-
CO-3	2	3	-	1	1	-	2	-	-	2	-	-
CO-4	3	3	3	1	1	2	2	-	-	-	-	-
CO-5	2	2	2	2	2	-	-	-	-	2	-	-
CO-6	-	3	2	2	2	3	-	1	-	2	3	-

BUILDING & TOWN PLANNING (FEB140101)

Credit -04 **L-T-P-: 2-0-4**

Unit	Description in detail	Total Hrs	Weightage
I	**INTRODUCTION TO BUILDINGS:** Detailed study of Principles of building planning (with case study), Orientation of building, Principles of architecture composition, Fundamentals of Building Information Modelling (BIM)	**05**	**18%**
II	**BUILDING BY–LAWS AS PER NATIONAL BUILDING CODE*:*** Building by–laws of local authority, Standards for Residential, Public, Commercial, Industrial And Institutional Buildings Planning, Planning of Earth Quake Resistant Building, overview of RERA (Real Estate Regulatory Authority) and ODPS (Online Development Permission System	**05**	**18%**
III	**SYMBOLS AND SIGN CONVENTIONS*:*** Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards **BUILDING DRAWING*:*** Planning and Preparing working drawing of Residential Building with scale proportion, Layout of Public Building, Industrial Building etc., Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundation plan. Roof drainage plans. Provision of Building services (like water supply, drainage, electrification, etc.), software application in building planning and building Drawing for 2D model generation,	**07**	**24%**
IV	**PICTORIAL VIEW:** Principles of isometrics and perspective drawing. Perspective view of building. Fundamentals of Building Information Modelling (BIM) **HISTORY OF TOWN PLANNING** : Historical aspects and origin of Town Planning in the World and in India, Necessity of Civic surveys for Planning purpose, types, data and its presentation and analysis, Fundamental principles of Town Planning.	**06**	**22%**
V	**TOWN PLANNING**:	**05**	**18%**

	Components of town such as Land use, Zones, Road Network, CBD, Neighbourhood planning, Development controls for new town planning schemes for growth negotiation, Formation of Slums, Causes of Slum formation, remedial measures for avoiding slum formation, Slum Clearance and Rehabilitation Use of GIS tools for Town Planning.		

Reference Books :

1. Planning, designing building by Y. S. Sane, Allies Book Stall
2. Sikka, V.B. (2013), A Course in Civil Engineering Drawing, S.K.Kataria& Sons,
3. Sham Tickoo Swapna D (2009), "AUTOCAD for Engineers and Designers", Pearson Education,
4. Building Drawing by M. G. Shah, C. M. Kale and S. Y. Patki, Tata Mc Graw Hill, New Delhi
5. Architecture- Form, Space and Order by Francis D.K. Ching
6. Building Planning, Designing and scheduling by Gurucharan Singh, Standard Book House, New Delhi
7. National Building Code of India - 2016: Vol.-1 & Vol.-2, Bureau of Indian Standards, New Delhi
8. General Development Control Regulations published by Development Authority
9. Town Planning by S.C. Rangwala, Charotar publishing House, Anand
10. Venugopal (2007), "Engineering Drawing and Graphics + AUTOCAD", New Age International Pvt. Ltd
12. Corresponding set of CAD Software Theory and User Manuals.
13. Guide to RERA with RERA check list by Texman publications.

Course Outcome :

After learning the course the students should be able to

1. Comprehend local building bye-laws and provisions of National Building Code in respect of building and town planning resulting in functionally efficient, economically viable and legally acceptable buildings.
2. Discuss and apply various aspects of principles of building planning and town planning
3. Understand and implement various aspects of Principles of Architectural composition
4. Explain the principles of planning and design considerations to construct earthquake resistant building
5. Understand, interpret and prepare working drawings, foundation plans, perspective drawing and other executable drawings and prepare the drawing using software

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	1	1	1	-	1	1	1	1	1	-	-
CO-2	2	2	2	-	-	1	1	2	-	-	-	1
CO-3	2	2	2	-	-	1	1	2	-	-	-	-
CO-4	3	3	3	1	2	2	1	1	1	-	-	1
CO-5	3	3	3	2	1	1	1	2	-	-	-	1

Civil Engineering Global & Social Impact (FEB140102)

Credit -02 **L-T-P-: 2-0-0**

Unit	Description in detail	Total Hrs	Weightage
I	**Introduction:** Introduction to Course and Overview; Understanding the past to look into the future: Pre-industrial revolution days, Agricultural revolution, first and second industrial revolutions, IT revolution; Recent major Civil Engineering breakthroughs and innovations; Present day world and future projections, Ecosystems in Society and in Nature; the steady erosion in Sustainability; Global warming, its impact and possible causes; Evaluating future requirements for various resources; GIS and applications for monitoring systems; Human Development Index and Ecological Footprint of India Vs other countries and analysis **Importance of Civil Engineering :** Understanding the importance of Civil Engineering in shaping and impacting the world; the ancient and modern Marvels and Wonders in the field of Civil Engineering; Future Vision for Civil Engineering	**09**	**35%**
II	**Civil Engineering Infrastructures** Infrastructure - Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy); Water provisioning; Telecommunication needs (towers, above-ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability.	**04**	**14%**
III	**Environmental Civil Engineering** Environment- Traditional & futuristic methods; Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River interlinking), Multi-purpose water projects, Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationary and no stationary; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability.	**05**	**18%**

IV	**Global Crisis** Built environment – Facilities management, Climate control; Energy efficient built environments and LEED ratings, Recycling, Temperature/ Sound control in built environment, Security systems; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures & Heritage structures; Innovations and methodologies for ensuring Sustainability	**02**	**07%**
V	**Social Aspects of Civil Engineering** Civil Engineering Projects – Environmental Impact Analysis procedures; Waste (materials, manpower, equipment) avoidance/ Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects; New Project Management paradigms & Systems (Ex. Lean Construction), contribution of Civil Engineering to GDP, Contribution to employment (projects, facilities management), Quality of products, Health & Safety aspects for stakeholders; Innovations and methodologies for ensuring Sustainability during Project development.	**08**	**26%**

Reference Books :

- Žiga Turk (2014), Global Challenges and the Role of Civil Engineering, Chapter 3 in: Fischinger M. (eds) Performance-Based Seismic Engineering: Vision for an Earthquake Resilient Society. Geotechnical, Geological and Earthquake Engineering, Vol. 32. Springer, Dordrecht
- Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, Economic and Working Environment, 120th ASEE Annual Conference and Exposition
- NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The Bridge, Vol 34, No.2, Summer 2004.
- Allen M. (2008) Cleansing the city. Ohio University Press. Athens Ohio.
- Ashley R., Stovin V., Moore S., Hurley L., Lewis L., Saul A. (2010). London Tideway Tunnels Programme – Thames Tunnel Project Needs Report – Potential source control and SUDS applications: Land use and retrofit options
- Ashley R M., Nowell R., Gersonius B., Walker L. (2011). Surface Water Management and Urban Green Infrastructure. Review of Current Knowledge. Foundation for Water Research FR/R0014
- Blackmore J M., Plant R A J. (2008). Risk and resilience to enhance sustainability with application to urban water systems. J. Water Resources Planning and Management. ASCE. Vol. 134, No. 3, May.
- Fundamentals of Management: Essential Concepts and Applications, Robbins S.P. and Decenzo David A. - Pearson Education
- Economics: Principles of Economics, N Gregory Mankiw - Cengage Learning

- Principles and Practices of Management, L.M.Prasad
- Principles of Management, Tripathy and Reddy
- Modern Economic Theory, Dr. K. K. Dewett& M. H. Navalur - S. Chand Publications

COURSE OUTCOMES

1. Describe about recent civil engineering breakthroughs &innovates

2. Explain the awareness of various codes & standards governing infrastructure development

3. Describe about environmental metrics & monitoring

4. Explain the sustainability of structure and environment

5. Explain the innovations and methodologies for ensuring sustainability during project development

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	1	-	1	-	2	2	-	-	2	1	1
CO-2	3	1	-	2	-	1	2	-	-	1	2	1
CO-3	3	2	-	1	-	1	3	-	-	1	1	1
CO-4	2	2	-	1	-	1	2	-	-	-	1	1
CO-5	2	3	-	-	-	2	1	-	-	-	-	1

FLUID MECHANICS (FEB140103)

Credit -03 **L-T-P-: 2-0-2**

Sr No	Contens	Teaching Hrs	% Weightage
1	**Module 1: Properties of Fluids** Mass density, specific weight, specific gravity, specific volume, vapour pressure, compressibility, elasticity, surface tension, capillarity; Newton's law of viscosity, classification of fluids, dynamic viscosity, kinematic viscosity, variation of viscosity with temperature; Basic concept applicable to fluid mechanics.	05	16%
2	**Module 2: Fluid Statics** **Measurement of Pressure:** Pressure variation in static fluid, PASCAL's law, Units and scale of pressure measurement- Atmospheric pressure, Absolute pressure, Gauge pressure, and Vacuum pressure, Hydrostatic paradox, Piezometer, U- Tube manometer, Single column manometer, U-tube differential manometer, Inverted U-tube differential manometer, micro manometers, Mechanical pressure gauges.	05	16%
3	**Module 3: Hydrostatic force on plane and curved surface:** Total pressure and center of pressure, pressure diagram, Total pressure on plane surfaces and curved surfaces depth of center of pressure, Practical applications of Total pressure and Center of pressure. **Buoyancy and Flotation:** Buoyant force, Buoyancy and Center of Buoyancy, Archimedes Principle, Metacenter and Metacentric height, Equilibrium of floating and submerged bodies, Metacentric height evaluation –theoretical and experimental method, Oscillation of floating body **Fluids in Relative Equilibrium**: Static fluid subjected to uniform linear acceleration, Liquid containers subjected to	06	18%

	constant horizontal acceleration, Liquid containers subjected to constant vertical acceleration, Liquid containers subjected to constant rotation.		
4	**Module 4: Fluid Kinematics** Fluid flow methods of analysis of fluid motion, Streamlines, Path lines, Streak lines and Stream tubes. Types of fluid Flow-Steady and unsteady flow, Uniform and non-uniform flow, Laminar and turbulent flow, Reynolds number, Reynolds experiment, Rotational and Irrotational flow, Subcritical, critical and Supercritical flow, Compressible and Incompressible flow, One, Two and three dimensional flow, Circulation and vorticity, Velocity potential and stream function, flow net, Source, Sink and Doublet.	**08**	**25%**
5	**Module 5: Fluid Dynamics** Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation: venturimeter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced; Dimensional Analysis and Dynamic Similitude - Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number; Buckingham's π-Theorem.	**08**	**25%**

Reference Books:

1. Fluid Mechanics and Machinery, C.S.P. Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010
2. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill
3. Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.J.
4. Finnemore, International Student Edition, Mc Graw Hill.

