MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)
B.Tech. in Civil Engineering
Scheme of Instruction and Examination
(Choice Based Credit System)

V Semester

S.No	Course Code	Course Title	Instruction			Examination			Credits
			Hours Per Week			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE		
1	MS507HS	Engineering Economics and Financial Accounting	2	0	0	30	70	3	2
2	CE501PC	Concrete Technology	3	0	0	30	70	3	3
3	CE502PC	Geotechnical Engineering	3	0	0	30	70	3	3
4	CE503PC	Design of Reinforced Concrete Structures	3	1	0	30	70	3	4
5	CE504PC	Structural Analysis -II	3	1	0	30	70	3	4
6		Open Elective-I	2	0	0	30	70	3	2
7	MC502ES	Cyber Security	3	0	0	30	70	3	0
8	CE551PC	Concrete Technology Lab	0	0	3	30	70	3	1.5
9	CE552PC	Geotechnical Engineering Lab	0	0	3	30	70	3	1.5
10	MA554BS	Finishing School- III (Quantitative Aptitude & Analytical Ability)	0	0	2	30	70	3	1
Total Hours/Marks/Credits			**19**	**2**	**8**	**300**	**700**	**---**	**22**

VI Semester

S.No	Course Code	Course Title	Instruction			Examination			Credits
			Hours Per Week			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE		
1	CE601PC	Environmental Engineering	3	0	0	30	70	3	3
2	CE602PC	Hydrology and Water Resources Engineering	3	1	0	30	70	3	4
3	CE603PC	Design of Steel Structures	3	1	0	30	70	3	4
4		Professional Elective-I	3	0	0	30	70	3	3
5		Professional Elective-II	3	0	0	30	70	3	3
6		Open Elective-II	2	0	0	30	70	3	2
7	MC601HS	Intellectual Property Rights	3	0	0	30	70	3	0
8	MC601ES	Artificial Intelligence	3	0	0	30	70	3	0
9	CE651PC	Environmental Engineering Lab	0	0	2	30	70	3	1
10	CE652PC	Geographical Information Systems Lab	0	0	2	30	70	3	1
11	EN653HS	Finishing School- IV (Advanced Communication Skills Lab)	0	0	2	30	70	3	1
12	MC601ESC	Environmental Science (For Lateral Entry Students)	3	0	0	30	70	3	0
Total Hours/Marks/Credits			**23**	**2**	**6**	**330**	**770**	**---**	**22**
Total Hours/Marks/Credits (for Lateral Entry Students)			**26**	**2**	**6**	**360**	**840**	**---**	**22**

MC601ESC - Environmental Science – Should be Registered by Lateral Entry Students Only

VII Semester

S.No	Course Code	Course Title	Instruction			Examination			Credits
			Hours Per Week			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE		
1	CE701PC	Transportation Engineering	3	0	0	30	70	3	3
2	CE702PC	Estimation, Costing and Project Management	3	1	0	30	70	3	4
3		Professional Elective-III	3	0	0	30	70	3	3
4		Professional Elective-IV	3	0	0	30	70	3	3
5		Open Elective-III	2	0	0	30	70	3	2
6	CE751PC	Transportation Engineering Lab	0	0	2	30	70	3	1
7	CE752PC	Computer Aided Design Lab (STAAD Pro)	0	0	2	30	70	3	1
8	CE753PC	Industrial Oriented Mini Project/ Summer Internship	0	0	2	--	100	--	1
9	CE754PC	Seminar	0	0	2	100	--	--	1
10	CE755PC	Project Stage-I	0	0	4	30	70	--	2
Total Hours/Marks/Credits			**14**	**1**	**12**	**340**	**660**	**---**	**21**

VIII Semester

S.No	Course Code	Course Title	Instruction			Examination			Credits
			Hours Per Week			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE		
1		Professional Elective-V	3	0	0	30	70	3	3
2		Professional Elective-VI	3	0	0	30	70	3	3
3	MS803HS	Professional Practice Law & Ethics	2	0	0	30	70	3	2
4	CE801PC	Project Stage-II	0	0	16	30	70	--	8
Total Hours/Marks/Credits			**8**	**0**	**16**	**120**	**280**	**---**	**16**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Grand Total of Credits

Semester	I	II	III	IV	V	VI	VII	VIII	Total Credits
Credits	18	19	21	21	22	22	21	16	160

Department of Civil Engineering

List of Professional Electives offered:

Professional Elective-I:

CE611PE	Remote Sensing and GIS
CE612PE	Repairs and Rehabilitation of Structures
CE613PE	Advanced Structural Analysis
CE614PE	Rock Mechanics

Professional Elective-II:

CE615PE	Elements of Earthquake Engineering
CE616PE	Foundation Engineering
CE617PE	Construction Technology and Management
CE618PE	Theory of Elasticity

Professional Elective-III:

CE711PE	Pre-stressed Concrete Structures
CE712PE	Environmental Impact Assessment
CE713PE	Ground Improvement Techniques
CE714PE	Sustainable Materials & Green Buildings

Professional Elective-IV:

CE715PE	Irrigation and Hydraulic Structures
CE716PE	Advanced Structural Design
CE717PE	Railway and Airport Engineering
CE718PE	Health Monitoring of Structures

Professional Elective-V:

CE811PE	Air Pollution and Control
CE812PE	Finite Element Methods for Civil Engineering
CE813PE	Watershed Management
CE814PE	Traffic Engineering

Professional Elective-VI:

CE815PE	Pavement Design
CE816PE	Solid Waste Management
CE817PE	Ground Water Hydrology
CE818PE	Earth and Rock Fill Dams and Slope Stability

List of Open Electives offered:

Open Elective -I:

CE521OE	Disaster Preparedness and Planning Management
CE522OE:	Geo-Informatics

Open Elective -II:

CE621OE	Advanced Engineering Materials
CE622OE:	Environmental Impact Assessment

Open Elective -III:

CE721OE	Finite Element Methods
CE722OE:	Remote Sensing and GIS

L	T	P	C
2	0	0	2

B.Tech in Civil Engineering
V Semester Syllabus
MS507HS: Engineering Economics and Financial Accounting

Course Objectives:

- To understand demand concepts and its applications in the field of engineering
- To prepare engineering students to analyze cost/ revenue/ financial data
- To understand economic and financial analysis in decision making process
- To examine the performance of companies engaged in engineering.
- To develop the analysis of cost concepts and its applications

Course Outcomes:

- **Understand** macroeconomic concepts- National income, its methods
- **Evaluate** present and future worth of the alternate projects and to appraise projects by using traditional and DCF Methods.
- **Categorize** cost benefit analysis of projects and to **calculate** BEP of different alternative projects.
- **Examine** the financial statements of companies and understand its performance
- **Discuss** economic principles and its applications in engineering

Unit I: Introduction to Engineering Economics:
Introduction to Engineering Economics- Objectives and importance- Basic Principles and Methodology of Engineering Economics– Fundamental Concepts- Demand – Demand Determinants - Law of Demand- Utility – types-Law of Diminishing marginal Utility-Demand Forecasting and Methods- Elasticity of demand- Meaning, significance, types and measurement of elasticity of demand (Price, income cross and promotional)- Theory of Firm – Supply- Elasticity of Supply.

Unit II: Macroeconomic Concepts:
Macroeconomic Concepts: Meaning, Scope and Limitations of Macro Economics. National Income Accounting - Methods of Estimation- Various Concepts of National Income - Inflation – Definition –Causes and Effects on different Segments of population and sectors of the Economy and Measures to Control Inflation - New Economic Policy 1991- Liberalisation-Privatization-Globalization (LPG) –Reforms in Industrial policy, Trade policy, and Fiscal policy- Impact on three sectors of India.

Unit III: Capital budgeting
Sources of finance- Capital Budgeting: Significance of Capital Budgeting - Time Value of Money- Choosing between alternative investment proposals- Methods of Appraisal Techniques- Pay Back Period - Average Rate of Return – Net Present Value- Internal Rate of Return – Profitability Index. (Simple problems)

Unit IV: Working Capital Management
Working Capital Management**:** Meaning of working capital, Kinds of working capital, Sources of working capital, Objectives of working capital management, Determinants of working capital requirement, Estimation of working capital requirement -Borrowings on Investment: Equity Vs Debt Financing- Leverages- Concept of Leverage- Types of Leverages: Operating Leverage- Financial Leverage and Composite Leverage. EBIT-EPS Analysis (Simple Problems)

Unit V: Accounting
Accounting: Definition-objectives-importance-limitations- Accounting Principles- Concepts and conventions- Book-keeping vs. Double entry system - Journal- ledger-Trial balance- Trading and Profit and Loss account- Balance Sheet. Cost Accounting, Introduction- Classification of costs- Breakeven Analysis, Meaning and its application, Limitations. (Simple Problems).

Text Books:

1. Henry Malcom Steinar-Engineering Economics, Principles, McGraw Hill Pub.
2. D.D. Chaturvedi, S.L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
3. Jain and Narang" Accounting, Kalyani Publishers.

Reference Books:

1. Arora, M.N." Cost Accounting, Vikas Publication.
2. S. N. Maheshwari, Financial Management, Vikas Publishing House.
3. Zahid A Khan, Arshad N Siddique, et.al, Principles of Engineering Economics with Applications, 2e, Cambridge University Press.

L	T	P	C
3	0	0	3

B.Tech in Civil Engineering
V Semester Syllabus
CE501PC: Concrete Technology

Course Objectives:

- Know the properties of Bogue's compounds and their influence on the properties of cement.
- Understand the economic concrete mix proportion for different exposure conditions and intended purposes.
- Know field and laboratory tests on concrete in plastic and hardened stage

Course Outcomes:

- **Determine** the properties of Cement by conducting various tests and apply the use of various and admixtures to cement-based materials
- **Understand** the characteristics of aggregate in concrete.
- **Explain** the behavior of fresh concrete and testing methods adopted to know the rheology of concrete
- **Understand** the behavior of hardened concrete and destructive, non-destructive testing on hardened concrete.
- **Estimate** concrete mix design as per IS Codes and study the special concretes

Unit I: Cement & Admixtures:
Cement: Portland cement- Grades – chemical composition –Bogue's compounds- Hydration– Structure of hydrated cement – Tests on physical properties -Setting of cement. Admixtures: Types of admixtures – Mineral and Chemical admixtures.

Unit II: Aggregates:
Classification of aggregates – Effect of Aggregate shape & texture on bond, strength & other mechanical properties of aggregate – Specific gravity, Bulk density, porosity, adsorption & moisture content of aggregate – Bulking of sand – Deleterious substance in aggregate – Soundness of aggregate – Alkali aggregate reaction – Thermal properties – Sieve analysis – Fineness modulus – Grading curves – Grading of fine and coarse Aggregates – Gap graded aggregate – Nominal Maximum size of aggregate - Properties of Recycled aggregate.

Unit III: Fresh Concrete:

Workability – Factors affecting workability – Measurement of workability by different tests – Setting times of concrete – Effect of time and temperature on workability –Segregation & Bleeding – Steps in manufacture of concrete – Mixing and Vibrating methods– Quality of mixing water.