COURSE OUTCOMES

After completion of the course, the students will be able to:

1. Understand the broad principles of fluid statics, kinematics and dynamics

2. Understand definitions of the basic terms used in fluid mechanics

3. Understand classifications of fluid flow

4. Be able to apply the continuity, momentum and energy principles

5. Be able to apply dimensional analysis

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	3	2	1	1	3	1	2	-	2	-	2
CO-2	3	3	2	1	-	3	-	1	-	1	-	2
CO-3	3	3	2	1	-	3	-	-	-	1	-	1
CO-4	3	3	3	2	2	3	-	1	1	-	-	-
CO-5	3	3	3	2	1	3	-	-	1	-	-	-

Materials, Testing and Evaluation(FEB140104)

Unit	Description in detail	Total Hrs	Weightage
I	**INTRODUCTION** Physical , chemical and engineering properties of building materials, Application of building materials, Alternative materials for the given items in building construction.	**04**	**15%**
II	**CLAY ,LIME AND POZZOLANA PRODUCTS** Classification of clay products, Types of bricks, Manufacturing process of bricks, Test on bricks, Standard requirements and grades of bricks as per BIS, Types of clay tiles and its uses, Sources and classification of Lime, Uses of lime with specific field situation, Types of pozzolanic materials, Advantages of addition of pozzolonic material	**08**	**25%**
III	**CEMENT CONCRETE** Types of cement with their specific use, Grade of cement as per BIS, Engineering properties of cement, Field and laboratory test of cement as per BIS, Methods of storing the cement, Types of aggregate as per BIS, Requirements of aggregate as per BIS, Engineering properties of aggregate, Test on aggregate	**10**	**35%**
IV	**TIMBER** Types of timber, Uses and application of timber, Defects in timber and wood, Seasoning, Wood products with specific uses	**02**	**05%**
V	**MISCELLANEOUS CONSTRUCTIO N MATERIALS** Plastics and PVC, Ceramic products, Paints and Varnish, Materials for damp proofing , water proofing, Materials for anti termite treatment, Glass and fiber, Steel and iron materials, Materials used for false ceiling, Asbestoses, Concrete blocks	**06**	**20%**

Reference Books :

1. Engineering Materials by Dr. Janardan Jha, Khanna
2. Materials of Construction by A K Roy Chaudhary,
3. Building materials by S. K. Duggal, New Age International
4. Engineering Materials by Vazirani and Chandola,
5. Engineering Materials by S C Rangwala, Charotar
6. Construction Materials by D.N. Ghose, TATA Mc Graw Hill
7. Civil Engineering materials by TTTI ,Chandigarh, TTTI

Course Outcome :

1. Identify clay based products for use in building constructions based on its properties.
2. Appreciate the uses of lime and Pozzolana products in building

construction.

3. Select appropriate ingredients of proper quality for cement concrete as per required BIS codes.
4. Describe timber and wood products and its uses in building construction.
5. Identify different types of advanced building materials and their uses in construction

Course Outcomes	Expected Mapping with Programme Outcomes *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3		2	-	3	3	2	3	2	2	1	1
CO-2	3	2	2	1	2	-	-	1	-	-	2	-
CO-3	3	2	3	2	2	1	2	-	-	1	-	2
CO-4	2	1	2	1	2	-	3	2	-	-	-	1
CO-5	2	2	2	3	2	-	1	-	1	-	3	-

STRUCTURAL ANALYSIS-I (FEB140105)

Credit -03 **L-T-P-: 2-0-2**

Unit	Description in detail	Total Hrs	Weightage
I	**Fundamentals of Statically Determinate Structures:** Types of statically determinate & indeterminate structures, static and kinematic indeterminacy, stability of structures, principle of superposition, Maxwell's reciprocal theorems. Computation of internal forces in statically determinate structures such as plane truss, plane frame, grids.	**05**	**15%**
II	**Displacement of Determinate Beams and Plane Truss:** Differential equation of elastic curve, relation between moment, slope and deflection, Macaulay's method, Moment Area Method, Conjugate Beam Method applied to beams. Joint displacement of determinate plane truss using unit load method.	**07**	**25%**
III	**Direct and Bending stresses:** Members subjected to eccentric loads, middle third rule, kernel of section, chimney subjected to wind pressure, retaining walls, dams subjected to hydraulic pressure **Columns and Struts:** Buckling of columns, different end conditions, effective length, least radius of gyration, Euler's and Rankine's formulae, columns with initial curvature, eccentrically loaded columns, columns with lateral loading.	**09**	**34%**
IV	**Arches, Cables and Suspension Bridges:** Calculation internal forces in three hinge arches with circular and parabolic shapes subjected to various types of loading. Forces and end actions in cables due to various types of loading. Unstiffened three hinged parabolic and centenary type suspension bridge.	**07**	**25%**
V	**Fixed Beams & Consistent Deformation Method**: Computation of fixed-end actions for various types of loads and secondary Effects using basic principles, beams of varying moment of inertia. Analysis of propped cantilever beams & beams of varying moment of inertia using Consistent Deformation Method	**This portion to be covered in laboratory**	**0%**

Reference Books :

1. Junarkar S.B. & Shah H.J.; Mechanics of Structures Vol-I; Charotar publishing house, Anand
2. Wang C. K.; Intermediate Structural Analysis; Tata McGraw Hill book Company, New Delhi
3. Popov E.P.; Engineering Mechanics of Solids; Prentice Hall of India, New Delhi
4. Ryder G.H.; Strength of Materials; Mcmillan
5. Gere & Timoshenko; Mechanics of Materials; CBS Publishers & Distributors, Delhi
6. Hibbler R C; Mechanics of Materials; Pearson Education
7. Hibbler R C; Structural Analysis; Pearson Education

Course Outcome :

After studying this subject student will be able to:

1. Apply principles of statics to determine reactions & internal forces in statically determinate structures.
2. Determine displacements of statically determinate structures.
3. Determine stresses due to axial & eccentric loading.
4. Determine buckling load for columns & struts with different end conditions.
5. Determine fixed-end actions for various types of loads.

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	3	3	1	-	-	-	2	-	-	-	-
CO-2	3	2	3	1	-	-	-	1	-	-	-	-
CO-3	3	3	2	2	-	-	-	1	-	-	-	-
CO-4	3	3	3	1	-	-	-	1	-	-	-	-
CO-5	2	3	3	1	-	-	-	1	-	-	-	-

SURVEYING (FEB140106)

Credit -03 **L-T-P-: 2-0-2**

Unit	Description in detail	Total Hrs	Weightage
I	**Plane Table Survey:** Introduction, principle, instruments, setting up the plane table, methods of plane tabling, advantages, sources of Errors	**04**	**15%**
II	**Theodolite Traversing:** Introduction, definitions, the Vernier transit theodolite, temporary and permanent adjustment of theodolite, measuring horizontal and vertical angles, methods of traversing, closing error, computation of latitudes and departure, check in closed and open traverse, balancing of traverse, Gale's table **Trigonometric levelling:** Indirect levelling, heights and distances, methods, direct levelling on steep ground.	**06**	**25%**
III	**Curves:** Elements of simple and compound curves – Method of setting out– Elements of Reverse curve - Transition curve – length of curve – Elements of transition curve - Vertical curves **Areas and Volumes:** Introduction, computation of area, computation of area from field notes and plotted plans, boundary area, area of traverse, Use of Plannimeter, computations of volumes, Volume from cross sections, Trapezoidal and Prismoidal formulae, Prismoidal correction, Curvature correction, capacity of reservoir, volume from borrow pits	**08**	**30%**
IV	**Tachometric Surveying**: Introduction, purpose, principle, instruments, methods of tacheometry, stadia constants, analytic lens, Sub tense bar, field work in tacheometry, reduction of readings, errors and precisions **Geodetic Surveying:** Introduction, triangulation, principle and uses of triangulation, triangulation systems and its classification, well conditioned triangles, strength of figure, selection of triangulation stations and their inter-visibility, stations marks, signals, towers and scaffolds, base line, site selection and base line	**08**	**25%**

	measurement, tape corrections, the base net, extension of base line, satellite station and reduction to centre		
V	**Theory of Errors :** Introduction, types of errors, definitions, laws of accidental errors, laws of weights, theory of least squares, rules for giving weights and distribution of errors to the field observations, determination of the most probable values of quantities. **Modern Surveying Instruments:** Introduction, electromagnetic spectrum, electromagnetic distance measurement, types of EDM instruments, electronic digital theodolites, total station, digital levels, scanners for topographical survey, global positioning system.	**02**	**05%**

Reference Books :

1. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
2. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011
3. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010
4. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
5. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001.
6. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.
7. Surveying Vol.I, II and III by Dr. B.C. Punamia
8. Surveying and Levelling Vol. I and II by T.P Kanetkar and S.V Kulkarni
9. Surveying Vol. I and II by S. K. Duggal
10. Surveying and Levelling by N.N. Basak
11. Surveying and Levelling by R. Agor
12. Advanced Surveying by R. Agor.
13. Roy, S.K., Fundamentals of Surveying, Prentice Hall India, New Delhi
14. Subramanian, R., Surveying and Leveling, Oxford University Press, New Delhi

Course Outcome :

The course will enable the students to:

1. Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities
2. Translate the knowledge gained for the implementation of Civil infrastructure facilities
3. Relate the knowledge on Surveying to the new frontiers of science like Hydrographic surveying, Electronic Distance Measurement, Global Positioning System, Photogrammetry and Remote Sensing
4. Relate the knowledge on Surveying to the new frontiers of science like Global Positioning System, Photogrammetry and Remote Sensing
5. To understand practical knowledge of process of theodolite and tacheometry survey..

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	3	1	-	3	1	-	2	2	1	1	-
CO-2	3	3	-	-	2	1	-	2	2	1	1	-
CO-3	3	3	2	2	3	1	-	2	2	-	-	-
CO-4	3	2	3	2	2	1	-	1	2	-	1	-
CO-5	3	3	3	2	2	2	-	1	2	1	-	1

ENGINEERING ECONOMICS & MANAGEMENT (FEB150001)

Credit -03 **L-T-P-: 3-0-0**

Unit	Description in detail	Total Hrs	Weightage
I	**Introduction:** Definitions, Nature, Scope, Difference between Microeconomics & Macroeconomics Theory of Demand & Supply; meaning, determinants, law of demand, law of supply, equilibrium between demand & supply Elasticity; elasticity of demand, price elasticity, income elasticity, cross elasticity **Theory of production**: Theory of production; production function, meaning, factors of production (meaning & characteristics of Land, Labour, capital & entrepreneur), Law of variable proportions & law of returns to scaleCost; Meaning, Short run & Long run cost, fixed cost, Variable cost, Total cost,Average cost, Marginal cost, Opportunity cost.Break even analysis; meaning, explanation, numerical	**08**	**20%**
II	**Markets and National Income :** Markets; Meaning, types of markets & their characteristics (Perfect Competition, Monopoly, Monopolistic Competition, Oligopoly) National Income; Meaning, stock and flow concept, NI at current price, NI at constant price, GNP, GDP, NNP,NDP, Personal income, disposal income **Basic Economic Problems :** Poverty - meaning, absolute & relative poverty, causes, measures to reduce itUnemployment: meaning, types, causes, remediesInflation; meaning, types, causes, measures to control.	**09**	**20%**

III	**Money and Banking :** Money; meaning, functions, types, Monetary policy- meaning, objectives, tools, Fiscal policy-meaning, objectives, toolsBanking; meaning, types, functions, Central Bank- RBI; its functions, concepts; CRR, bank rate, repo rate, reverse repo rate, SLR. **Introduction to Management :** Definitions, Nature, scope Management & administration, skill, types and roles of managers Management Principles; Scientific principles,Administrative principles,Maslow's Hierarchy theory of needs	**08**	**21%**
IV	**Functions of Management :** Functions of Management; Planning, Organizing, Staffing, Directing, Controlling(Meaning, nature and importance)Organizational Structures; meaning, principles of organization, types-formal and Informal, line, line & staff, matrix, hybrid (explanation with merits and demerits),Span of control, departmentalization. **Marketing and Finance Management :** Meaning, Marketing Mix, concepts of marketing, demand forecasting and methods, market segmentation Finance Management; Introduction, Meaning, scope, sources, functional departmental - zation.	**10**	**22%**
V	**Production and Human Resource Management:** Production Management; Introduction, definitions, objectives, functions, plant layout-types & factors affecting it, Human Resource Management; Introduction definitions, objectives of manpower planning, process, sources of recruitment, process of selection. **Corporate Social Responsibility and Business Ethics :** Corporate Social Responsibility; meaning, importance Business Ethics; meaning, Importance	**07**	**17%**

Reference Books :

1. Engineering Economics, R.Paneerselvam - PHI publication
2. Fundamentals of Management: Essential Concepts and Applications, Robbins S.P. and Decenzo David A. - Pearson Education
3. Economics: Principles of Economics, N Gregory Mankiw - Cengage Learning
4. Principles of Management, Tripathy and Reddy
5. Modern Economic Theory, Dr. K. K. Dewett & M. H. Navalur - S. Chand Publications

Course Outcome :

After learning the course the students should be able to:

1. To impart knowledge, with respect to concepts, principles and practical applications of economics, which govern the functioning of a firm/organization under different market conditions.
2. To help the students to understand the fundamental concepts and principles of management; the basic roles, skills, functions of management, various organizational structures and basic knowledge of marketing.
3. To help the students to understand the principles of management and basic knowledge of marketing
4. To understanding of the fundamental concepts of Managerial economics and demand.
5. The ability to apply knowledge to evaluate future demand and theory of production.

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	2	-	-	1	1	1	2	1	2	2	1
CO-2	2	2	-	-	1	2	1	2	2	1	2	2
CO-3	2	3	-	-	1	1	1	2	2	1	2	2
CO-4	3	2	-	-	1	1	-	2	2	1	2	1
CO-5	3	2	-	-	1	2	-	2	2	2	2	2

HYDROLOGY AND WATER RESOURCES ENGINEERING (FEB150101)

Credit -04 **L-T-P-: 3-1-0**

Unit	Description in detail	Credit	Weightage
I	***Introduction*** - hydrologic cycle, water-budget equation, history of hydrology, World water balance, applications in engineering, sources of data. ***Precipitation*** - forms of precipitation, characteristics of precipitation in India, measurement of precipitation, rain gauge network, mean precipitation over an area, depth area- duration relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP), rainfall data in India. ***Abstractions from precipitation*** - evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapotranspiration, measurement of evapotranspiration, evapotranspiration equations, potential evapotranspiration over India, actual evapotranspiration, interception, depression storage, infiltration, infiltration capacity, measurement of infiltration, modelling infiltration capacity, classification of infiltration capacities, infiltration indices.	**07**	**20 %**
II	***Runoff*** - runoff volume, SCS-CN method of estimating runoff volume, flow duration curve, flow-mass curve, hydrograph, factors affecting runoff hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph surface water resources of India, environmental flows. ***Ground water and well hydrology*** - forms of subsurface water, saturated formation, aquifer properties, geologic formations of aquifers, well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests	**08**	**25 %**
III	***Water withdrawals and uses*** – water for energy production, water for agriculture, water for hydroelectric generation; flood control. Analysis of surface water supply, Water requirement of crops- Crops and crop seasons in India, cropping pattern, duty and delta; Quality of irrigation water; Soil-water relationships, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation	**7**	**20 %**
IV	***Distribution systems*** -canal systems, alignment of canals, canal losses, estimation of design discharge. Design of channels- rigid boundary channels, alluvial channels, Kennedy's and Lacey's	**4**	**10 %**

	theory of regime channels. Canal outlets: non-modular, semi-modular and modular outlets. Water logging: causes, effects and remedial measures. Lining of canals, types of lining. Drainage of irrigated lands: necessity, methods.		
V	***Dams and spillways***- embankment dams: classification, design considerations, estimation and control of seepage, slope protection. Gravity dams: forces on gravity dams, causes of failure, stress analysis, elementary and practical profile. Arch and buttress dams. Spillways: components of spillways, types of gates for spillway crests; Reservoirs- Types, capacity of reservoirs, yield of reservoir, reservoir regulation, sedimentation, economic height of dam, selection of suitable site.	**10**	**25 %**

Reference Books :

1. K Subramanya, Engineering Hydrology, Mc-Graw Hill.
2. K N Muthreja, Applied Hydrology, Tata Mc-Graw Hill.
3. K Subramanya, Water Resources Engineering through Objective Questions, Tata Mc-Graw Hill.
4. G L Asawa, Irrigation Engineering, Wiley Eastern
5. L W Mays, Water Resources Engineering, Wiley.
6. J D Zimmerman, Irrigation, John Wiley & Sons
7. C S P Ojha, R Berndtsson and P Bhunya, Engineering Hydrology, Oxford.

Course Outcome :

At the end of the course, students must be in a position to:

1. Understand the interaction among various processes in the hydrologic cycle
2. Apply the application of fluid mechanics and use of computers in solving a host of problems in hydraulic engineering
3. Study types and classes of hydrologic simulation models and design procedures for safe and effective passage of flood flows for design of hydraulic structures
4. Understand the basic aquifer parameters and estimate groundwater resources for different hydro-geological boundary conditions
5. Understand application of systems concept, advanced optimization techniques to cover the socio-technical aspects in the field of water resources
6. Apply the principles and applications of remote sensing, GPS and GIS in the context to hydrological extreme flood and drought events in water resources engineering

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	2	1	3	1	3	2	-	-	-	-	2
CO-2	3	3	2	1	2	3	-	-	1	-	-	-
CO-3	3	3	2	2	2	3	1	1	2	3	2	1
CO-4	3	3	2	3	2	3	2	1	2	1	-	1
CO-5	3	2	3	3	2	3	3	2	2	2	1	1
CO-6	3	3	2	1	2	3	2	-	1	1	-	-

SOIL ENGINEERING – I(FEB150102)

Credit -04 **L-T-P-: 3-0-2**

Unit	Description in detail	Credit	Weightage
I	**Introduction** Types of soils, their formation and deposition, Definitions: soil mechanics, soil engineering, rock mechanics, geotechnical engineering. Scope of soil engineering. Comparison and difference between soil and rock. Basic Definitions and Relationships-Soil as three-phase system in terms of weight, volume, voids ratio, and porosity. Definitions: moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity, mass specific gravity, etc. Relationship between volume weight, voids ratio-moisture content, unit weight- percent air voids, saturation-moisture content, moisture content- specific gravity etc. Determination of various parameters such as: Moisture content by oven dry method, pycnometer, sand bath method, torsional balance method, nuclear method, alcohol method and sensors. Specific gravity by density bottle method, pycnometer method, measuring flask method. Unit weight by water displacement method, submerged weight method, core-cutter method, sand-replacement method. **Plasticity Characteristics of Soil** Introduction to definitions of: plasticity of soil, consistency limits-liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and consistency indices, flow & toughness indices, definitions of activity and sensitivity. Determination of: liquid limit, plastic limit and shrinkage limit. Use of consistency limits. Classification of Soils-Introduction of soil classification: particle size classification, textural classification, unified soil classification system, Indian standard soil classification system. Identification: field identification of soils, general characteristics of soil in different groups.	**12**	**30**
II	**Permeability of Soil** Darcy's law, validity of Darcy's law. Determination of coefficient of permeability: Laboratory method: constant-head method, falling-head method. Field method: pumping- in test, pumping- out test. Permeability aspects: permeability of stratified soils, factors affecting permeability of soil. Seepage Analysis- Introduction, stream and potential functions, characteristics of flow nets, graphical method to plot flow nets. **Effective Stress Principle**	**08**	**25**

	Introduction, effective stress principle, nature of effective stress, effect of water table. Fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition.		
III	**Compaction of Soil** Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Compaction in field, compaction specifications and field control.	**05**	**15**
IV	**Consolidation of Soil** Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, interpretation of consolidation test results, Terzaghi's theory of consolidation, final settlement of soil deposits, computation of consolidation settlement and secondary consolidation.	**05**	**15**
V	**Shear Strength of Soil** Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses, Mohr-Coulomb theory, types of shear tests: direct shear test, merits of direct shear test, triaxial compression tests, test behavior of UU, CU and CD tests, pore-pressure measurement, computation of effective shear strength parameters. Unconfined compression test, vane shear test.	**06**	**15**

Reference Books :

1. Soil Mechanics by Craig R.F., Chapman & Hall
2. Fundamentals of Soil Engineering by Taylor, John Wiley & Sons
3. An Introduction to Geotechnical Engineering, by Holtz R.D. and Kovacs, W.D., Prentice Hall, NJ
4. Principles of Geotechnical Engineering, by Braja M. Das, Cengage Learning
5. Principles of Foundation Engineering, by Braja M. Das, Cengage Learning
6. Essentials of Soil Mechanics and Foundations: Basic Geotechnics by David F. McCarthy
7. Soil Mechanics in Engineering Practice by Karl Terzaghi, Ralph B. Peck, and GholamrezaMesri.
8. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering (Civil and Environmental Engineering) by V.N.S. Murthy

Course Outcome :

After learning the course, the students should be able to:

1. Classify the soil and will be able to understand its behaviors and will be able to compute/estimate index parameters.
2. Interpret soil behaviors through learning soil compaction, consolidation, and analyses various theories and calculate parameters needed in design.
3. Compute earth pressure, stress distributions and FOS for slopes using various graphical and analytical tools for various engineering projects/site.
4. Differentiate, compare, formulate, and evaluate soil parameters through performing various tests as per site conditions or project needs ethically and professionally.
5. Suggest suitable type of foundation as per soil type, estimate bearing capacity and demonstrate its socio-economic feasibility.