Unit IV: Hardened Concrete:
Water / Cement ratio – Abram's Law – Gel/space ratio – Maturity concept – Strength in tension and compression – Factors affecting strength – Relation between compression and tensile strength – Curing of concrete.
Testing of Hardened Concrete: Compression tests – Tension tests – Flexure tests – Splitting tests – Pull out Test, Non-destructive testing methods – codal provisions for NDT. Elasticity ,Creep and Shrinkage– Modulus of elasticity – Static and Dynamic modulus of elasticity – Poisson's ratio – Creep of concrete – Factors influencing creep – Relation between creep & time – Nature of creep – Effects of creep – Shrinkage – Types of shrinkage.

Unit V: Mix Design & Special Concretes:
Factors in the choice of mix proportions – Durability of concrete – Quality Control of concrete – Statistical methods – Acceptance criteria – Proportioning of concrete mixes by various methods – BIS method of mix design.
Special Concretes: Introduction to Light weight concrete – Cellular concrete – No-fines concrete – High density concrete – Fiber reinforced concrete – Polymer concrete – High performance concrete – Self compacting concrete-Self curing,-Bacterial concrete-Geo polymer concrete.

Text Books:

1. Shetty M.S, A.K.Jain., Concrete Technology: Theory and Practice, S. Chand & Co.; 2022
2. Neville A. M.,Properties of Concrete, Low priced Edition – 5th edition, 2012

Reference Books:

1. Mehta P.K. and Monteiro J.M., Concrete: Micro structure, Properties and Materials, Mc-Graw Hill Publishers, 4th edition, 2013
2. Santhakumar A.R., Concrete Technology , 2nd Edition, Oxford university Press, New Delhi, Second Edition, 2018.
3. Gambhir M. L.,Concrete Technology,Tata Mc. Graw Hill Publishers, New Delhi, 5th edition, 2014
4. IS 456-2000- Code for Plain and Reinforced Concrete, BIS, New Delhi.
5. IS 383- 1970-Specification for Coarse and Fine Aggregates. BIS, New Delhi.
6. IS 10262-2019- Concrete Mix Proportioning, BIS, New Delhi.
7. IS 516(Part1/Sec 1) : 2021- Hardened Concrete- Methods of Test, BIS, New Delhi.

L	T	P	C
3	0	0	3

B.Tech in Civil Engineering
V Semester Syllabus
CE502PC: Geotechnical Engineering

Course Objectives:

- To understand the formation of soil and classification of the soils
- To determine the Index & Engineering Properties of Soils
- To determine the flow characteristics & stresses due to externally applied loads
- To estimate the consolidation properties of soils
- To estimate the shear strength and seepage loss

Course Outcomes:

- **Characterize** and **classify** the soils
- **Estimate** seepage, stresses under various loading conditions and compaction characteristics
- **Determine** the stress distribution in soils
- **Analyze** the compressibility of the soils
- **Understand** the strength of soils under various drainage conditions

Unit – I :
Introduction: Soil formation and structure – moisture content – Mass, volume relationships – Specific Gravity-Field density by core cutter and sand replacement methods-Relative density. Index Properties of Soils: Grain size analysis – Hydrometer analysis- consistency limits and indices – UCS and I.S. Classification of soils.

Unit –II :
Permeability: Soil water – capillary rise – flow of water through soils – Darcy's law- permeability – Factors affecting permeability – laboratory determination of coefficient of permeability –Permeability of layered soils.

Effective Stress & Seepage through Soils: Total, neutral and effective stress – principle of effective stress - quick sand condition – Seepage through soils – Flownets: Characteristics and Uses.

Unit –III:
Stress Distribution in Soils: Boussinesq's and Westergaard's theories for point load, uniformly loaded circular and rectangular areas, pressure bulb, variation of vertical stress under point load along the vertical and horizontal plane, and Newmark's influence chart for irregular areas.

Compaction: Mechanism of compaction – factors affecting compaction – effects of compaction on soil properties – Field compaction Equipment – compaction quality control.

Unit – IV:
Consolidation: Types of compressibility – Immediate Settlement, primary consolidation and secondary consolidation - stress history of clay; e-p and e-log(p) curves – normally consolidated soil, over consolidated soil and under consolidated soil - preconsolidation pressure and its determination - Terzaghi's 1-D consolidation theory – coefficient of consolidation: square root time and logarithm of time fitting methods - computation of total settlement and time rate of settlement.

Unit – V:
Shear Strength of Soils: Importance of shear strength – Mohr's– Coulomb Failure theories – Types of laboratory tests for strength parameters – strength tests based on drainage conditions – strength envelops – Shear strength of sands - dilatancy – critical void ratio.

Text Books:

1. Gopal Ranjan & Rao ASR, Basic and Applied Soil Mechanics, 2016 New Age International Pvt. Ltd.
2. Murthy VNS, Soil Mechanics and Foundation Engineering,2018, CBS Publishers and Distributors.
3. Arora K.R., Soil Mechanics and Foundation Engg. 2020, Standard Publishers and distributors, Delhi.
4. Braja M. Das, Principals of Geotechnical Engineering.2002, Cengage Learning Publishers.

Reference Books:

1.Venkataramiah C.., Geotechnical Engineering by, New Age International Pvt. Ltd, (2002).
2. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain, Soil Mechanics and Foundation by Laxmi, publications Pvt. Ltd., New Delhi
3. Manoj Dutta & Gulati S.K., Geotechnical Engineering by– Tata McGraw-Hill Publishers New Delhi.
4. Cuduto., Geotechnical Engineering Principles and Practices by, PHI International.

L	T	P	C
3	1	0	4

B.Tech in Civil Engineering
V Semester Syllabus
CE503PC: Design of Reinforced Concrete Structures

Course Objectives:

- Identify the basic components of any structural system and the standard loading for the RC structure
- Identify and tell the various codal provisions given in IS. 456
- Describe the salient feature of limit state method, compare with other methods and the concepts of limit state of collapse and limit state of serviceability
- Evaluate the behavior of RC member under flexure, shear and compression, torsion and bond.

Course Outcomes :

- **Apply** the fundamental concepts of working stress method and limit state method and **Design** for flexure as per IS 456:
- **Design** of RC beams for Shear , Torsion and bond.
- **Design** and detailing of Reinforced concrete Slabs Limit state of collapse and serviceability
- **Design** of Reinforced concrete short columns
- **Design** and detailing of isolated and combined footings.

Unit I: Methods of Design :
Introduction- Structure - Components of structure - Different types of structures - Equilibrium and compatibility– Safety and Stability - Loads – Different types of Loads – Dead Load, Live Load, Earthquake Load and Wind Load– Forces – What is meant by Design? – Different types of materials – RCC, PSC and Steel – Planning of structural elements- Concepts of RCC Design – Different methods of Design- Working Stress Method and Limit State Method – Introduction to Working Stress Method - Load combinations as per Limit state method - Materials - Characteristic Values – Partial safety factors – Behavior and Properties of Concrete and Steel- Stress Block Parameters as per IS 456 -2000.

Unit II: Design for Flexure, Shear & Torsion:
Limit state Analysis and design of sections in Flexure – Behavior of RC section under flexure - Rectangular, T and L-sections, singly reinforced and doubly reinforced Beams – Detailing of reinforcement

Design for Shear, Bond and Torsion - Mechanism of shear and bond failure - Design of shear using limit state concept – Design for Bond –Anchorage and Development length of bars - Design of sections for torsion - Detailing of reinforcement

Unit III: Design of Slabs:
Design of Two-way slabs with different end conditions, one-way slab, and continuous slab Using I S Coefficients - Design of dog-legged staircase – Limit state design for serviceability for deflection, cracking and codal provisions.

Unit IV: Design of Compression Members:
Design of compression members - Short Column - Columns with axial loads, uni-axial and bi-axial bending – Use of design charts- I S Code provisions.

Unit V: Design of Footings:
Introduction to footings - Different types of footings –Design of flat isolated square, rectangular, circular footings and combined footings for two columns.

Text Books:

1. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain, Limit State Design of Reinforced concrete, Laxmi, publications Pvt. Ltd. 2007
2. Karve & Shah, Limit state theory & design of Reinforced concrete (IS 456 :2000), Standard Publishers 2014
3. P.C.Varghese, Limit State Design of Reinforced Concrete , 2nd Revised edition,PHI Learning Pvt Ltd,2008

Reference Books:

1. Unnikrishna Pillai S. & Devdas Menon ,Reinforced Concrete Design, Tata McGraw Hill, Third edition, 2017
2. Krishna Raju N. and Pranesh R.N.,Reinforced Concrete Design, New age International Publishers, 2018.

Code Books:

1. IS 456 : 2000-Plain and Reinforced Concrete - Code of Practice, BIS, New Delhi
2.IS 875-1 (1987): Code of practice for design loads (other than earthquake) for buildings and structures, BIS, New Delhi
3. IS 875-2 (1987): Code of Practice for Design Loads (Other Than Earthquake) for buildings and structures, BIS, New Delhi
4. SP-16- Design Aids for Reinforced Concrete, BIS, New Delhi

L	T	P	C
3	1	0	4

B.Tech in Civil Engineering
V Semester Syllabus
CE504PC: Structural Analysis-II

Course Objectives:

- Identify the various actions in arches.
- Understand classical methods of analysis for statically indeterminate structures.
- Differentiate the approximate and numerical methods of analysis for indeterminate structures.
- Find the degree of static and kinematic indeterminacies of the structures.
- Plot the variation of S.F and B.M when a moving load passes on indeterminate structure

Course Outcomes :

- **Analyze** the two hinged arches and cables and suspension bridges.
- **Analyze** statically indeterminate beams and portal frames using moment distribution method and Kani's method
- **Apply** approximate methods of analysis for multi-storey frames.
- **Formulate** the stiffness, flexibility matrices and analyze the beams and trusses using matrix methods.
- **Sketch** the influence line diagram for shear force and bending moment for indeterminate beams**.**

Unit I:Two Hinged Arches and Cables and Suspension Bridges:
Two Hinged Arches: Introduction – Classification of Two hinged Arches – Analysis of two hinged parabolic arches – Secondary stresses in two hinged arches due to temperature and elastic shortening of rib.
Cables and Suspension Bridges:
Equilibrium of a Suspension Cable subjected to concentrated loads and uniformly distributed loads - Length of a cable - Cable with different support levels - Suspension cable supports - Suspension Bridges - Analysis of Three Hinged Stiffening Girder Suspension Bridges.

Unit II: Moment Distribution Method & Kani's Method :
Moment Distribution Method - Analysis of continuous beams with and without settlement of supports using - Analysis of Single Bay Single Storey Portal Frames including side Sway - Shear force and Bending moment diagrams, Elastic curve.
Kani's Method: Analysis of continuous beams including settlement of supports - Analysis of single bay single storey, Frames including Side Sway using Kani's Method - Shear force and bending moment diagrams - Elastic curve.