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	3	2	2	1	3	2	1	1	-	-	1
CO-2	3	3	2	3	3	3	2	2	1	-	-	2
CO-3	3	3	3	3	3	3	2	2	1	-	-	1
CO-4	3	3	3	3	3	3	1	2	1	-	-	2
CO-5	3	3	2	2	2	3	1	2	1	-	-	1

Structural Analysis-II (FEB150103)

Credit -04 **L-T-P-: 3-0-2**

Unit	Description in detail	Total Hrs	Weightage
I	**Energy Principles**: Castigliano's theorems , computation of displacements of statically determinate beams, trusses and frames by unit load method, analysis of indeterminate structures – beams, trusses, frames	**05**	**10%**
II	**Slope Deflection Method** Analysis of continuous beams for various loading including settlement/ rotation of support, analysis of simple portal frame with sway	**06**	**20%**
III	**Moment Distribution Method** Analysis of continuous beams & frames including sway, use of symmetry of structure up to two storeyed / two bay frames.	**06**	**15%**
IV	**Influence line diagrams** ILD for statically determinate beams- I.L.D of support reaction, shear force and moment bending moment for beams subjected to u.d.l and several point loads, criteria for maximum effects, ILD for statically determinate trusses, forces in members for u.d.l and point loads ILD for statically indeterminate beams: Muller-Breslau's principle, steps for obtaining I.L for reaction and internal forces in propped cantilever and continuous beams, qualitative I.L for rigid jointed structures having higher degree of statically indeterminacy.	**08**	**20%**
V	**Matrix Methods:** Types of skeletal structures, Internal forces and deformations. Introduction and applications of stiffness method to analyze beams, Trusses and plane frames by system approach Introduction and applications of Flexibility method to analyze beams, Trusses and plane frames by system approach	**16**	**35%**
	Plastic Analysis Concept, Assumptions, Shape factor for different cross section, Collapse load, Load factor, Plastic modulus of section, Plastic moment of resistance, Computation of collapse load for fixed beam, Continuous beam and plane frame subjected to various load cases		

Reference Books :

1. Junarkar S.B. & Shah H.J.; Mechanics of Structures Vol-I; Charotar publishing house, Anand

2. Wang C. K.; Intermediate Structural Analysis; Tata McGraw Hill book Company, New Delhi

3. Popov E.P.; Engineering Mechanics of Solids; Prentice Hall of India, New Delhi

4. Ryder G.H.; Strength of Materials; Mcmillan

5. Gere & Timoshenko; Mechanics of Materials; CBS Publishers & Distributors, Delhi

6. Hibbler R C; Mechanics of Materials; Pearson Education

7. Hibbler R C; Structural Analysis; Pearson Education

Course Outcome :

After learning the course the students should be able to:

(a) Apply equilibrium and compatibility equations to determine response of statically determinate and indeterminate structures.
(b) Determine displacements and internal forces of statically indeterminate structures by classical, iterative and matrix methods.
(c) Determine internal forces and reactions in determinate and indeterminate structures subjected to moving loads
(d) Determine stresses due to axial and eccentric loading
(e) Determine fixed end reactions for various types of loads

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	2	3	2	-	-	-	2	-	-	-	1
CO-2	3	3	3	1	-	-	-	1	-	-	-	-
CO-3	3	2	2	2	-	-	-	1	-	-	-	1
CO-4	3	2	3	1	-	-	-	1	-	-	-	-
CO-5	2	3	3	1	-	1	-	1	-	-	-	1

TRANSPORTATION ENGINEERING I (FEB150104)

Credit -04 **L-T-P-: 3-0-2**

Unit	Description in detail	Total Hrs	Weightage
I	**Highway development and planning:**-Classification of roads, road development in India, Current road projects in India; highway alignment and project preparation	**05**	**10%**
II	**Geometric design of highways**:- Introduction; highway cross section elements; sight distance, design of horizontal alignment; design of vertical alignment; design of intersections, problems.	**08**	**15%**
III	**Design of pavements**:- Introduction; Bituminous material and tests, flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements- components and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems	**15**	**30%**
IV	**Hill roads**: – alignment, construction, drainage and maintenance. Roadside development – arboriculture, street lighting. Highway administration, economics and finance, road safety audit. Pavement failures, Maintenance, Surface and subsurface drainage, **Traffic engineering & control**:- Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of road intersections; design of parking facilities; highway lighting; problems	**15**	**30%**
V	**Tunnel Engineering** Necessity/advantage of a tunnel, Classification of Tunnels, Size and shape of a tunnel, Alignment of a Tunnel, Portals and Shafts, Methods of Tunneling in Hard Rock and Soft ground.	**08**	**15%**

Reference Books :

12. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros, 2017
13. Kadiyali, L.R., ' Traffic Engineering and Transport Planning', Khanna Publishers.
14. Partha Chakraborty, ' Principles Of Transportation Engineering, PHI Learning,
15. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski,'Principles of Highway Engineering and Traffic Analysis', 4th Edition, John Wiley

16. Srinivasa Kumar, R, Textbook of Highway Engineering, Universities Press, 2011.
17. Paul H. Wright and Karen K. Dixon, Highway Engineering, 7th Edition, Wiley Student Edition, 2009

Course Outcome :

After learning the course the students should be able to:

1. Know about highway planning and its classification
2. Carryout geometric design of highway
3. Carryout laboratory tests on aggregates and bituminous materials
4. Carryout preliminary design of flexible and rigid pavement
5. Know about pavement failures, its maintenance, importance of drainage, hill roads and their challenges
6. Carryout survey of classified traffic volume count and spot speed study on highway

Know about importance and working of different traffic control devices

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	-	-	-	3	3	2	3	2	2	1	1
CO-2	3	2	2	1	2	-	-	-	-	-	-	-
CO-3	3	2	2	1	2	-	-	-	-	-	-	-
CO-4	2	3	2	1	2	-	3	-	-	-	-	-
CO-5	2	2	2	1	2	-	-	-	-	-	-	-
CO-6	3	3	3	2	3	-	-	-	-	3	3	-
CO-7	-	2	2	3	2	2	-	1	-	2	-	-

INFRASTRUCTURE PLANNING (FEB150106)

Credit -03 **L-T-P-: 3-0-0**

Unit	Description in detail	Total Hrs	Weightage
I	**Introduction :-** Definition of infrastructure, characteristics of infrastructure projects, scope of infrastructure management. Infrastructure in India: An Overview of the Power Sector in India. Water Supply and Sanitation Sector. The Road, Rail, Air and Port Transportation Sectors. Telecommunications Sector. The Urban Infrastructure, The Rural Infrastructure, An Introduction to Special Economic Zones, Organizations and Players in the field of Infrastructure. The Stages of an Infrastructure Project Lifecycle. An Overview of Infrastructure Project Finance.	**06**	**20%**
II	**Privatization of Infrastructure :-** A Historical Overview of Infrastructure Privatization. The Benefits of Infrastructure Privatization. Problems with Infrastructure Privatization. Challenges in Privatization of Infrastructure. Privatization of Infrastructures in India. Introduction to infrastructure development through PPP route; Benefits of PPP Mode of procurement; Types of PPP Models and their contractual structure, Stakeholders' perspectives: Granting authority, Funders and Concessionaire, Government's role in successful PPP projects, Financial and Economic Appraisal of BOT Projects; VFM evaluation, PPP procurement process; Lifecycle of PPP projects, Contractual package of PPP project; Bankable concession agreement, Case study – Procurement process of Indian PPP projects	**06**	**20%**
III	**Challenges to Successful Infrastructure Planning And Implementation:** Mapping and Facing the Landscape of Risks in Infrastructure Projects. Economic and Demand Risks. Political Risks. Socio-Environmental Risks. Cultural Risks in Infrastructure Projects. Legal and Contractual Issues in Infrastructure. Challenges in Construction and Maintenance of Infrastructure. Introduction to risk management concept, Risk analysis techniques, Risk mitigation strategies.	**08**	**30%**
IV	**Strategies for Successful Infrastructure Project Implementation:**	**08**	**30%**

	Shaping the Planning Phase of Infrastructure Projects to mitigate risks.Designing Sustainable Contracts. Introduction to Fair Process and Negotiation. Negotiating with multiple Stakeholders on Infrastructure Projects. Sustainable Development of Infrastructure. Information Technology and Systems for Successful Infrastructure Management. Innovative Design and Maintenance of Infrastructure Facilities. Infrastructure Modeling and Life Cycle Analysis Techniques. Capacity Building and Improving the Government's Role in Infrastructure Implementation.		

Reference Books :

1. Akintoye, A., Beck. M., and Hardcastle, C. (Eds.). (2003). Public-Private Partnerships "Managing risks and opportunities". Oxford: Blackwell Science Limited.
2. Alvin Goodman, MakarandHastak, Infrastructure Planning Handbook: Planning, "Engineering and Economics" 1st Edition, MH/ASCE press.
3. Raghuram G (2001) "Infrasturcture Development and Finnancing" Towards A Public Private Partenership, Macmillan Publishers, New Delhi
4. Alagiri, "Infrastructure Development", ICFAI University press, Hydrabad
5. Marcel Hertogh, Stuart Baker, Pau LianStaal-Ong and Eddy Westerveld, Managing Large.
6. Finnerty, J. D. (1996). Project financing - Asset-based financial engineering. New York: John Wiley & Sons, Inc.
7. Infrastructure Projects, ISBN/EAN 978-90-810025-2-3, NUR-code 801.
8. Merna, T., and Njiru, C. (2002). "Financing infrastructure projects" (First ed.). London: Thomas Telford.
9. Nevitt P. K., and Fabozzi F. J. (2000). "Project financing" (7 Ed.). London, UK: Euromoney Books.

Raghuram, G., Jain, R., Sinha, S., Pangotra, P., and Morris, S. (2000). "Infrastructure Development and Financing" Towards a Public-Private Partnership: MacMillan.

Course Outcome:

After learning the course, the students should be able to

1. Comprehend local building bye-laws and provisions of National Building Code in respect of building and town planning resulting in functionally efficient, economically viable and legally acceptable buildings.
2. Discuss and apply various aspects of principles of building planning and town planning
3. Understand and implement various aspects of Principles of Architectural composition

4. Explain the principles of planning and design considerations to construct earthquake resistant building
5. Understand, interpret and prepare working drawings, foundation plans, perspective drawing and other executable drawings and prepare the drawing using software

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	2	3	2	2	3	3	3	3	2	3	3
CO-2	2	2	2	3	3	3	3	3	1	2	2	2
CO-3	2	2	2	2	3	2	2	3	1	2	1	2
CO-4	3	3	2	3	3	2	2	3	1	1	2	3
CO-5	2	2	3	2	2	2	1	2	1	2	3	2

ENVIRONMENTAL ENGINEERING (FEB160101)

Credit -04 **L-T-P-: 3-0-2**

Unit	Description in detail	Total Hrs	Weightage
I	**Introduction** Components of environment, Types of microbes, their growth and role in environment. **Quality and Quantity of Water for supply to towns/Cities:** Sources of water, Assessment of domestic and industrial requirement, Water borne diseases and their control, The water (prevention and control of pollution) Act – 1974.	**10**	**15%**
II	**Characteristics of Wastewater:** Indian Standards for effluent to be disposed in receiving water body like rivers, estuaries, lakes, sea and oceans. Study of characteristics of several industrial wastewaters like textile, chemical dairy and pharmaceutical wastewaters. Disposal of treated wastewaters (i) into inland surface waters; (ii) into oceans; (iii) into public sewers (iv) into estuaries and (v) onto land. Effect of organic pollution on Stream, river water quality, and self-purification, DOSAG Curve. **Water Treatment processes and Treatment units:** Plain sedimentation, aeration, sedimentation tank, sedimentation with coagulation, types of coagulants, mixing devices, theory of filtration, types of filters and their comparison, Hardness, methods of removing hardness.	**08**	**18%**
III	**Solid Waste Management:** Quantity composition and characteristics of solid wastes. Classification of solid wastes. Hazardous solid wastes, Biomedical solid wastes, Typical generation rate for solid wastes, factors affecting the generation rate. Estimation of quantity of solid waste, Onsite handling, storage and processing, collection services, types of collection systems. Determination of vehicle and labor requirements, collection routes, transfer stations, location of transfer stations, transfer means and methods, solid waste processing techniques, Mechanical volume reduction, Thermal volume reduction, manual component separation. Ultimate disposal, land filling with solid waste, Design of landfills. **Air Pollution:**	**12**	**32%**