Unit III: Approximate Methods of Analysis:
Introduction – Analysis of multi-storey frames for lateral loads: Portal Method, Cantilever method and Factor method - Analysis of multi-storey frames for gravity loads - Substitute Frame method

Unit IV: Matrix Methods of Analysis:
Introduction to matrix methods of analysis- Flexibility and Stiffness matrix methods of analysis– Analysis of continuous beams including settlement of supports using flexibility(upto three degree of indeterminacy) and stiffness methods (upto three degree of freedom)- Shear force and bending moment diagrams - Elastic curve. Analysis of pin-jointed plane frames using flexibility (up to two degree of indeterminacy), using stiffness method (up to two degrees of freedom)

Unit V: Influence Lines for Indeterminate Beams:
Introduction – influence line diagram for shear force and bending moment for two span continuous beam with constant and different moments of with two ends are simply supported, - influence line diagram for shear force and bending moment for propped cantilever beams.

Text Books:

1. Pandit G.S. and Gupta S.P. Structural Analysis Vol I & II, Tata McGraw Hill Education Pvt. Ltd., Section Edition, 2008
2. Dr. M.M. Ratwani and Prof. V.N. Vazirani, Analysis of Structures Vol 1 &2 ,Khanna Publishers,1999

Reference Books:

1. Muthu . K.U. et al., Indeterminate Structural Analysis , I.K. International Publishing House Pvt. Ltd, 2014
2.Thandavamoorthy T. S , Structural analysis, Oxford university Press, 2011
3. Shah H.J. and Junnarkar S.B. , Mechanics of Structures Vol –II, Charotar Publishing House Pvt. Ltd. 24th Edition, 2017.
4. Reddy C.S. , Basic Structural Analysis, Tata McGraw Hill Publishers, 3rd Edition, 2004
5. Hibbeler R. C. , Structural Analysis, Pearson Education. 10th Edition, 2018
6. Devdas Menon, Structural Analysis, Narosa Publishing House, 2nd Edition, 2018

L	T	P	C
2	0	0	2

Open Elective for other Departments
V Semester Syllabus
CE521OE : Disaster Preparedness and Planning Management
(Open Elective-I)

Course Objectives:

- To understand basic concepts in Disaster Management.
- To Understand definitions and terminologies used in Disaster Management.
- To Understand Types and Categories of Disasters.
- To Understand the Challenges posed by Disasters.
- To understand Impacts of Disasters Key Skills.

Course Outcomes:

- **Understand** the various definitions associated with disaster concept.
- **Analyze** relationship between development and disasters.
- **Understand** categories of disasters and their impacts.
- **Interpret** the different phases of disaster management cycle
- **Formulating** disaster risk reduction plans.

Unit - I Introduction :
Concepts and definitions: disaster, hazard, vulnerability, resilience, risks severity, frequency and details, capacity, impact, prevention, mitigation and case studies.

Unit - II Disasters - Disasters classification:
Natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

Unit - III Disaster Impacts :
Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

Unit - IV Disaster Risk Reduction (DRR) :
Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Unit - V Disasters, Environment and Development:
Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, landuse changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

Text Books:

1. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
2. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
3. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation

Reference Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).
3. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003
4. Inter-Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC

L	T	P	C
2	0	0	2

Open Elective for other Departments
V Semester Syllabus
CE522OE: Geo-Informatics
(Open Elective-I)

Course Objectives:

- To introduce the concepts of remote sensing, satellite image characteristics and its components.
- To expose the various remote sensing platforms and sensors and to introduce the concepts of GIS, GPS and GNSS.

Course Outcomes:

- **Identify** and recognize the characteristics of aerial photographic images
- **Interpret** the principles and application of Remote sensing and remote sensing satellites
- **Examine** satellite imagery and to their patterns and classifications
- **Articulate** concepts of GIS and its data models.
- **Interpret** the principles of Global Navigation Satellite System.

Unit – I :Aerial Photogrammetry:
Aerial Photographs- Basic terms & Definitions, scales, relief displacements, Flight Planning, Stereoscopy, Characteristics of photographic images – fiducial marks, principal point, Nadir, Isocenter, camera axis, tilt angle & overlap, Fundamentals of aerial photo interpretation, Introduction to Digital Photogrammetry.

Unit – II :Remote Sensing:
Remote Sensing: Physics of remote sensing, Principles of Remote Sensing, Remote sensing satellites, and their data products, Sensors and orbital characteristics, Spectral reflectance curves, resolution and multi-concept, FCC

Unit – III: Satellite Imagery:
Satellite Image - Characteristics and formats, Image histogram, Introduction to Image rectification, Image Enhancement, Land use and land cover classification system, Unsupervised and Supervised Classification, Applications of remote sensing

Unit - IV: GIS:
Basic concepts of geographic data, GIS and its components, Data models, Topology, Process in GIS: Data capture, data sources, data encoding, geospatial analysis, GIS Applications, Differential GPS

Unit - V: Navigation System:
History of Navigation, Global Navigation Satellite System (GNSS), Components of GNSS, GPS, GLONASS, GALILEO, GPS: Space segment, Control segment, User segment, GPS satellite signals, Datum, coordinate system and map projection, Static, Kinematic and Differential GPS, GPS Applications

Text Books:
1. Chouhan. T S, Geoinformatics – Fundamentals and application, Scientific Publishers
2. Garg. P K, Principles and Theory of Geo-informatics, Khanna Publishers
3. Elliott D. Kaplan and Christopher J. Hegarty, Understanding GPS/GNSS: Principles and Applications, Third Edition by, Artech House

Reference Books:
1. Lillesand T M et al: Remote Sensing & Image Interpretation
2. Punmia B C, Ashok K. Jain, Higher Surveying, Laxmi Publications
3. Bhatta B., Remote Sensing& GIS, Oxford University Press
4. Agarwal N K. Essentials of GPS , Spatial Networks: Hyderabad
5. Chandra A M, Higher Surveying, New Age International Publisher

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B.Tech in Civil Engineering
V Semester Syllabus
MC502ES: Cyber Security

Course Objectives:

- To familiarize various types of cyber-attacks and cyber-crimes
- To give an overview of the cyber laws
- To study the defensive techniques against these attac

Course Outcomes :

- The students will be able to understand cyber-attacks, types of cybercrimes, cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks..

Unit I: Introduction to Cyber Security:
Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

Unit II: Cyberspace and the Law & Cyber Forensics:
Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy.
Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email,Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing

Unit III: Cybercrime: Mobile and Wireless Devices:
Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Unit IV: Cyber Security: Organizational Implications:
Introduction, cost of cyber crimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.
Cybercrime and Cyber terrorism:
Introduction, intellectual property in the cyber space, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

Unit V: Privacy Issues:
Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc Cybercrime.

Examples and Mini-Cases:
Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mails spoofing instances.
Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain

Text Books:

1. Nina God bole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

Reference Books:

1. James Graham, Richard Howard and Ryan Otson, Cyber Security Essentials, CRC Press.
2. Chwan-Hwa(john) Wu,J. David Irwin, Introduction to Cyber Security, CRC Press T&F Group.

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B.Tech in Civil Engineering
V Semester Syllabus
CE551PC: Concrete Technology Lab

Course Objectives:

- To learn laboratory tests and their procedures cement and fine aggregate.
- To evaluate fresh and hardened properties of concrete.
- To understand the test procedures for characterization of concrete and bituminous mixes

Course Outcomes :

- **Perform** the tests on ingredients of concrete for it characterization.
- **Understand** behavior of Fresh concrete through workability test.
- **Evaluate** the behavior of hardened concrete by compression and flexure tests.

I. Test on Cement

1. Fineness & Specific gravity of cement
2. Normal Consistency of cement
3. Initial Setting times of Cement
4. Compressive strength of cement

II. Test on Fine Aggregates

5. Bulking of sand

III. Test on Fresh Concrete

6. Workability test on normal concrete by Slump test
7. Workability test on normal concrete by Compaction factor test

IV. Test on hardened concrete

8. Compression test on cube
9. Flexure test on beam
10. Split Tensile Test on cylinder
11. Static Modulus of Elasticity of Concrete

Demonstration:

1. Final setting time of cement
2. Workability of concrete by Vee-Bee test
3. Workability of concrete by Flow table test
4. Non destructive testing on Concrete-Rebound hammer and Ultrasonic pulse velocity test

Text Books:

1. Shetty M.S., Concrete Technology., S. Chand & Co, 2019

Reference Books:

1. IS- 10262 :2019, “Concrete Mix Proportioning – Guidelines”
2.1S -516:2006, “Methods of Tests on Strength of Concrete”

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B.Tech in Civil Engineering
V Semester Syllabus
CE552PC: Geotechnical Engineering Lab

Course Objectives:

- To obtain index and engineering properties of locally available soils,
- To understand the behavior of these soil under various loads.
- To determine field density of soils

Course Outcomes:

- **Classify** the soils
- **Evaluate** the behavior of the soils subjected to various loads.
- **Determine** the shear strength of soils.

List of Experiments :

1. Atterberg Limits (Liquid Limit, Plastic Limit, and shrinkage limit)
2. a) Field density by core cutter method and
   b) Field density by sand replacement method
3. Determination of Specific gravity of soil and Grain size distribution by sieve analysis
4. Permeability of soil by constant and variable head test methods
5. Standard Proctor's Compaction Test
6. Determination of Coefficient of consolidation (square root time fitting method)
7. Unconfined compression test
8. Direct shear test
9. Vane shear test
10. Differential free swell index (DFSI) test

Reference books:

1. Saibaba Reddy E. and Rama Sastri K., Measurement of Engineering Properties of Soils, New Age International publishers

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B.Tech in Civil Engineering
V Semester Syllabus
MA554BS: Finishing School-III (Quantitative Aptitude & Analytical Ability)

Course Objectives:

- Students will be introduced to higher order thinking skills and problem-solving on the following areas - Arithmetic ability, Numerical ability and General reasoning.
- Students will be trained to work systematically with speed and accuracy while solving problems.

Course Outcomes:

- **Solve** questions on the above-mentioned areas using shortcut and smart methods
- **Understand** the fundamental concepts of Aptitude skills
- **Perform** calculations with speed and accuracy

Unit- 1: Quantitative Aptitude - Numerical Ability:

• Number systems

• LCM & HCF

• Speed Math

- Divisibility Rules
- Square root
- Cube root
- Problems on numbers with shortcuts

Unit -2: Quantitative Aptitude- Arithmetic Ability:

- Percentage
- Profit loss and discounts
- Simple and Compound interest
- Ratio proportions
- Averages
- Pipes and Cisterns
- Ages
- Time-Speed-Distance
- Clocks & Calendars
- Venn diagrams
- Tables and graphs

Unit- 3: Reasoning Ability – General Reasoning Part 1:

- Coding decoding
- Directions
- Series completions - Letter, Number & Element Series
- Seating arrangements
- Odd one out
- Spatial ability Questions

Unit- 4: Reasoning Ability- General Reasoning Part 2:

- Analogies
  - Alphabet Analogy
  - Numerical Analogy
- Classification
  - Alphabet Classification
  - Word Classification
  - Miscellaneous Classification
- Alphabet test
  - Arranging words in ALPHABETICAL ORDER
  - Problems based on LETTER-WORD
  - Problems based on ALPHABETICAL QUIBBLE
- Blood Relations
- Statements and conclusions
- Direction Sense test

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B.Tech in Civil Engineering
VI Semester Syllabus
CE601PC: Environmental Engineering

Course Objectives:

- Design and safely distribute potable water to the consumers.
- Learn Treatment, and dispose wastewater safely into the environment.