	Definition, Composition of atmospheric air, Classification and sources of air pollutants. Effects of air pollution on human, plant and material, Air pollution control methods, equipment and safety. Salient features of the Air (Prevention and control of pollution) Act – 1981. **Noise Pollution:** Sources, Effects and control of noise pollution.		
IV	**Collection of sewage &estimation of its discharge:** Different types of sewers, sewerage systems, variation in sewage flow, sewer appurtenance, separate and combined sewerage systems **Unit operations/ processes for wastewater treatment:** Layout plan and section of municipal wastewater treatment plant, Physical unit operation screening, flow equalization, mixing, flocculation, sedimentation. Chemical unit processes-chemical precipitation. Biological unit processes: Aerobic attached growth and aerobic suspended growth treatment processes, anaerobic suspended growth treatment processes, an aerobic suspended growth treatment processes, lowcost sanitation systems, septic tanks, soak pit, stabilization ponds. **Design of wastewater treatment units:** Design of racks, screens, grit chamber, aeration units, primary & secondary clarifiers, activated sludge plant and trickling filter units, rotating biological contactors, sludge dewatering units, sludge digesters and drying beds	**12**	**35%**
V	**Determination of Various Agents (laboratory hours):** Water Standards – IS10500, Impurities in water, Indian standards for drinking water, Computation of hardness Optimum dose of coagulants, Physical, chemical and biological characteristics of domestic and Industrial wastewaters. BOD and COD, Measurement of sound **Estimation and Design (laboratory hours):** Design of sedimentation tank, Design of flocculation unit, design of slow &rapid sand filter, washing of filter, methods of disinfection, estimation of wastewater discharge in a sewer in sewerage system, estimation of storm water discharge in urban area	**This portion to be covered in Laboratory**	**Theory weightage shall be Zero**

Reference Books :

1. H.S. Peavy, D.R. Rowe and G. Tchbanoglous, Environmental Engineering, McGraw Hill International Edition.

2. M. L. Davis, Water and waste water Engineering, Mc Graw Hill education (India) Pvt. Ltd. 2013 edition.P. Sincero and G.A. Sincero, Environmental Engineering, Prentice Hall of India, New Delhi.
3. G. Tchabanoglous, Solid Waste Treatment and Disposal, McGraw Hill Pub.
4. G.S. Birdie and J.S. Birdie, Water Supply and Sanitary Engineering, DhanpatRai Publishing Co. New Delhi.
5. H.C. Parkins, Air Pollution, McGraw-Hill Pub.
6. J.A. Salvato, Environmental Sanitation, Wiley Interscience.
7. Environmental engineering volume 1 and 2 by S.K.Garg, Khanna publisher
8. Environmental engineering volume 1 and 2 by B.C.Punamia, laxmi publication
9. Environmental engineering volume 1 and 2 by Dr.P.M.Modi

Course Outcome :

After learning the course, the students should be able to:

1. Understand the role of microorganisms in various components of environments
2. Understand the quality and characteristics of waste water
3. Design and prepare drainage plan of buildings
4. Understand and design solid waste management system
5. Understand various types of pollution
6. Understand various environmental Acts.

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	2	2	2	2	3	3	1	1		1	1
CO-2	3	2	3	1	2	2	3	-	-	-	1	-
CO-3	2	3	3	3	2	1	3	-	-	-	2	1
CO-4	3	2	3	3	2	1	3	-	1	-	1	1
CO-5	3	2	2	1	2	1	3	-	-	-	1	-
CO-6	3	3	3	2	3	1	3	-	-	-	2	-

HYDRAULIC ENGINEERING (FEB160102)

Credit -04 L-T-P-: 3-0-2

Unit	Description in detail	Credit	Weightage
I	**Module 1**: **Laminar Flow-** Laminar flow through: circular pipes, annulus and parallel plates. Stokes's law, Measurement of viscosity. **Turbulent Flow-** Reynolds experiment, Transition from laminar to turbulent flow. Definition of turbulence, scale and intensity, Causes of turbulence, instability, mechanism of turbulence and effect of turbulent flow in pipes. Reynolds stresses, semi-empirical theories of turbulence, Prandtl's mixing length theory, universal velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes, Moody's diagram.	**6**	**14**
II	**Module 2**: **Boundary Layer Analysis-** Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and Turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control. **Dimensional Analysis and Hydraulic Similitude:** Dimensional homogeneity, Rayleigh method, Buckingham's Pi method and other methods. Dimensionless groups. Similitude, Model studies, Types of models. Application of dimensional analysis and model studies to fluid flow problem.	**9**	**22**
III	**Module 3: Introduction to Open Channel Flow-** Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Velocity Distribution of channel section. **Uniform Flow-** Continuity Equation, Energy Equation and Momentum Equation, Characteristics of uniform flow, Chezy's formula, Manning's formula. Factors affecting Manning's Roughness Coefficient "n_. *Most economical section of ch*annel. Computation of Uniform flow, Normal depth.	**5**	**12**
IV	**Module 4: Non-Uniform Flow-** Specific energy, Specific energy curve, critical flow, discharge curve Specific force Specific depth, and Critical depth. Channel Transitions. Measurement of Discharge and Velocity – Venturi	**6**	**14**

	Flume, Standing Wave Flume, Parshall Flume, Broad Crested Weir. Measurement of Velocity- Current meter, Floats, Hot-wire anemometer. Gradually Varied Flow-Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profile, Characteristics of surface profile. Computation of water surface profile by graphical, numerical and analytical approaches. Direct Step method, Graphical Integration method and Direct integration method. **Hydraulic Jump-** Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types, applications and location of hydraulic jump. Energy dissipation and other uses, surge as a moving hydraulic jump. Positive and negative surges. Dynamics of Fluid Flow- Momentum principle, applications: Force on plates, pipe bends, moments of momentum equation,		
V	**Module 5: Flow through Pipes**: Loss of head through pipes, Darcy-Weisbatch equation, minor losses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, flow through laterals, flows in dead end pipes, siphon, power transmission through pipes, nozzles. Analysis of pipe networks: Hardy Cross method, water hammer in pipes and control measures, branching of pipes, three reservoir problem. **Computational Fluid Dynamics:** Basic equations of fluid dynamics, Grid generation, Introduction to in viscid incompressible flow, Boundary layer flow as applicable to C.F.D. Hydro informatics: Concept of hydro informatics –scope of internet and web-based modeling in water resources engineering.	**16**	**38**

Reference Books :

1. Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House
2. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
3. Open channel Flow, K. Subramanya, Tata McGraw Hill.
4. Open Channel Hydraulics, Ven Te Chow, Tata McGraw Hill.
5. Burnside, C.D., “Electromagnetic Distance Measurement,” Beekman Publishers, 1971

Course Outcome:

a. The students will be able to apply their knowledge of fluid mechanics in addressing problems in open channels.
b. They will possess the skills to solve problems in uniform, gradually and rapidly varied flows in steady state conditions.
c. They will have knowledge in hydraulic machineries (pumps and turbines).
d. Analyze and design streamlined objects considering boundary layer effects.
e. Carry out model studies for fluid flow problems

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	3	3	2	1	3	1	2	2	2	-	2
CO-2	3	3	3	2	2	3	2	1	2	1	-	2
CO-3	3	3	3	1	2	3	3	-	-	1	-	1
CO-4	3	3	3	2	2	3	-	1	1	-	-	-
CO-5	3	3	3	2	2	3	1	-	1	-	-	1

SOIL ENGINEERING – II (FEB160103)

Credit -04 L-T-P-: 3-0-2

Unit	Description in detail	Credit	Weightage
I	**Unit 1: Stability of slope** Infinite and finite slopes, factor of safety, type of slope failure, stability of infinite slopes, finite slopes form of slip surfaces, limit equilibrium method and critical stage instability analysis, effects of tension crack and submergence, C-analysis-method of slices, Taylor's stability no., use of Bishop's method. **Introduction to Geosynthetics** Introduction to geosynthetics-types and its application in various field of civil engineering.	**09**	**25%**
II	**Unit 2: Earth Pressure** Determination of lateral earth pressure under different conditions, Rebhann's and culminnn's Graphical methods of determination of lateral earth pressures. **Stress Distribution of Soils** Causes of stress in soil, geostatic stress, Boussinesq's equation, stress distribution diagrams, New-mark's influence chart Westergard's equation, contact pressure, stresses due to triangular and other loadings.	**08**	**25%**
III	**Unit 3: Selection of Foundation and Sub-Soil Exploration /Investigation:** Types of foundation, Factors affecting the selection of type of foundations, steps in choosing types of foundation based on soil condition, Objectives and planning of exploration program, methods of exploration-wash boring and rotary drilling-depth of boring, soil samplesand soil samplers-representative and undisturbed sampling, field penetration tests: SPT, SCPT, DCPT. Introduction to geophysical methods, bore log and report writing, data interpretation.	**08**	**15%**
IV	**Unit 4: Shallow Foundation** Introduction, significant depth, design criteria, modes of shear failures.Detail study of bearing capacity theories (Prandtl, Rankine, Terzaghi,Skempton), bearing capacity determination using IS Code, Presumptivebearing capacity. Settlement, components of settlement & its estimation,permissible settlement, Proportioning of footing for equal settlement,allowable bearing pressure. Bearing capacity from in-situ tests (SPT,SCPT, PLATE LOAD), Factors affecting bearing capacity includingWater Table., Bearing capacity	**09**	**15%**

	of raft/mat foundation as per codal provisions, Contact pressure under rigid and flexible footings.		
V	**Unit 5: Pile Foundation** Introduction, load transfer mechanism, types of piles and their function, factors influencing selection of pile, their method of installation and their load carrying characteristics for cohesive and granular soils, piles subjected to vertical loads- pile load carrying capacity from static formula, dynamic formulae (ENR and Hiley), penetration test data & Pile load test (IS 2911).	**08**	**20%**

Reference Books :

1. P. Purushothama Raj; Soil Mechanics and Foundation Engineering; Pearson Education.
2. B.C. Punamia; Soil Mechanics & Foundation Engineering; Laxmi Pub. Pvt. Ltd., Delhi.
3. Das, B.M., Principles of Foundation Engineering, Nelson Engineering.
4. Tomlinson, M. J., Foundation Design and Construction, Prentice Hall.
5. V. N. S. Murthy; Soil Mechanics & Foundation Engineering; Sai Kripa Technical Consultants,Banglore

Course Outcome:

After learning the course, the students should be able to:

1. Select appropriate soil investigation/testing technique/method and get true sub soil parameters used for selection of type of foundation as per codal guidelines.
2. Select and design appropriate/suitable foundation system (shallow/Deep) for different structures that satisfy the allowable bearing capacity and settlement requirements based on soil properties.
3. Design deep foundation satisfying bearing capacity and settlement requirements.
4. Design and analysis of retaining walls and sheet piles under static loads.
5. Understand the engineering behavior of expansive soils and selection of suitable foundation type for such soils.