Course Outcomes:

- **Analyze** the characteristics of water and wastewater
- **Estimate** the quantity of potable water and wastewater generated
- **Design** components of water and sewerage systems
- **Learn** and **understand** treatment options for various impurities from water and wastewater.
- **Identify** the safe disposal options for wastewater.

Unit – I: Water Quantity and Conveyance:
Objectives of Water supply systems, Water demand, Per Capita Demand, Types of Demand, Population forecasting, Design period, Types of Intakes, Water quality and testing: Physical, Chemical and Biological impurities, drinking water standards, Water Borne Diseases.

Unit – II: Water Treatment:
Layout and general outline of water treatment units, Plain Sedimentation, Design aspects, Coagulation, Types of Coagulants, Filtration, Slow and Rapid gravity filters, Construction and operation, Comparison of filters, Disinfection methods, Chlorination, Role of Nano-Technology in water Purification.

Unit – III: Water Distribution Methods:
Distribution systems, Methods of Supply, Distribution Reservoirs, Layouts, Hardy Cross and equivalent pipe methods, Valves, House Plumbing-Pipes and Fittings, Traps, One pipe and Two pipe systems.

Unit – IV: Sanitary Engineering:
Conservancy and water carriage systems, Sewage and storm water estimation, Design of sewers, Shapes and materials, Sewer Appurtenances-Types, Characteristics of sewage, Decomposition of sewage, BOD and COD, Primary Treatment: Theory of Screens, Grit chambers, Design of Sedimentation tanks.

Unit – V: Biological Treatment:
Trickling filters –Standard and High rate, Operational Problems, Principle of Activated Sludge Process, Methods of Aeration Sludge digestion, Factors affecting tank, Sludge disposal by Dilution-Self Purification, Oxygen Sag Curve, Zones of Pollution, Land Disposal by Irrigation, Effluent Disposal: Septic tanks- principle and design.

Text Books:

1. Garg S.K., Environmental Engineering, Khanna Publishers
2. Birdie, G.S., Water Supply and sanitary Engineering, Dhanpat Rai & sons Publishers.
3. BC.Punmia, Ashok K Jain, Arun K Jain, Environmental Engineering – Water supply Engineering, Laxmi Publications, 2016

Reference Books:

1. Steel, Water and Waste Water Technology, Wiley publications,2011
2. Metcalf and Eddy, Waste water engineering, McGraw Hill, 2015.
3. Fair Geyer and Okun, Water and Waste Water Engineering, Wiley publications, 2011

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B.Tech in Civil Engineering
VI Semester Syllabus
CE602PC: Hydrology and Water Resources Engineering

Course Objectives:

- To study various types of precipitation and to understand the concepts of runoff
- To understand the concepts of hydrographs
- To know the principles of well hydraulics and irrigation
- To know the concepts of canals and their design

Course Outcomes:

- **Demonstrate** Hydrologic cycle and its applications and **Analyze** hydro-meteorological data
- **Discuss** various abstractions from precipitation and **formulate** rainfall-runoff equations
- **Interpret** hydrograph and **Analyze** various types of Unit hydrographs.
- **Determine** the yield of wells and **Evaluate** duty, delta and irrigation efficiencies**.**
- **Design** alluvial canals and **compute** design discharge over a catchment.

Unit – I:

Introduction: Concepts of Hydrologic cycle, Global Water Budget, Applications in Engineering. Sources of data.

Precipitation: Forms of precipitation, characteristics of precipitation in India, measurement of precipitation: Recording and non-recording types, rain gauge network: mean precipitation over an area: Arithmetic, Theissen's and Isohyetal methods, Missing Rainfall Data – Estimation, Consistency of Rainfall records, depth area-duration relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP), rainfall data in India.

Unit – II:

Abstractions from Precipitation: Evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapotranspiration, measurement of evapotranspiration.

Evapotranspiration Equations: Penman and Blaney & Criddle Methods, potential evapotranspiration, actual evapotranspiration, , interception, depression storage, infiltration, infiltration capacity, measurement of infiltration, modelling infiltration capacity, classification of infiltration capacities, infiltration indices.

Runoff: Components of Runoff, Factors affecting runoff, Basin yield, SCS-CN method of estimating runoff, Flow duration curves, Mass curve of runoff – Analysis.

Unit – III:

Hydrographs: Hydrograph – Distribution of Runoff – Hydrograph Analysis Flood Hydrograph – Effective Rainfall – Base Flow- Base Flow Separation - Direct Runoff Hydrograph Unit pulse and Unit step function - Unit Hydrograph, definition, limitations and applications of Unit hydrograph, derivation of Unit Hydrograph from Direct Runoff Hydrograph and vice versa - S-hydrograph, Synthetic Unit Hydrograph.

Unit – IV:

Groundwater Hydrology: Occurrence, movement and distribution of groundwater, aquifers – types, Specific Yield, Permeability, Storage coefficient, Transmissibility, Darcy's Law. Well Hydraulics - Steady radial flow into well for confined and unconfined aquifers, Recuperation tests. Well constants.

Crop Water Requirements: 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.

Unit – V:

Canal Systems: Classification of canals under various considerations, Canal systems, alignment of canals, canal losses, estimation of design discharge. Design of channels- rigid boundary channels, alluvial channels, Regime channels, Kennedy's and Lacey's theory of regime channels. Water logging: causes, effects and remedial measures. Lining of canals- Types of lining-Advantages and disadvantages of canal lining.

Text Books:

1. Santhosh Kumar Garg , Irrigation Engineering and Hydraulic structures, Khanna Publishers.2006
2. Punmia B.C & Lal, Irrigation and Water Power Engineering, Laxmi publications Pvt.Ltd, New Delhi.,2016
3. Jaya Rami Reddy. P, Engineering Hydrology , Laxmi Publications,2011
4. K.R. Arora, Irrigation, Water Power and Water Resources Engineering, Standard Publishers Distributors,2010

Reference Books:

1. Singh V.P. Elements of Engineering Hydrology ,Tata McGraw-Hill,2009
2. Asawa G L, Irrigation Engineering, Wiley Eastern Publications,2005
3. David Keith Todd , Ground water Hydrology, John Wiley & Son, New York,2004
4. Duggal K.N. and Soni J.P. ,Elements of Water Resources Engineering ,New Age International,2016

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B.Tech in Civil Engineering
VI Semester Syllabus
CE603PC: Design of Steel Structures

Course Objectives:

- Explain the mechanical properties of structural steel, plasticity, yield point.
- Identify and explain the codal provisions given in IS. 800-2007.
- Analyze the behavior of steel structures under tension, compression and flexure.
- Design the tension, compression, flexural members and plate and gantry girders.

Course Outcomes :

- **Understand** the fundamental concepts of limit state method in designing Steel Structures and design of connections.
- **Design** Tension and Compression members using simple and built-up sections.
- **Understand** plastic analysis, and design of beams.
- **Design** various elements of plate girders.
- **Design** of roof trusses and welded Gantry Girder.

Unit I: Materials & Design of Connections:
Materials: Types of structural steel – Mechanical properties of steel – Concepts of plasticity – yield strength - Loads and Stresses – Local buckling behavior of steel. Concepts of limit State Design – Different Limit States – Load combinations for different Limit states - Design Strengths - deflection limits serviceability – stability check.
Design of Connections: Different types of connections – Bolted connections – Design strength – efficiency of joint– prying action - Welded connections – Types of welded joints.

Unit II: Design of Tension and Compression Members :
Design of tension members : Simple and built up members - Design strength – Design procedure for splicing - lug angle.
Design of compression members : Buckling class – slenderness ratio – Design of simple compression members - laced – battened columns – splice – column base – slab base.

Unit III: Plastic Analysis & Design of Flexural Members:
Plastic Analysis: Plastic moment – Plastic section modulus - Plastic analysis of continuous beams

Design of Flexural Members – Introduction to flexural members- Design of laterally supported and unsupported Beams – Bending and shear strength/buckling – Built-up sections - Beam splice

Unit IV: Plate Girders:
Design of welded plate girders – elements – economical depth – design of main section – connections between web and flange – design of stiffeners - bearing stiffener– intermediate stiffeners – Design of web splice and flange splice.

Unit V: Design of Industrial Structures:

Types of roof trusses - loads on trusses – wind loads - Purlin design – truss design – Design of welded Gantry girder

Text Books:

1. Duggal .S.K., Design of steel structures, Tata Macgraw hill publishers,3rd Edition.2008
2. Subramanian N., Design of steel structures: Limit State method, Oxford University press, 2018

Reference Books:

1. Ramchandra,,Design of Steel Structures,,Vol 1& 2,Standard publishers,19th edition,2016
2. Edwin H. Gayrold and Charles Gayrold, Design of steel structures, Tata McGraw-Hill publishers,1972
3. Sairam K.S., Design of steel structures, Pearson Educational India, 2nd Edition, 2013.

Code Books:

1. IS 800 (2007): General Construction in Steel - Code of Practice
2. IS 875-1 (1987): Code of practice for design loads (other than earthquake) for buildings and structures
3. IS 875-2 (1987): Code of Practice for Design Loads (Other Than Earthquake) for buildings and structures.
4.IS 875-3 (1987) :code of practice for design loads (other than earthquake) for buildings and structures.

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B.Tech in Civil Engineering
VI Semester Syllabus
CE611PE :Remote Sensing and GIS
(Professional Elective-I)

Course Objectives:

- The principles of Photogrammetry
- Principles and applications of Remote sensing
- Introduction to GIS, Spatial Systems, and its applications to Engineering Problems.
- The data types in GIS

Course Outcomes:

- **Identify** characteristics and principles of photogrammetry
- **Understand** concepts of remote sensing and to **analyze** the energy interactions in the atmosphere and earth surface features
- **Understand** and **apply** GIS concepts and to **interpret** the images for preparation of thematic maps
- **Analyze** spatial and attribute data for solving spatial problems
- **Recognize** and **apply** the knowledge of GIS data models

Unit – I: Introduction to Photogrammetry:
Principles& types of aerial photograph, geometry of vertical aerial photograph, Scale & Height measurement on single vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of stereoscopy, fiducial points, parallax measurement using fiducial line.

Unit – II: Remote Sensing:
Basic concept of remote sensing, Data and Information, Remote sensing data Collection, Remote sensing advantages & Limitations, Remote Sensing process. Electro- magnetic Spectrum, wavelength regions important to remote sensing, Energy interactions with atmosphere and with earth surface features (soil, water, vegetation), Atmospheric scattering, absorption – Atmospheric windows – spectral signature concepts, Indian Satellites and Sensors characteristics, Resolution, Map and Image, False color composite, introduction to digital data, elements of visual interpretation techniques.