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	3	2	3	3	3	2	2	1	-	-	2
CO-2	3	3	3	2	2	3	1	1	-	-	-	-
CO-3	2	2	3	2	2	2	1	1	-	-	-	-
CO-4	2	2	3	2	2	2	1	1	-	-	-	-
CO-5	3	3	2	3	3	2	2	1	1	-	-	1

TRANSPORTATION ENGINEERING- II (FEB160104)

Credit -03 L-T-P-: 2-0-2

Unit	Description in detail	Total Hrs	Weightage
I	**Module 1: Railway Engineering** Development of railways in India, Permanent way and railway track components, different gauges in India, conning of wheels, function and types of rails, rail sections, defects in rails, creep of rails, rail joints and welding of rails, sleepers – types, spacing and density, rail fixtures and fastenings, ballast, subgrade and embankment. Geometric design of railway track: gradients, grade compensation, speed of trains on curves, super elevation, cant deficiency, negative super elevation, curves, widening on curves.Railway traction and track resistance, stresses in railway track – rails, sleepers, ballast. Points and crossings – turnouts, switches, crossings	**15**	**35%**
II	**Module 2: Bridge Engineering** Classification of bridges – with respect to construction materials, structural behavior of super structure, span, sub structure, purpose. Temporary and movable bridges. Factors affecting site selection. Various loads/stresses acting on bridges. Bridge hydrology – design discharge, water way, afflux, scour depth, economical span. Bridge components – foundation, piers, abutments, wing wall, approach, bearings, floor, girders, cables, suspenders.	**13**	**30%**
III	**Module 3: Harbor and Airport** History of water transportation at world level and at national level development and policy, classification of harbors, natural and artificial. Major ports in India, administrative set up. Harbour components, ship characteristics, characteristics of good harbour and principles of harbour planning, size of harbour, site selection criteria and layout of harbours. Surveys to be carried out for harbor planning. General design aspects. History, development, policy of air transport, aircrafts, aerodromes, air transport authorities, air transport activities, aircrafts and its characteristics, airport classifications as per ICAO.Regional planning-concepts and advantages, location and planning of airport as per ICAO and F.A.A. recommendations, airport Elements, estimation of future air traffic, development of new airport, requirements of an ideal airport layout	**This portion will be covered in laboratory hours**	**35%**

Reference Books :

1. Satish Chandra and M.M. Agrawal, Railway Engineering, Oxford University Press, New Delhi
2. S.C. Saxena and S. P. Arora, A Text Book of Railway Engineering, Dhanpat Rai & Sons, New Delhi
3. S.C. Rangwala, K.S. Rangwala and P.S. Rangwala, Principles of Railway Engineering, Charotar Publishing House, Anand.
4. S.P. Bindra, Principles and Practice of Bridge Engineering, Dhanpat Rai & Sons, New Delhi
5. S.C. Saxena, Tunnel Engineering, Dhanpat Rai & Sons, New Delhi 6. D.J. Victor, Essential of Bridge Engineering, Oxford & IBH Pub. Co. Ltd. Mumbai
6. Dr. S. K. Khanna, M.G.Arora and S.S. Jain, Airport Planning & Design, Nem Chand &Bros.,Roorkee
7. G.V. Rao Airport Engineering, Tata McGraw Hill Pub. Co., New Delhi
8. R. Srinivasan and S. C. Rangwala, Harbour, Dock and Tunnel Engineering, 1995, CharotarPub.House, Anand
9. S. P. Bindra, A Course in Docks and Harbour Engineering, 1992, DhanpatRai& Sons, NewDelhi
10. Airport Engineering, Charotar Publishing House Pvt. Ltd, Anand

COURSE OUTCOMES

After completion of the course, the students will be able to Know about railway track components, their materials, size, function and importance

1. Carry out geometric design of railway track
2. Know about various components in diverging, merging and crossings of railway
3. tracks, stations, yards, signaling, interlocking and control systems.
4. Know about requirements of railway track for high-speed trains, safety aspects and maintenance
5. Understand about different types of bridges, their components, loads/stresses
6. acting on bridges, requirement and function of the components, hydrological
7. design, methods of erection, maintenance of bridge
8. To understand the various elements of Harbour and Airpor

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	2	-	-	2	3	3	1	2	2	3	2	1
CO-2	3	2	2	3	1	-	-	-	-	-	-	-
CO-3	1	3	2	1	2	-	-	-	-	2	1	-

CO-4	3	3	3	2	2	2	3	-	-	-	-	-
CO-5	2	-	2	1	3	-	-	-	-	1	-	-
CO-6	1	3	3	2	3	-	-	-	-	3	3	-

CONCRETE TECHNOLOGY & REPAIR STRATEGY (FEB160105

Credit -04 **L-T-P-: 3-0-2**

Sr No.	Subject Content	Teaching Hours	Weightage (%)
I	**Introduction of concrete:** Historic development,. Composition of concrete ,advantage of concrete cover and material of concrete, ,advantage and future trends in concrete Overview of Sustainability and Concrete development	04	10%
II	**Fresh Concrete**: Properties of fresh concrete, Definition and Measurement methods of workability as per IS and ASTM standards,factors affecting workability, Segregation & Bleeding, Slump loss, Re-tempering, Site preparations for concreting, Mixing, Conveying, Placing, Compaction, Finishing of concrete. Curing & various method **Hardened concrete :** strength of hardened concrete Various tests of hardened concrete (tensile, compressive, flexural and bond test (Destructive, Semi-destructive, Non- destructive): Field & laboratory testing procedures for evaluating the structure for strength, corrosion activity, performance & integrity, durability. Interpretation of the findings of the tests.	12	30%
III	**Deterioration of concrete structures**: Types of deterioration – Signs, causes & symptoms, Mechanism of deterioration, contributing factors like permeability, inadequate durability & micro-structure of concrete. Physical deterioration due to moisture, temperature, shrinkage, freeze-thaw, abrasion, erosion, cavitation, crystallization of salts, Efflorescence, exposure to severe environment like marine exposure. Chemical deterioration due to corrosion of reinforcement (chloride induced, carbonation induced), Alkali-silica reaction, sulphate attack, Acid attack. **Mix design of concrete**: Principles of concrete mix design, and parameter and factor influencing mix design Indian standard method for mix design, various provision for mix design as per IS code	12	25%
IV	**Repairs, rehabilitation & Retrofitting of concrete structures:** **Repair materials** - Criteria for durable concrete repair, Methodology, performance requirements, repair options, selection of repair materials, Preparatory stage of repairs, Different types of repair materials & their application, types of repair techniques. **Retrofitting/Strengthening:** Need for retrofitting, Design philosophy of strengthening structures, Techniques available for strengthening including conventional and advanced techniques. **Seismic retrofit of concrete structures :**Deficiencies in structure requiring seismic retrofit, Design philosophy, Techniques to enhance	10	25%

	the seismic resistance of structures, advanced techniques for making seismic resistant structures		
V	Special concrete and concreting method advanced cement based composition, fiber reinforced concrete Polymer modified concrete ,self- compacting concrete,light weight concrete,high strength concrete,lightweight and heavyweight concrete, high volume fly ash concrete Special concreting method: pumped concrete,ready mix concrete, under water concreting , Hot & cold weather concrete,precast concrete	**04**	**10%**

Reference Books :

1. Properties of Concrete - Neville A. M.
2. Concrete Microstructure, Properties and Materials –P.Kumar Mehta / Paulo J.M.Monteiro
3. Concrete Technology- Shetty M. S.
4. Advanced Concrete Technology – ZONGJIN Li
5. Concrete Technology- Gambhir M. L.
6. Concrete Technology by A.R. Santhakumar, IIT Madras

COURSE OUTCOMES

1. Understand features of special concrete and concreting methods
2. Identify, Describe and carry out lab tests relevant to use of civil engineering materials on site
3. Design concrete mix according to given conditions as per IS Code
4. Identify type of distress in deteriorated concrete structures
5. Estimate the **extent** of damage level in concrete structures using Non-Destructive Testing
6. Implement various retrofitting and strengthening techniques using various innovative materials in structures.

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	2	1	1	-	1	1	1	1	-	-	-	1
CO-2	3	2	2	-	2	1	1	2	2	1	-	-
CO-3	3	3	3	2	2	1	1	1	1	-	-	-
CO-4	3	3	2	2	1	2	2	1	1	-	-	1

CO-5	3	3	3	1	2	1	1	1	2	1	-	-
CO-6	3	3	2	1	2	2	1	1	2	1	-	-

METRO SYSTEMS AND ENGINEERING (FEB170002)

Credit -03 **L-T-P-: 3-0-0**

Unit	Description in detail	Total Hrs	Weightage
I	**General**: Overview of Metro Systems; Need for Metros; Routing studies; Basic Planning and Financials	**03**	**6%**
II	**Civil Engineering** Overview and construction methods for: Elevated and underground Stations; Viaduct spans and bridges; Underground tunnels; Depots; Commercial and Service buildings. Initial Surveys & Investigations	**15**	**32%**
III	**Basics of Construction Planning & Management,** Construction Quality & Safety Systems; Traffic integration, multimodal transfers and pedestrian facilities; Environmental and social safeguards; Track systems-permanent way.	**15**	**32%**
IV	**Facilities Management** Electronics and Communication Engineering; Signaling systems; Automatic fare collection; Operation Control Centre (OCC and BCC); control systems; Platform Screen Doors	**05**	**15%**
V	**Mechanical & TV + AC**: Rolling stock, vehicle dynamics and structure; Tunnel Ventilation systems; Air conditioning for stations and buildings; Fire control systems; Lifts and Escalators.	**05**	**15%**

Reference Books :

1. S.C. Rangwala, K.S. Rangwala and P.S. Rangwala, Principles of Railway Engineering, 1964; Charotar Publishing House, Anand.
2. S.P. Bindra, Principles and Practice of Bridge Engineering, Dhanpat Rai & Sons, New Delhi
3. S.C. Saxena, Tunnel Engineering, Dhanpat Rai & Sons, New Delhi 6. D.J. Victor, Essential of Bridge Engineering, Oxford & IBH Pub. Co. Ltd. Mumbai
4. Dr. S. K. Khanna, M.G.Arora and S.S. Jain, Airport Planning & Design, Nem Chand & Bros.,Roorkee
5. G.V. Rao Airport Engineering, Tata McGraw Hill Pub. Co., New Delhi
6. R. Srinivasan and S. C. Rangwala, Harbour, Dock and Tunnel Engineering, 1995, Charotar Pub.House, Anand

7. S. P. Bindra, A Course in Docks and Harbour Engineering, 1992, DhanpatRai& Sons, NewDelhi
8. Highway Engineering; 2001; Author: Khanna S. K. and Justo C. E.G. Publisher: Nemchand and Brothers
9. Dr. H. R. Varia, Dr. P. J. Gundaliya, Ujjaval Solanki; Urban Transportation Engineering; 2017; Mahajan Publishing House

Course Outcome :

After learning the course the students should be able to:

1. Know about metro track components, their materials, size, function and importance
2. Routing studies; Basic Planning and Financials
3. Importance of tunnel in metro system
4. Concepts of traffic integration, multimodal transfers and pedestrian facilities.
5. Signaling systems; Automatic fare collection; Operation Control Centre (OCC and BCC); SCADA and other control systems; Platform Screen Doors.