Unit – III : Geographic Information Systems:
Introduction to GIS; Components of a GIS; Geospatial Data: Spatial Data-Attribute data – Joining Spatial and Attribute data; GIS Operations: Spatial Data Input, verification, storage and output- Attribute data Management –Data display- Data Exploration- Data Analysis. Coordinate Systems: Geographic Coordinate System: Map Projections: Types of Map Projections-Map projection parameters- Commonly used Map Projections - Projected coordinate Systems

Unit – IV : Vector Data Model:
Representation of simple features- Topology and its importance; coverage and its data structure, Shape file; Data models for composite features, Object Based Vector Data Model; Classes and their Relationship; The geo-base data model; Geometric representation of Spatial Feature and data structure, Topology rules

Unit – V : Raster Data Model:
Elements of the Raster data model, Types of Raster Data, Raster Data Structure, Data Conversion, Integration of Raster and Vector data. Data Input**:** Metadata, Conversion of Existing data, creating new data; Remote Sensing data, Field data, Text data, Digitizing, Scanning, on screen digitizing, importance of source map, Data Editing

Text Books:

1. Bhatta B,Remote Sensing and GIS ,Oxford Publishers 2015.
2. M. Anji Reddy, Remte sening and Geographic Information system, 2012
3. Kang-Tsung Chang,Introduction to Geographic Information System –, McGrawHill,2015
4. Kumar S, Basics of Remote Sensing, Laxmi Publications

Reference Books:

1. Young K.W. and Lo Albert C. P., Concepts & Techniques of GIS ,, Prentice Hall(India)Publications.
2. Peter A Burragh and Rachael A ,Principals of Geo physical Information Systems.
3. Lillesand and Kiefer , Remote Sensing and GIS, John Willey 2008.

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B.Tech in Civil Engineering
VI Semester Syllabus
CE612PE: Repairs and Rehabilitation of Structures
(Professional Elective - I)

Course Objectives:

- Learn the fundamentals of maintenance and repair strategies.
- Study the quality assurance, serviceability and durability of concrete.
- Know the various materials and techniques used for repair of structures.
- Educatethedifferentrepair,strengthening,rehabilitationandretrofittingtechniques.
- Instruct the various health monitoring and demolition techniques.

Course Outcomes :

- **Understand** the fundamentals of maintenance and repair strategies.
- **Examine** for serviceability and durability aspects of concrete.
- **Understand** the materials and techniques used for the repair of structures.
- **Identify** the appropriate repair, strengthening, rehabilitation, and retrofitting technique required for a case study building.
- **Choose** appropriate health monitoring and demolition techniques.

Unit – I : Introduction:
Introduction to Building Maintenance: Definitions of repair, renovation, remodeling, restoration, retrofitting and rehabilitation. Need for maintenance, types of maintenance, routine maintenance works in buildings.
Deterioration of Structures – Distress in Structures – Causes of distress in concrete structures and Prevention. Mechanism of Damage – Types of Damage - assessment procedure for evaluating damaged structure, and causes of deterioration. Types of Defects and Damages in Structures: During pre-construction stage, construction stage and post-construction stage. Cracks – Types, Causes and characteristics.

Unit – II : Quality of Concrete:
quality assurance for concrete construction, concrete properties - strength, permeability, thermal properties and cracking. - Effects due to climate, temperature, chemicals, corrosion - design and construction errors - Effects of cover thickness and cracking.
Corrosion and Fire: Corrosion of Steel Reinforcement – Causes – Mechanism and Prevention. Damage of Structures due to Fire – Fire Rating of Structures – Phenomena of Desiccation.

Unit – III : Inspection and Testing:
Symptoms and Diagnosis of Distress –Assessment and Non-destructive Testing & Evaluation: Definition, objectives and stages of condition assessment, Destructive and partially destructive tests. Non-destructive tests (NDTs). Classification of NDT procedures, Visual Inspection, Ultrasonic Testing methods (Impact echo, Pulse velocity, Pulse echo), Rebound hammer (IS 13311), Windsor probe test, Half-cell potential measurement, Electrical resistivity measurement, Carbonation depth measurements, Petrographic Analysis, Electromagnetic methods for Rebar detection, Ground Penetrating radar, Infrared thermography, Radiography, Radio isotope gauges, Remote viewing, Hammer sounding, Chain drag techniques.

Unit – IV : Repair Materials and Techniques:
Repair Methodology, Repair materials (cement-based, polymer-based, resin based, microcrete, composites, etc.), compatibility considerations, Repair techniques: Using mortars, dry pack, epoxy bonded pack, pre-placed aggregate concrete, gunite, shotcrete, grouting, polymer impregnation, resin injection, routing & sealing, stitching, surface patching, overlays & surface coatings, autogenous healing, gravity filling, drilling and plugging

Retrofitting & Rehabilitation Procedures: Strengthening of Existing Structures – Overview, general procedures, Techniques: section enlargement, composite construction, post-tensioning, stress reduction, strengthening by reinforcement, methods of strengthening in beams, slabs, columns (plate bonding, RC

jacketing, FRP methods, concrete overlays, etc.) strengthening of substructure (shoring, underpinning)-case studies on repair and retrofitting.

Unit – V : Health Monitoring of Structures:
Long term health monitoring techniques, engineered demolition techniques for dilapidated structures, Use of Sensors - Building Instrumentation. Use of Sensors – Building Instrumentation.

Text Books:

1. Gupta B.L. and Amit Gupta, Maintenance and Repair of Civil Structures, Standard Publications.
2. Santa kumar A.R. ,Concrete Technology, Oxford Universitypress
3. Varghese P. C. (2015), Maintenance, Repair & Rehabilitation & Minor Works of Buildings, PHI Learning Pvt. Ltd, Delhi.

References Books:

1. Spon EF & N, Defects and Deterioration in Buildings, London
2. Bung, ey– Surrey, Non-Destructive Evaluation of Concrete Structures, University Press
3. Spon EF & N and Richardson B.A., Building Failures: Diagnosis and Avoidance, London,1991.
4. IS 13311:1992(Part -1) code for Non Destructive Testing of Concrete Methods of Test

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B.Tech in Civil Engineering
VI Semester Syllabus
CE613PE: Advanced Structural Analysis
(Professional Elective-I)

Course Objectives:

- Understand the matrix method of analysis statically indeterminate frames and trusses.
- Know the transformation of coordinates and assembly of stiffness matrices
- Differentiate between flexibility and stiffness methods of analysis of beams, frames and plane trusses.

Course Outcomes :

- **Develop** Flexibility and Stiffness Matrices for beam and truss element
- **Assemble** and **develop** stiffness matrices
- **Analyze** continuous beam, plane frame and truss using the Flexibility method.
- **Analyze** continuous beam, plane frame and truss using the Stiffness method.
- **Understand** Static condensation and sub structuring methods.

Unit I: Introduction to Matrix Methods :

Introduction to matrix methods of analysis statically indeterminacy and kinematics indeterminacy- degree of freedom-coordinate system-structure idealization stiffness and flexibility matrices-suitability element stiffness equations-elements flexibility equations-mixed force-displacement equations-for truss element, beam element and tensional element

Unit II: Formulation of Stiffness Matrix:

Element stiffness matrix-and load vector-local and global coordinates. Assembly of stiffness matrix from element stiffness matrix (up to four noded truss-and two span continuous beam)-direct stiffness method-general procedure- banded matrix-semi bandwidth

Unit III: Stiffness Method:

Analysis of continuous beams with and without sinking of supports -plane frame upto three degree of freedom and plane truss upto two degree of freedom

Unit IV: Flexibility Method:

Formulation of Flexibility matrix- Analysis of continuous beams with and without sinking of supports-plane frame upto three degree of static Indeterminacy and plane truss upto two degree of static indeterminacy.

Unit V: Special Analysis Procedures & Shear Walls:

Static condensation- derivation of static condensation to reduce degree of freedom, - Introduction to sub-structuring- examples.

Shear Walls Necessity-structural behavior of large frames with and without shear walls-approximate methods of analysis of shear walls

Text Books:

1. Willam Weaver and Gere, Matrix methods of structural analysis, CBS Publishers,2nd edition,2004
2. Pandit G.S. and Gupta S.P, Structural Analysis -A Matrix approach, McGraw Hill, 2nd edition ,2008
3. Ghali and Neyveli, Structural Analysis: A unified classical and matrix approach Narosa Publishers Pvt Ltd,2003

Reference Books:

1. Jain A.K. , Advanced Structural Analysis, Nemch and Publishers.3rd edition,2015

2. Meek .J, Matrix methods of structural analysis, McGraw-Hill Inc.,1971

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B.Tech in Civil Engineering
VI Semester Syllabus
CE614PE: Rock Mechanics
(Professional Elective- I)

Course Objectives:

- Identify the classification of Rocks as per engineering aspects
- Explain the basic laboratory in-situ tests, strengths and its responses
- Understand Rock slopes and its failures, underground and open excavations and its requirements

Course Outcomes:

- **Determine** the required rock properties and classify rock mass
- **Predict** strength of rock mass with respect to various Civil Engineering applications
- **Determine** the bearing capacity of rocks
- **Checking** the stability of slopes, and design underground and open excavation.
- **Identify** the methods of open excavations using blasting techniques

Unit I: Engineering Classification of Rocks:
Classification of intact rocks, Rock mass classifications, Rock Quality Designation (RQD), Rock Structure Rating (RSR), Rock Mass Rating (RMR), Norwegian Geotechnical Classification (Q-system), Strength and modulus from classifications, Classification based on strength & modulus and strength and fracture strain, Geo-engineering classification.

Unit II: Laboratory and In-Situ Testing of Rocks:
Physical properties, Compressive strength, Tensile strength, Direct shear test, Triaxial shear test, Slake durability test, Schmidt rebound hardness test, Sound velocity test, In-Situ Tests: Seismic methods, Electrical resistivity method, In situ stresses, Plate loading test, Goodman jack test, Plate jacking test, In-situ shear test, Field permeability test.

Unit III: Strength, Modulus and Stresses-Strain Responses of Rocks:
Factors influencing rock response, Strength criteria for isotropic intact rocks, Modulus of intact rocks, effect of confining pressure, Uniaxial Compressive strength, Strength criteria for intact rocks, Strength due to induced anisotropy in rocks. Stress Strain Models: Constitutive relationships, Elastic, Elasto-plastic, Visco-elastic, Elasto- visco-plastic stress-strain models.

Unit IV: Introduction to Rock Slopes:
Introduction to Rock slopes, Modes of failure, Rotational failure, Plane failure, Design charts, Wedge method of analysis, Buckling failure, Toppling failure, Improvement of slope stability and protection.

Unit V: Underground and Open Excavations:
Blasting operational planning, Explosive products, Blast Design, Underground blast design, Controlled blasting techniques, blasting damage and control, Safe practice with explosives and shots.