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	1	1	1	1	1	3	2	3	1	1	1	3
CO-2	3	3	3	2	3	2	3	3	2	2	1	3
CO-3	3	3	2	3	2	1	2	3	1	2	1	2
CO-4	2	3	2	2	3	2	3	3	2	3	2	2
CO-5	1	2	2	1	3	3	2	3	1	3	1	3

PROFESSIONAL PRACTICE & VALUATION (FEB170101)

Credit -04 L-T-P-: 3-0-2

Unit	Description in detail	Credit	Weightage
I	**Computation of areas and volumes:** (i) Cylinder- Area of curved surface and volume (ii) Cone- Volume and area of curved surface (iii) Frustum of cone- Volume and curved surface area (iv) Frustum of pyramid- Volume and surface area of all sides. (v) Area of sector and segment of a circle (vi) Area and volume of sphere and segment of sphere (vii) Ellipse- Area of ellipse and Units of measurements	**04**	**10**
II	**Estimates:** Estimates- Definition, Units of measurements, types of estimates, Different methods to find the quantities of civil works. Estimated cost and its importance. Provisions of IS-1200, for working out quantities and deductions in civil works. Entering the measurements in quantity sheet and calculation of quantities of various items of civil works for residential, commercial and industrial buildings, Market rates of material and labour, Introduction to schedule of rates, Entering quantities and rates in abstract sheet, calculation of estimated cost.	**10**	**25**
III	**Specifications:** Definition, importance of specification, Types of specification, Care to be taken while drafting specifications, Drafting general specifications, and detailed specifications for various civil work items. **Rate Analysis:** Definition of rate analysis, Definition of task, Determination of man power and material requirement for a given quantity of items of civil works, study of present wages of labour and prices of material in the market. Study of market rents of different construction equipments, Determination of rate of item of civil work. Working out rates of various items of civil works like 10m2 plaster,10 m^3 1:2:4 plain and reinforced concrete, 10m3 brick work etc.	**10**	**25**
IV	**Contract**	**08**	**20**

	Definition, legal requirements of a valid contract, types of contracts, conditions of contract, sub contracts and contractual disputes, Arbitration. **Tender and Tender notice:** Bidding process, Prequalification process, tender notice and its essential features, drafting tender notice, Bid submission, Analysis of tenders, Basis for evaluation and acceptance, letter of intent, work order, agreement.		
V	**Valuation:** Definitions of value, price and cost, depreciation, sinking fund , different type of values and their significance, factor affecting value, rent and standard rent, Years purchase , valuation tables, Easement, types of easements, significance of easement in valuation, Methods of valuation of buildings and land, Estimation of values of different types of buildings and lands.	**10**	**20**

Reference Books :

1. B. N. Dutta, Estimation and Costing In Civil Engineering, Ubs Publishers Distributors, Ltd.
2. S. C. Rangwala, Estimating and Costing, Charotar Publishing House.
3. G. S. Birdi, Textbook of Estimating & Costing, Dhanpat Rai and Sons, Delhi.
4. M. Chakraborti, Estimating, Costing, Specification and Valuation.
5. P.W.D. Handbook and SOR, IS Code – 1200.
6. A. S. Kotadia, Professional Practice and Valuation, Mahajan Publications.
7. S. C. Rangwala, Valuation of Real Properties, Charotar Publication.

Course Outcome :

1. Work out (i) the estimated cost of any proposed civil engineering structure and (ii) The value of any old structure
2. Apply the software for working out quantities of items of civil works
3. Prepare rate analysis, specifications, tenders and contract of different civil work.
4. Prepare approximate and detailed estimate of a civil engineering work.
5. Solve examples on valuation of properties/ buildings.

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	3	2	2	3	3	-	3	1	1	1	1
CO-2	3	3	2	3	3	3	-	2	1	-	2	2
CO-3	3	3	2	2	2	3	-	2	2	-	2	2
CO-4	3	3	2	2	2	3	-	2	2	-	1	2
CO-5	3	3	2	2	2	3	-	1	2	-	1	1

Structural Design - I(FEB170102)

Credit -05 **L-T-P-: 4-0-2**

Unit	Description in detail	Total Hrs	Weightage
I	**Introduction** Objectives, Properties of Reinforced Concrete and Structural Steel, Loads & load combinations, Methods of Analysis, Codes & specifications, Design Philosophies - Working stress Method, Ultimate Load Method, Limit State Method, Plastic Method	**04**	**10%**
II	**Limit state design of RC structural Element** Philosophy of Limit state design for RC structures Limit state of collapse & serviceability, partial safety factors for material & loading. Limit State of Flexure: Stress-strain characteristics of concrete & reinforcing steel, Type of section-under reinforced, over reinforced & balance section, Neutral Axis depth, Moment of Resistance for singly reinforced, doubly reinforced and flanged sections. Limit state of Axial, Shear and Torsion, combined flexure & torsion, Bond & Anchorage, Development length, splicing	**06**	**15%**
III	**Design of Structural element** Design of Beams: Simply supported, cantilever and continuous beams Design of Slab: One way, two way simply supported and continuous slabs Design of Column**:** Classifications, Assumptions, Design of Short Columns under axial load. Design of Foundations: Design of isolated footing under axial load and uni-axial bending, combined footing	**20**	**35%**
IV	**Limit State design of Steel elements: Philosophy of Limit state design:** Limit state of collapse & serviceability, partial safety factor for material and loading, Type & behavior of sections – Plastic, compact, semi-compact, slender **Connections:** Bolted connections – bearing type, behavior of bolted joints, Design strength of ordinary & HSFG bolts. Welded connections- Fillet and Butt weld, design of simple connections such as lap and butt joints, truss joint connections **Axial force design:** Tension member: types of tension member, behavior, modes of failure, Design of tension member, splices, lug angle. Compression member: Behaviour, classification of sections, possible modes of failure, elastic buckling of slender member, design of compression member having single & built-up section, lacing & battening,	**16**	**25%**

V	**Design for Beams and Beam-Columns:** Type of sections, classification, Lateral stability, Design strength of laterally restrained and unrestrained beams, shear strength, deflection, web buckling & crippling, Design of simply supported beam. Combined axial and flexural design of member (Beam-Column) **Footing :** slab based, gusseted base foundation	**10**	**20%**

Reference Books : (RCC)

1. Shah & Karve; Limit State Theory & Design of Reinforced Concrete; Structure Pub., Pune
2. Dr. H.J. Shah; Reinforced concrete Vol-I; Charotar Pub. Anand
3.Punmia B.C "Advanced RCC Design" Laxmi Publications Pvt. Ltd". 2006.
4. A.K.Jain; Design of Concrete Structures, Nemchand Publication
5. IS: 456 - Code of practice for plain and reinforced concrete
6. IS: 875 (Part I to V) - Code of practice for structural safety of Buildings Loading standards
7. IS: 1893 - Criteria for earthquake resistant design of structures
8. IS: 13920 -Code of Practice for ductile detailing of RC structure subjected to seismic force

Reference Books (Steel Design)

1. N.Subramanian; Steel Structures, Oxford Publication
2. Arya A.S. & Ajamani J.L.; Design of Steel Structures; Nemchand & Bros., Roorkee
3. Dayaratnam P.; Design of Steel Structures; Wheelor pub. co., Delhi
4. Ramamrutham S. & Narayanan R.; Design of Steel Structures; Dhanpatrai & Sons, Delhi
5. K. S. Sai Ram; Design of Steel Structures, Pearson
6. IS: 800 – 2007, Code of practice for General Construction in steel
7. IS: 875 - (Part I to V) - Code of practice for structural safety of building loading standards
8. IS: 226 - Structural steel (Standard Quality)
9. SP: 6(1) - Structural steel section
10. SP: 6(6) - Application of plastic theory in design

After learning the course the students should be able to:

1. Understand various design philosophy to be used in the design of structural elements.
2. Design basic structural elements like slab, beams, columns and foundation etc. using steel and concrete as materials
3. Design basic structural elements slab, beams, columns and foundation etc. using limit state approach.

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	3	3	1	2	2	2	1	1	-	2	-

CO-2	3	3	3	2	1	1	-	1	1	-	1	-
CO-3	3	3	3	1	-	-	1	-	-	-	1	1

EARTHQUAKE ENGINEERING (FEB170103)

Credit -03 **L-T-P-: 2-0-2**

Unit	Description in detail	Credit	Weightage
I	**Earthquake Basics**: Interior of Earth, plate tectonics, faults, consequences of earthquake, Basic parameters of earthquake, magnitude & intensity, scales, Seismic zones of India, damages caused during past earthquakes (worldwide).	03	**12%**
II	**Design Philosophy:** Philosophy of earthquake resistant design, earthquake proof v/s earthquake resistant design, four virtues of earthquake resistant	10	**38%**

	structures (strength, stiffness, ductility and configuration), seismic structural provisions. Configuration, Introduction to IS: 1893 (Part I), IS: 875 (Part V). Seismic load: **Seismic Coefficient Method** – base shear and its distribution along height. Introduction to Response spectrum, IS code		
III	**Lateral Loads on Buildings:** **Lateral Load Distribution (SDOF):** Rigid diaphragm effect, centers of mass and stiffness, torsionally coupled and uncoupled system. **Lateral Load Analysis:** Analysis of frames using approximate methods like portal & cantilever methods	06	**19%**
IV	**Ductile Detailing:** Concepts of Detailing of various structural components as per IS: 13920 provisions.	03	**12%**
V	**Special topics:** Introduction to Earthquake Resistant Features of un-reinforced & reinforced masonry Structure, Confined Masonry, Soil liquefaction, Structural controls, Seismic strengthening.	06	**19%**

Reference Books :

1. K Subramanya, Engineering Hydrology, Mc-Graw Hill.
2. K N Muthreja, Applied Hydrology, Tata Mc-Graw Hill.
3. K Subramanya, Water Resources Engineering through Objective Questions, Tata Mc-Graw Hill.
4. G L Asawa, Irrigation Engineering, Wiley Eastern
5. L W Mays, Water Resources Engineering, Wiley.
6. J D Zimmerman, Irrigation, John Wiley & Sons
7. C S P Ojha, R Berndtsson and P Bhunya, Engineering Hydrology, Oxford.

Course Outcome :

After learning the course the students should be able to:

1. Determine the response of SDOF & MDOF structural system subjected to vibration including earthquake.
2. Apply the concept of Earthquake Resistant Design & concept of lateral load distribution on buildings.
3. Determine the lateral forces generated in the structure due to earthquake.
4. Apply the concept of ductile detailing in RC structures.