Text Books:

1. Goodman, Introduction to Rock mechanics, Willey International
2. Ramamurthy, T. - Engineering in Rocks for slopes, foundations and tunnels, Prentice Hall of India (2007)

Reference Books:

1. Jaeger, J. C. and Cook, N. G. W. – Fundamentals of Rock Mechanics, Chapman and Hall, London. (1979)
2. Hoek, E. and Brown, E. T. - Underground Excavation in Rock, Institution of Mining and Metallurgy, 1982.
3. Brady, B. H. G. and Brown, E. T. - Rock Mechanics for Underground Mining, Chapman & Hall, 1993

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B.Tech in Civil Engineering
VI Semester Syllabus
CE615PE: Elements of Earthquake Engineering
(Professional Elective- II)

Course Objectives:

- To understand the analysis of the behavior of structures under dynamic loads and understand the principles of design for seismic and wind loads and relevant codal provisions

Course Outcomes :

- **Asses** the cause of an Earthquakes, it's magnitude and its effects on structures
- **Apply** the concepts of damped and un-damped vibrations to single, two and multi degree of freedom
- **Apply** the concepts of seismic design philosophy and earthquake resistant design
- **Evaluate** the seismic performance of RC buildings
- **Understand** the effects of nonstructural systems on structural systems.

Unit I: Engineering Seismology:
Engineering Seismology: Earthquake phenomenon cause of earthquakes-Faults- Plate tectonics- Seismic waves- Terms associated with earthquakes-Magnitude/Intensity of an earthquake-scales-Energy released-Earthquake measuring instruments- Seismoscope, Seismograph, accelerograph-strong ground motions- Seismic zones of India.

Unit II: Theory of Vibrations:
Elements of a vibratory system- Degrees of Freedom-Continuous system-Lumped mass idealization-Oscillatory motion-Simple Harmonic Motion-Free vibration of single degree of freedom (SDOF) system- undamped and damped-critical damping-Logarithmic decrement-Forced vibrations-Harmonic excitation-Dynamic magnification factor-Excitation by rigid based translation for SDOF system-Earthquake ground motion.

Unit III: Earthquake Resistant Design:
Conceptual Design: Introduction-Functional planning-Continuous load path-Overall form- simplicity and symmetry-elongated shapes-stiffness and strength-Horizontal and Vertical members-Twisting of buildings-Ductility-definition-ductility relationships-flexible buildings- framing systems-choice of construction materials-unconfined concrete-confined concrete- masonry-reinforcing steel.
Introduction to Earthquake Resistant Design: Seismic design requirements-regular and irregular configurations -basic assumptions-design earthquake loads-basic load combinations- permissible stresses-seismic methods of analysis-factors in seismic analysis.

Unit IV: Reinforced Concrete Buildings:
Principles of earthquake resistant deign of RC members- Structural models for frame buildings- Seismic deign methods- IS code based methods for seismic design- Seismic evaluation and retrofitting- Vertical irregularities-Plan configuration problems- Lateral load resisting systems- Determination of design lateral forces- equivalent lateral force procedure -Lateral distribution of base shear.
Ductility in RC Buildings: Assessment of Ductility- Factors affecting Ductility- Ductile detailing considerations as per IS 13920.

Unit V: Structural Walls & Non Structural Elements:
Strategies in the location of structural walls- sectional shapes- variations in elevation- cantilever walls without openings – Failure mechanism of non-structures- Effects of non-structural elements on structural system-Analysis of non-structural elements- Prevention of non-structural damage- Isolation of non- structures.

Text Books:

1. Duggal S. K. Earthquake Resistant Design of structures, Oxford University Press 2nd Edition,2007
2. Pankaj Agarwal and Manish Shrikhande, Earthquake Resistant Design of structures , Prentice Hall of India Pvt. Ltd, 2011

Reference Books:

1. Paulay T.and. Priestly M.J.N ,Seismic Design of Reinforced Concrete and Masonry Building, John Wiley & Sons, First Edition, 1992.
2. Vinod Hosur, Earthquake Resistant Design of Building structures, Wiley India Pvt. Ltd. 1st edition, 2013
3. Murthy C.V.R., Earthquake Tips, Learning Earthquake Design and Construction,
4. IS: 1893 (Part-1) -2016. "Criteria for Earthquake Resistant – Design of structures." B.I.S., New Delhi.
5. IS:4326-2013, " Earthquake Resistant Design and Construction of Building", Code of Practice B.I.S., New Delhi.
6.IS:13920-2016, " Ductile detailing of concrete structures subjected to seismic force" – Guidelines, B.I.S., New Delhi.

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B.Tech in Civil Engineering
VI Semester Syllabus
CE616PE: Foundation Engineering
(Professional Elective- II)

Course Objectives:

- To Plan Soil exploration programme for civil engineering projects
- To check the stability of slopes
- To determine the lateral earth pressures and design retaining walls
- To determine the Bearing capacity of Soil
- To design pile group foundation

Course Outcomes:

- **Understand** the principles and methods of Geotechnical Exploration
- **Decide** the suitability of soils and check the stability of slopes
- **Calculate** lateral earth pressures and check the stability of retaining walls
- **Analyze** and design the shallow and deep foundations
- **Determine** the load carry capacity of pile groups &ground its importance

Unit – I : Soil Exploration:
Need – methods of soil exploration – boring and sampling methods –penetration tests – planning of soil exploration program, Bore logs and preparation of soil investigation report.

Unit – II: Slope Stability:
Infinite and finite earth slopes – types of failures – factor of safety of infinite slopes – stability analysis by Swedish slip circle method, method of slices, Bishop's Simplified method of slices – Taylor's Stability Number-stability of slopes of earth dams under different conditions.

Unit – III: Earth Pressure Theories and Retaining Walls:
Active, Passive and at rest soil pressures Rankine's theory of earth pressure – earth pressures in layered soils – Coulomb's earth pressure theory.
Retaining Walls: Types of retaining walls – stability of gravity and cantilever retaining walls against overturning, sliding and, bearing capacity, filter material for drainage.

Unit – IV: Shallow Foundations:
Types - choice of foundation – location and depth - safe bearing capacity – shear criteria – Terzaghi's, and IS code methods - settlement criteria – allowable bearing pressure based on SPT N value and plate load test .

Unit – V: Pile Foundations:
Types of piles, laterally loaded piles – load carrying capacity of piles based on static pile formulae – dynamic pile formulae – Pile Capacity through SPT results - pile load tests - load carrying capacity of pile groups in sands and clays – Settlement of pile groups – negative skin friction

Text Books:

1. Gopal Ranjan & Rao ASR, Basic and Applied Soil Mechanics, New age International Pvt . Ltd, New Delhi
2. Braja M, Das, Principals of Geotechnical Engineering, Cengage Learning Publishers.
3. Arora K.R., Soil Mechanics and Foundation Engg. 2020, Standard Publishers and distributors, Delhi.

Reference Books:

1. VNS Murthy Soil Mechanics and Foundation Engineering, CBS Publishers and Distributors.
2. Cuduto, Geotechnical Engineering Principles and Practices, PHI International.
3. Swami Saran, Analysis and Design of Substructures, Oxford and IBH Publishing company Pvt Ltd

4. S. K.Gulhati & Manoj Datta, Geotechnical Engineering ,Tata Mc.Graw Hill Publishing company New Delhi. 2005.
5. Bowles, J.E., (1988) Foundation Analysis and Design – 4th Edition, McGraw-Hill Publishing company, New York.
6. Varghese P.C.., Foundation Engineering, PHI

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B.Tech in Civil Engineering
VI Semester Syllabus
CE617PE: Construction Technology and Management
(Professional Elective - II)

Course Objectives:

- Learn Overall planning, coordination and control of projects.
- Understand Scientific principles in construction and the behavior of construction materials.

Course Outcomes:

- **Understand** the role and responsibilities of a project manager
- **Identify** the equipment used in construction
- **Prepare** schedule of activities in a construction project
- **Learn** Modeling Systems in construction industry
- **Understand** resource allocation and management in a construction project

Unit – I :
Management -Fundamentals of construction project management: Introduction, Project Initiation and Planning, Decision Making.

Unit – II:
Construction Equipment and Methods: Earthwork equipment, Cement concrete construction- Construction of Piles - Construction of Cofferdams - Construction of Tunnels.

Unit – III:
Planning and Scheduling: Critical Path Method (CPM)&Program Evaluation and Review Technique (PERT): Activities and Events, Activity and Event Times, Float, Slack, Methods in scheduling: Bar Charts, Gantt Charts. Project Cost Control, Direct and Indirect Cost, Cost Optimization-Steps involved.

Unit - IV:
Introduction to Building Information Modeling (BIM), Lean construction, and Integrated Project Delivery in construction, Safety in construction.

Unit – V:
Resource Management: Manpower and Machinery Management, Resource smoothing, Resource Leveling, Establishing Workers Productivity, Advantages and Disadvantages of using Equipment, Objectives of Material management, Functions of Material Management Department, Stores Management.

Text Books:

1. Seetharaman. S, Construction Engineering and Management, 5th Edition,2017.
2. Chitkara, K. K. Construction Project Management, Tata McGraw-Hill Education, 4th Edition, 2010.

Reference Books:

1. Peurifoy, Robert Leroy, Cliff J. Schexnayder and Shapira A. Construction planning, equipment, and methods. McGraw-Hill, 7th Edition,2010.
2. Bennett, Lawrence F.., The management of construction: a project life cycle Approach,2003.
3. Oberlender, Garold D., Project management for engineering and construction.

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B.Tech in Civil Engineering
VI Semester Syllabus
CE618PE:Theory of Elasticity
(Professional Elective - II)

Course Objectives:

- To impart knowledge on the basic concepts of theory of elasticity, and solve the Structural Engineering problems.
- Solve the Structural Engineering problems.

Course Outcomes:

- **Demonstrate** the application of plane stress and plane strain in a given situation.
- **Develop** the analytical ability to analyze two dimensional engineering problems.
- **Evaluate** the stresses for two dimensional engineering problems in polar coordinates.
- **Analyze** stresses and strains for three dimensional engineering problems.
- **Acquire** skill to analyze torsion and prismatic members.

Unit I: Introduction:
Elasticity - notation for forces and stress - components of stresses - components of strain - Hooks law. Plane stress and plane strain analysis - differential equations of equilibrium 2D &3D - boundary conditions – Strain Displacement Relations - compatibility equations – stress tensor and strain tensor.

Unit II: Two Dimensional Problems in Rectangular Coordinates:
solution by polynomials - Saint-Venants principle - determination of displacements - bending of simple beams – Simple Supported and Cantilever Beam

Unit III: Two Dimensional Problems in Polar Coordinates:
stress distribution symmetrical about an axis - pure bending of curved bars - strain components in polar coordinates - displacements for symmetrical stress distributions, Edge Dislocation.

Unit IV:Analysis of Stress and Strain in Three Dimensions:
Principal stress - stress ellipsoid - director surface -determination of principal stresses Stress Invariants - max shear stresses - Homogeneous deformation - principal axes of strain-rotation. General Theorems: Differential equations of equilibrium - conditions of compatibility - determination of displacement - equations of equilibrium in terms of displacements - principle of super position - uniqueness of solution - the reciprocal theorem Strain Energy.

Unit V:Torsion of Circular Shafts: -
Torsion of Straight Prismatic Bars – Saint Venants Method - torsion of prismatic bars - bars with elliptical cross sections - membrane analogy - torsion of a bar of narrow rectangular bars.

Text Books:

1. Timoshenko, Theory of Elasticity,3rd Edition, McGraw-Hill Publications
2. Sadhu Singh, Theory of Elasticity, Khanna Publications, New Delhi

Reference Books:

1. Srinath L.S “Advanced Mechanics of Solids”, Third Edition, Tata McGraw Hill publishing company, New Delhi, 2009
2. Fung,Y.C, Foundations of Solid Mechanics,Prentice Hall of India, 1968
3. Chakarbarthy J., Theory of Plasticity (third edition), McGrawhill Publications, 2006.

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Open Electives for other departments
VI Semester Syllabus
CE621OE: Advanced Engineering Materials
(Open Elective -II)

Course Objectives:

- Know about different types of material used in construction works.
- Understand about the properties of composite materials.
- Design and prepare different mortars and steel fibrous concrete.

Course outcomes:

- **Understand** the properties of plastics, glass and its uses.
- **Understand** the properties of timber and its uses.
- **Understand** the properties of Fly ash, rubber, steel, heat insulating materials and sound absorbent materials.
- **Understand** the properties of fiber composites and its uses
- **Able** to prepare cement, lime, surkhi mortars and steel fibrous concrete.

Unit- I:

Plastics: Brief history, composition, polymerization, classification of plastics, resins, Moulding compounds, Fabrication, properties of plastics, uses of plastics, PVC pipes in building.

Glass: General, properties, types and uses, special varieties of glass.

Unit -II:

Timber: Characteristics, identification and uses of common Indian timber –teak, deodar, shisham, chil, sal, veneers, plywood, laminated boards-their uses and properties, uses and strength of bamboo,preservation of timber against fire and weather etc.

Unit- III:

Miscellaneous Materials: Fly ash, Rubber–types, uses and properties, Heat insulating materials, Sound absorbent material.

Steel: Market forms, properties of mild steel and hard steel, preventive measures for corrosion.

Unit- IV:

Composite Materials: Definition, classification – particulate composites, fibrous composites, properties of fibers and conventional materials.

Uni-directional Composites: Introduction, volume fractions, weight fractions, longitudinal strength and stiffness, factors influencing longitudinal strength and stiffness, transverse strength and stiffness.

Short Fiber Composites: Introduction, modulus and strength of short fiber composites, rubber reinforced composites, Laminated composites - and its applications, Fiber reinforced plastics (FRP) and its applications

Unit -V:

Mortars: Properties and uses of cement, lime and surkhi mortars, proportions, mixing, uses.

Steel fibrous concrete: Introduction, types of fibers, properties of steel fibrous concrete.

Text Books:

1.Agarwal B D and Broutman, L J, "Analysis and Performance of Fiber Composites" Wiley Interscience Publication, John Wiley & sons New York,1980.
2.Rangwala S C, "Engineering Materials" Charotar Publishing House, Anand,1985.
3.Weatherhead R G, "FRP Technology" Applied Science Publishers Ltd., London,1998.

Reference Books:

1. Raina K B, "Civil Engineering Materials" Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1999.
2. Budinski K G, "Engineering Materials, Prentice Hall of India, New Delhi, 1985

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Open Elective for other departments
VI Semester Syllabus
CE622OE: Environmental Impact Assessment
(Open Elective - II)

Course Objectives:

- Learn various aspects of Environment Impact Assessment methodologies, impact of development activities.
- Analyze the impact on surface water, Air and Biological Environment.

Course Outcomes:

- **Identify** the environmental attributes to be considered for the EIA study.
- **Formulate** plan for EIA studies.
- **List** the suitable methodology and prepare EIA report.
- **Choose** the right methodology among available alternatives
- **Understand** Air Act, Water Act, Wildlife Acts.

Unit – I: Basic Concepts & Methodologies of EIA :

Elements of EIA, Functions of EIA process, Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmentalparameters.EIA Methodologies, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/benefit Analysis.

Unit- II: EIA on Vegetation and Wildlife:

Prediction and Assessment of developmental activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation.

Unit- III: EIA on Soil, Water and Air Quality:

Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures-EIA on Soil quality, water quality and air quality, Methodology for Assessment.

Unit – IV: Environmental Audit & Environmental legislation objectives:

Environmental Audit, Types of environmental Audit, Audit protocol, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report, Post Audit activities.

Unit – V: Environmental Acts:

The Environmental Protection Act, The water Act, The Air (Prevention & Control of pollution Act, Wild life Act. Case studies and preparation of Environmental Impact assessment statement for various Industries.

Text Books:

1. Anjaneyulu Y., Environmental Impact Assessment Methodologies, 2nd Edition, Taylor & Francis. publications
2. Barthwal, R. R. Environmental Impact Assessment, New Age International Publications

Reference Books:

1. Khitoliya R.K., Environmental Pollution, S. Chand,2014.
2. Glynn, J. and Gary, W. H. K., Environmental Science and Engineering, Prentice Hall Publishers
3. Suresh K. Dhaneja, Environmental Science and Engineering, S.K. Kataria& Sons Publication. NewDelhi.
4. Bhatia, H. S., Environmental Pollution and Control, Galgotia Publication (P) Ltd, Delhi.
5. Wathern, P., Environmental Impact Assessment: Theory & Practice, Publishers- Rutledge, London,1992.

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B.Tech in Civil Engineering
VI Semester Syllabus
MC601HS: Intellectual Property Rights
(Common to all Branches)

Course Objectives:

- To enable the students to have an overview of Intellectual Property Rights
- To comprehensive knowledge to the students regarding Trademarks Registration process laws related to it.
- To disseminate knowledge on Copyrights, its related rights and recent developments.
- To make the students understand Patent Regime in India and abroad.
- To understand the framework of Trade secrets

Course Outcomes:

- **Gain** knowledge on Intellectual property rights and their importance
- **Understand** Indian and international Trademark Law and procedure for registration of Trademarks.
- **Obtain** the knowledge of Copyright Law, and the privileges awarded to the copyright owners.
- **Familiar** with the process of acquiring the patent and relevant laws.
- able to **understand** the importance of trade secrets for sustainability.

Unit – I: Introduction to Intellectual property :
Introduction-Meaning of intellectual property, types of intellectual property-trademarks, copyrights, patents, trade secrets importance of intellectual property rights, International organizations-WTO-WIPO-USPTO-INTA, International Conventions, agencies and treaties- Paris Convention-Berne Convention- Madrid Protocol-NAFTA-PCT-GATT-TRIPS.

Unit – II :Trademarks :
Trademarks: Purpose and functions of Trademarks-Categories of marks, acquisition of Trademark rights - Protectable matter, - Selecting and evaluating Trademark- Trademarks registration process – Trademark Infringement - Remedies for infringement in Trademarks-New developments in Trademark Law- International Trademarks Law.

Unit -III: Copyright :
Copyrights-Fundamental of Copyright Law -Requirements of Copyrightability- Originality of material, fixation of material, Authorship works, exclusions form copyright protection- Rights of Copyright Owner-Right of reproduction of copyrighted work, right to do derivative works ,right to distribute copies of the copyrighted work, right to perform the work publicly, right to display the copyrighted work, – Copyright Ownership issues – Joint Works, Works made for Hire, Specially commissioned works, Copyright Registration - Notice of Copyright – Copyright Infringement - Remedies for infringement in Copyrights- New developments in Copyright Law- International Copyright Law.

Unit- IV: Patents :
Patents: Concept of Patent - Classification – Utility Patents – Design Patents and Plant Patents, Patent searching process-Types of Patent Applications-Patent Registration Process, Ownership, Transfer, Assignment and Licensing of Patent-Patent Infringement, Remedies for Infringement of Patents, New developments in Patent Law- International Patent Law.

Unit – V: Trade Secrets & Law of Unfair Competition :
Trade Secrets: Trade secret law, determination of trade secrete status, measures for protecting trade secret status-Liability for misappropriations of trade secrets, protection for submissions, trade secret litigation. New developments in Trade secrets Law- International Trade Secrets.

Law of Unfair competition: Passing off, Misappropriation, right of publicity, dilution of trademarks, product disparagement, false advertising.

Text Books:

1. Deborah. E. Bouchoux,,Cengage learning, Intellectual property right.
2. Prabuddha Ganguli, Unleashing the knowledge economy, Intellectual property rights,Tata McGraw Hill Publishing company

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B.Tech in Civil Engineering
VI Semester Syllabus
MC601ES: Artificial Intelligence

Course Objectives:

• To train the students to understand different types of AI agents, various AI search algorithms, fundamentals of knowledge representation, building of simple knowledge-based systems and to apply knowledge representation and reasoning.

Course Outcomes :

• understanding of Markov Models enable the student ready to step into applied AI.

Unit - I
Introduction: AI problems, Agents and Environments, Structure of Agents, Problem Solving Agents

Basic Search Strategies: Problem Spaces, Uninformed Search (Breadth-First, Depth-First Search,Depth-first with Iterative Deepening), Heuristic Search (Hill Climbing, Generic Best-First, A*), Constraint Satisfaction (Backtracking, Local Search)

Unit - II
Advanced Search: Constructing Search Trees, Stochastic Search, A* Search Implementation, Minimax Search, Alpha-Beta Pruning Basic Knowledge **Representation and Reasoning:** Propositional Logic, First-Order Logic, Forward
Chaining and Backward Chaining, Introduction to Probabilistic Reasoning, Bayes Theorem

Unit - III
Advanced Knowledge Representation and Reasoning: Knowledge representation Issues, Non- monotonic Reasoning, Other Knowledge Representation Schemes
Reasoning Under Uncertainty: Basic probability, Acting Under Uncertainty, Bayes' Rule, Representing Knowledge in an Uncertain Domain, Bayesian Networks.

Unit - IV
Learning: What Is Learning? Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples, Winston's Learning Program, Decision Trees.

Unit - V
Expert Systems: Representing and Using Domain Knowledge, Shell, Explanation, Knowledge Acquisition.

Text Books:

1. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice- Hall, 2010.

Reference Books:

1. , Elaine Rich, Kevin Knight, Shivasankar B. Nair, Artificial Intelligence, The McGraw Hill publications, Third Edition, 2009.
2. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 6th ed., 2009.