	Expected Mapping with Programme Outcomes

Course Outcomes	*(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	3	2	-	1	1	1	-	-	-	-	1
CO-2	3	3	3	1	-	1	1	-	-	-	-	1
CO-3	3	3	2	2	-	-	1	1	-	-	-	1
CO-4	2	3	3	-	-	-	1	1	-	-	-	1
CO-5	2	2	1	-	-	-	-	-	-	-	-	-

CONSTRUCTION MANAGEMENT & EQUIPMENTS (FEB180101)

Credit -04 L-T-P-: 3-0-2

Unit	Description in detail	Credit	Weightage
I	**Introduction to Construction Management:** A construction project, Phases of construction project, Importance of construction and construction industry, Indian construction industry need of construction management, Stakeholders of construction management. **Construction Planning**: Types of project plans, Work break down structure, Planning techniques: Bar charts, CPM and PERT network analysis, ladder network, Line of balance method.	**11**	**27%**
II	**Resource Allocation &Leveling** Resource allocation, Importance of project scheduling, Deriving other schedules, Network crashing and cost time trade off. **Construction Material Management**: Material management functions, Inventory management. Job layout **Construction Project Value Managements** Value management in construction, Steps, Value engineering application in a typical case project.	**06**	**15%**
III	**Construction Quality Management:** Construction quality, Inspection, Quality control and Quality assurance in projects, Total quality management, Quality gurus and their teaching cost of quality ISO standards, Principles of quality management systems, (CONQUAS) construction quality assessment system	**05**	**10%**
IV	**Construction Safety Management:**	**04**	**08%**

	Evolution of safety, Accident causation theory, Unsafe conditions, Unsafe acts health and safety act and regulation cost of accidents, Role of safety personnel, Accident causes and principles of safety, Safety and health management system.		
V	**Construction Equipments:** **A) Excavating equipments** Selection, basic parts, operation, factors affecting output • Tractors and related equipment: Bulldozers, Rippers, Scrapers • Excavating Equipment: Power shovels, Draglines, Hoes, Clam • Shells and trenching machines. **B) Hauling and conveying equipments** •Hauling and lifting equipment: Trucks, wagons, cranes etc. •Belt conveyor system: Terminology, Classification, Components, Power requirement estimation and design.	**16**	**40%**

Reference Books :

1. Sharma, M.R., Fundamnetals of Construction Planning and Management, S.K. Kataria& Son, New Delhi, 2012
2. Seetharaman, S., Construction Engineering & Management, Umesh Publications, 2007.
3. Srinath, L.S., PERT & CPM Principles and Applications, Tata McGraw Hill, New Delhi.
4. Peurifoy, L., Schexnayder, C.J. and Shapira, A., Construction Planning, Equipment and Methods, McGraw Hill, New Delhi, 8th Edition, 2010.
5. Punamia, B.C. and Khandelwal, K.K., Project Planning and Control with PERT and CPM, Laxmi Publications, New Delhi, 2004.
6. Gahlot, P.S. and Dhir, B.M., Construction Planning & Management, New Age International (P) Ltd., New Delhi
7. Chitkara, K. K., Construction Project Management Planning, Scheduling and Controlling, Tata McGraw Hill, New Delhi.

Course Outcome:

After completion of the course, the students will be able to:

1. Execute all type of managerial tasks in construction projects.
2. Use software for construction projects management.
3. Student can demonstrate an ability to develop the various components of project controls including planning, scheduling, cost and resource management

4. Students will be able to demonstrate planning, scheduling and monitoring of projects using professional software.

5. Derive evaluation criteria and attributes for Construction Projects

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	2	2	2	1	2	2	2	3	1	3	1
CO-2	3	3	3	3	3	2	3	1	2	2	3	2
CO-3	2	2	2	2	3	1	2	2	2	2	2	2
CO-4	3	2	3	3	3	2	3	2	1	2	2	2
CO-5	2	3	2	3	2	2	2	1	1	2	1	1

STRUCTURE DESIGN II(FEB180102)

Credit -05 L-T-P-: 4-0-2

Unit	Description in detail	Total Hrs	Weightage
I	**RC Design** **Building Layout and Design:** Loads as per I.S., distribution & flow of loads, lateral load due to wind and seismic as per latest IS standards, load combinations, guide lines for preparation of structural layout for building. Analysis, design & detailing of G + 3 RC framed building for residential /commercial purpose including ductile detailing.	**10**	**15%**
II	**Design of Retaining wall:** Types, behavior and application of retaining wall, stability criteria, design & detailing of cantilever & counterfort type retaining wall for various ground conditions **Design of Flat Slab:** Direct design method – Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns – Shear in Flat slabs-Check for one way and two way shears, Limitations of Direct design method, Introduction to Equivalent frame method.	**10**	**20%**
III	**Design of Water Tank:** Classification of water tank and method of analysis, permissible stresses, codal provisions, Design of circular and rectangular under-ground water tanks using IS code method, Design of elevated water tank with Intze type of container, frame and shaft type of staging and foundation considering effect of earthquake and wind forces	**08**	**15%**
IV	**Loads & Load Combinations:** Appraisal of loading standards such as I.S, I.R.C., Effect of wind and earthquake on structure. **Design of plate girders:** Modes of failure : Elastic buckling, Bending in the plane of web, Local buckling, Buckling in the plane of web, Vertical buckling of the compression flange, Shear buckling Design of bolted, welded plate girder by Tension field Method & Simple Post Critical Method including design of vertical & horizontal stiffeners, Splices, Curtailment	**15**	**25%**

V	**Design of Industrial Building:** Structural layout of industrial building, Various types of trusses and their selection, effect of wind loads on purlin and trusses, bracing systems, columns, foundations, gantry girder – static and moving loads, selection & design of section. **Design of foot-over bridges:** Structural system of through & deck type bridges, design of foot-over bridge & its Supporting system.	**15**	**25%**

Reference Books : (RCC)

1. Shah & Karve; Limit State Theory & Design of Reinforced Concrete; Structure Pub., Pune
2. Dr. H.J. Shah; Reinforced concrete Vol-I; Charotar Pub. Anand
3.Punmia B.C "Advanced RCC Design" Laxmi Publications Pvt. Ltd". 2006.
4. A.K.Jain; Design of Concrete Structures, Nemchand Publication
5. IS: 456 - Code of practice for plain and reinforced concrete
6. IS: 875 (Part I to V) - Code of practice for structural safety of Buildings Loading standards
7. IS: 1893 - Criteria for earthquake resistant design of structures
8. IS: 13920 -Code of Practice for ductile detailing of RC structure subjected to seismic force

Reference Books (Steel Design)

1. N.Subramanian; Steel Structures, Oxford Publication
2. Arya A.S. & Ajamani J.L.; Design of Steel Structures; Nemchand & Bros., Roorkee
3. Dayaratnam P.; Design of Steel Structures; Wheelor pub. co., Delhi
4. Ramamrutham S. & Narayanan R.; Design of Steel Structures; Dhanpatrai & Sons, Delhi
5. K. S. Sai Ram; Design of Steel Structures, Pearson
6. IS: 800 – 2007, Code of practice for General Construction in steel
7. IS: 875 - (Part I to V) - Code of practice for structural safety of building loading standards
8. IS: 226 - Structural steel (Standard Quality)
9. SP: 6(1) - Structural steel section
10. SP: 6(6) - Application of plastic theory in design

Course Outcome :.

After learning the course the students should be able to:

1. Understand various design philosophy to be used in the design of structural elements.
2. Assess loads, prepare layout, analyse, design and detail of various structural elements for RC framed structure up to G+3.
3. Design & detail RC structures like Retaining Wall, Water Tank and Flat slab.
4. Prepare structural layout of Industrial steel structures, plate girder, foot-over bridge.
5. Determine the loads acting on it and identify the typical failure modes.
6. Apply the principles, procedures and current Indian codal provisions to the analysis and design of Industrial structures, plate girder & foot-over bridges.
7. Apply the principles of plastic design in steel beams & portal frames.

IRRIGATION ENGINEERING (FEB180104)

Credit -03 **L-T-P-: 2-0-2**

Unit	Description in detail	Total Hrs	Weightage
I	**Module I:** **Introduction:** Definition, Necessity, Scope, Benefits and ill effects of irrigation, Types of irrigation schemes, Social and environmental considerations, Irrigation development in India. **Water Requirement of Crops:** Soil-water-plant relation- field capacity, wilting point, available water, consumptive use, Irrigation Requirements – Net irrigation requirement, Field irrigation requirement, Gross Irrigation requirement, Soil moisture extraction pattern, Frequency of irrigation, Principal Indian crops, Gross Commanded area, Culturable command area, Intensity of irrigation Duty and delta relation, Introduction to various methods of application of irrigation water, Irrigation Efficiency, assessment of irrigation water.	**10**	**25%**
II	**Module 2** **Diversion Works:**Different stages of a river and their flowcharacteristics, Weir and barrages, Various parts of a weir and their functions, Exit gradient, Principles of weir design on permeable formations -Bligh's creep theory and Khosla's theory **Storage and Outlet works:**Types of earthen dams, Seepage in earth dams, Gravity dams, Forces Acting on a gravity dam, Rock-fill dams, Spillways, Types of spillways, Spillways gates and energy dissipation works.	**10**	**25%**
III	**Module 3** **Distribution works:**Modes of conveying irrigation water- Types of irrigation canals contour canal, ridge canal, side sloping canals, Canal sections-fillingcutting, partial cutting and partial filling, Balanced depth, Canal FSL,Capacity factor and Time factor, L-section, Losses of canal water, Silting and scouring of canals, Method of design of unlined section of irrigation canal, Silt theories, Lined canals, Design of lined canal, Linkcanals.	**08**	**20%**
IV	**Module 4** **Regulating and Cross Drainage Works:** Canal falls, Cross drainage works, Types of cross drainage works, Canal escapes, Head regulator and Cross regulator, Silt ejector, Flowmeters - Parshall flume, Irrigation outlets and types of outlets.	**06**	**20%**

V	**Module 5** **Water logging:** causes, Reclamation, Drainage principles and practice	**03**	**10%**

Reference Books :

1. Irrigation & Water Power Engineering - Dr. B.C.Punmia&B.B.Pande, Laxmi Publications, (P) Ltd, NewDelhi
2. Irrigation, Water Resources & Water Power Engineering - Dr. P.N.Modi, Standard Book House, Delhi
3. Irrigation, Water Power & Water Resources Engineering - Dr. K.R.Arora Standard PublishersDistributors, Delhi
4. Irrigation Engineering and Hydraulic Structures - S.K.Garg, Khanna Publishers, Delhi
5. Irrigation Engineering, S.K. Mazumder, Galgotia Publications Pvt Ltd., New Delhi

COURSE OUTCOMES

After completion of the course, the students will be able to:

1.Understand the irrigation methods and duty-delta relation for crops

2.Calculate Net Irrigation Requirement (NIR), Field Irrigation Requirement (FIR) and Gross Irrigation Requirement (GIR)

3. Calculate the pressure at key points of sheet piles and floor thickness for a weir/barrage using Khosla's theory

4. Plot seepage line of earthen dam with corrections at entry and exit

5. Calculate forces on gravity dams.

6. Understand function of spillway and energy dissipation

7. Design unlined canal using silt theories

8. Design a lined irrigation canal

9. Understand functions of regulating and cross drainage works

10. Understand drainage principles

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	3	2	2	2	3	3	1	1	-	-	2
CO-2	3	3	3	1	2	3	1	2	1	-	-	-
CO-3	3	3	3	1	2	3	1	2	1	-	-	-
CO-4	3	3	3	1	2	3	1	2	2	-	-	-
CO-5	3	3	2	1	2	3	2	2	1	-	-	-
CO-6	3	3	2	2	2	3	2	1	1	-	-	2
CO-7	3	3	3	1	1	3	1	1	-	-	-	-
C0-8	3	2	3	1	1	3	1	1	-	-	-	-
C0-9	3	3	2	2	2	3	2	2	1	-	-	2
CO-10	3	3	2	2	2	3	2	2	1	-	-	2