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B.Tech in Civil Engineering
VI Semester Syllabus

CE651PC: Environmental Engineering Lab

Course Objectives:

- Perform the experiments to determine water and waste water quality
- Understand the water & waste water sampling, their quality standards
- Estimate quality of water, waste water, Industrial water

Course Outcomes:

- **Examine** Physical characteristics of water quality
- **Examine** Chemical characteristics of water quality
- **Measure** Noise levels of a given area

List of Experiments:

1. Determination of pH
2. Determination of Electrical Conductivity
3. Determination of Total Solids (Organic and inorganic)
4. Determination of Turbidity
5. Determination of Alkalinity
6. Determination of Hardness (Total, Calcium and Magnesium Hardness)
7. Determination of Chlorides
8. Determination of optimum coagulant Dosage
9. Determination of Dissolved Oxygen (Winkler Method)
10. Determination of BOD
11. Determination of COD
12. Determination of Residual Chlorine
13. Noise level measurement

Any 12 Experiments may be Performed.

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B.Tech in Civil Engineering
VI Semester Syllabus
CE652PC: Geographical Information Systems Lab

Course Objectives:

- To Develop GIS interface to field problems through georeferencing.

Course Outcomes:

- **Demonstrate** the ability to georeference images based on proper identification of ground control points.
- **Design** maps by digitizing features.
- **Analyze** the maps using the spatial queries.

1. Identification of best locations of ground control points
2. Georeferencing of cadastral maps.
3. Georeferencing of Google earth images
4. Mosaicing the different sources of maps of information like topo sheets & satellite data and other drawings.
5. Digitization of line features polygon features and point features.
6. Assignment of attributes to the digitized features.
7. Spatial query of features.
8. GIS interface and features using open Source Software QGIS.
9. Case study on digitizing water bodies from topo sheets.
10. Developing a land use land cover map for an area of interest.

Text Books:

1. Lo, C.P. & Yeung A.K.W., Concepts and Techniques of Geographic Information Systems, Prentice Hall of India, New Delhi, 2002.
2. Burrough, P.A., Principles of Geographical Information Systems, Oxford Publication, 1998.
3. Clarke, K., Getting Started with Geographic Information Systems, Prentice Hall, New Jersey, 2001.
4. DeMers, M.N., Fundamentals of Geographic Information Systems, John Wiley & Sons, New York, 2000.
5. Geo Information Systems – Applications of GIS and Related Spatial Information Technologies, ASTER Publication Co., Chestern (England), 1992.

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B.Tech in Civil Engineering
VI Semester Syllabus
EN653HS: Finishing School-IV
(Advanced Communication Skills Lab)

Course Objectives:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.
- To prepare the students for both oral as well as written presentation skills.
- To make the students be adept in Group Discussions, Presentation Skills and Interview Skills.

INTRODUCTION:

Advanced Communication Skills Lab is considered essential as the students need to prepare themselves for their careers which may require them to listen to speak, read and write in English both for their professional and interpersonal communication in the globalized context. This course would enable students to use English effectively and perform the following:

1. Gathering ideas and information to organize ideas relevantly and coherently.
2. Engaging in debates.
3. Participating in group discussions.
4. Facing interviews.
5. Writing project/research reports/technical reports.
6. Making oral presentations.
7. Writing formal letters.
8. Transferring information from non-verbal to verbal texts and vice-versa.
9. Taking part in social and professional communication.

Syllabus:

1. Activities on Fundamentals of Inter-personal Communication and Building Vocabulary -Starting a conversation – responding appropriately and relevantly – using the right body language, Role Play in different situations & Discourse Skills- using visuals – Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.

2. Activities on Reading Comprehension –General Vs Local comprehension

Reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading, effective googling.

3. Activities on Writing Skills

Structure and presentation of different types of writing – Letter writing/Resume writing/ e-correspondence/Technical Report writing/ – planning for writing – improving one's writing.

4. Activities on Presentation Skills – Oral presentations (individual and group)
JAM sessions/seminars/PPTs and written presentations through posters/projects/reports/ e-Mails / assignments etc.

5. Activities on Group Discussion and Interview Skills
Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning,

opening strategies, answering strategies, interview through tele-conference &video-conference and Mock Interviews.

Text Books:

1. Effective Technical Communication by M Asharaf Rizvi. McGraw Hill Education (India) Pvt. Ltd. 2 nd Edition
2. Academic Writing: A Handbook for International Students by Stephen Bailey, Routledge, 5 th Edition.

Reference Books:

1.Shiv K. Kumar and Hemalatha Nagarajan, Learn Correct English – A Book of Grammar, Usage and Composition by . Pearson 2007
2. Aruna Koneru, Professional Communication, McGraw Hill Education (India) Pvt. Ltd, 2016.
3. Meenakshi Raman & amp, Sangeeta Sharma, Technical Communication, Oxford University Press 2009.
4. Paul V. Anderson, Technical Communication, Cengage Learning Pvt. Ltd. New Delhi,2007.
5. English Vocabulary in Use series, Cambridge University Press 2008.
6. David A. McMurrey & Joanne Buckley, Handbook for Technical Communication. Cengage Learning, 2012.
7. Leena Sen, Communication Skills, PHI Learning Pvt . Ltd., New Delhi, 2009.
8. Colm Downes, Job Hunting, Cambridge University Press 2008.
9. Aysha Vishwamohan, English for Technical Communication for Engineering Students, Tata Mc Graw-Hill 2009.

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B.Tech in Civil Engineering
VI Semester Syllabus
MC601ESC: Environmental Science
(For Lateral Entry Students)

Course Objectives

- Creating the awareness about environmental problems among students.
- Imparting basic knowledge about the environment and its allied problems.
- Developing an attitude of concern for the environment.
- Motivating students to participate in environment protection and environment improvement.

Course Outcomes:

- **Identify** and **analyze** environmental problems as well as the risks associated with these problems.
- **Understand** what it is to be a steward in the environment.
- **Studying** how to live their lives in a more sustainable manner.

Unit-I: Ecosystems and Biodiversity :

Definition, Scope and Importance of environmental studies. Concept of an ecosystem. - Structure and function of an ecosystem. Food chains, food webs and ecological pyramids- Energy flow models in ecosystem. Biogeochemical Cycles: Water cycle and Nitrogen cycle. Primary and Secondary production.

Introduction, Definition, Levels of Biodiversity, Values of biodiversity, Hot spots of biodiversity, Threats to biodiversity, Conservation of biodiversity: In-Situ and Ex-situ conservation methods.

Unit–II: Natural Resources :

Classification- Renewable and non-renewable resources Forest resources-uses, deforestation: causes, effects and preventive measures. Water Resources – uses and over utilization of ground water: Rain water harvesting, Big dams - benefits and problems. Causes, effects and management of flood and drought. Mineral resources - uses and Impacts of mining. Energy resources: Growing energy needs, renewable and non renewable energy resources, alternate energy resources.

Unit–III: Environmental Pollution :

Pollutants: Definition, classification. Air pollution: Definition, sources, Causes, effects and control measures. Ambient air quality parameters, Case Study (Bhopal Gas tragedy)

Water pollution: Definition, sources, Causes, effects and control measures. Waste water treatment. Case study (Namami Ganga Project)

Soil pollution: Sources, Land degradation-Soil erosion –effects and control measures. Impacts of modern agriculture on soil. Bio-magnification and Biological accumulation. (Minamata disease) Noise pollution: Sources, effects and control measures.

E-Waste and Municipal Solid Waste Management.

Unit–IV: Global Environmental Issues and Global Efforts :

Global warming: Greenhouse effect- definition, sources and effects of greenhouse gases. Ozone layer depletion- Importance of ozone layer, Ozone Depleting Substances - sources and effects. Acid rain - causes and effects. Climate change - International conventions/protocols - The Earth summit, Kyoto Protocol, Montreal Protocol.

Unit–V: Environmental Legislation & Acts, EIA, Sustainable Development :

Concept of sustainable development. Environmental education. Concept of Green Building, Ecological Foot Print, Low carbon life style, Clean Development Mechanisms.

Environmental Impacts Assessment – Concept, Structure and Flow Chart of EIA.

Environment Acts - Air pollution (Prevention and Control) Act 1981, Water (Prevention and control) Act -1974, Wildlife (Protection) Act – 1972, Biodiversity Act-2002. Project Work : Related to environmental issues.

Text Books:

1. Erach Bharucha, Textbook of Environmental Studies for Undergraduate Courses University Grants Commission. Universities Press.
2. Kaushik Anubha, Kaushik C.P., Text Book of Environmental Studies, New age International Publishers, 4th Edition.

Reference Books:

1. M. Anji Reddy, Textbook of Environmental Sciences and Technology, BS Publication.
2. Rajagopalan R, Environmental Studies, Oxford University Press.
3. Raghavan Nambiar .K,Text book of Environmental Studies, Scitech Publications.

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B.Tech in Civil Engineering
VII Semester Syllabus
CE701PC: Transportation Engineering

Course Objectives:

This course aims at providing a comprehensive insight of various elements of Highway transportation engineering. Topics related to the highway development, characterization of different materials needed for highway construction, structural and geometric design of highway pavements along with the challenges and possible solutions to the traffic related issues will be covered as a part of this course.

Course Outcomes:

- An ability to **apply** the knowledge of mathematics, science and engineering in the areas of traffic engineering, highway development and maintenance
- An ability to **design**, conduct experiments to assess the suitability of the highway materials like soil, bitumen, aggregates and a variety of bituminous mixtures. Also the students will develop the ability to interpret the results and assess the suitability of these materials for construction of highways.
- An ability to **design** flexible and rigid highway pavements for varying traffic compositions as well as soil subgrade and environmental conditions using the standards stipulated by Indian Roads Congress.
- An ability to **assess** the issues related to road traffic and provide engineering solutions supported with an understanding of road user psychological and behavioral patterns.
- An ability to **evaluate** the structural and functional conditions of in-service highway pavements and provide solution in the form of routine maintenance measures or designed overlays using Indian Roads congress guidelines.

Unit –I : Highway Development and Planning:
Introduction, History and Importance of Highways, Highway development in India, Highway planning, Different Road Development Plans; Classification of Roads – Road Network Patterns, Highway alignment, Engineering surveys for Highway alignment, Highway projects, Highway drawings and reports, Detailed Project Report preparation, PPP schemes of Highway development in India.

Unit – II: Highway Geometric Design:
Introduction to Highway Geometric Design; Width of Pavement, Formation and Land, Cross Slopes etc; Concept of Friction: Skid and Slip; Elements of geometric design of highways; Sight Distances: Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance; Horizontal alignment: Design of horizontal curves, super elevation, extra widening of pavement at curves, Transition curves; Vertical Alignment: Gradients, Compensation in Gradient, Design of summit curves and valley curves using different criteria; Integration of Horizontal and Vertical Curves

Unit – III :Traffic Engineering:
Basic traffic characteristics: Speed, volume and concentration, relationship between flow, speed and concentration; Highway capacity and Level of service (LOS) concepts: Factors affecting capacity and LOS, relationship between V/C ratio and LOS; Traffic Studies - Traffic volume and spot speed studies: Methods; Road Accidents - Causes and Preventive Measures - Accident Data Recording – Condition Diagram and Collision Diagrams, road safety auditing; Parking Studies – On street & Off street Parking.

Unit – IV : Traffic Regulations & Intersection Design:
Traffic Signs – Types and Specifications, Road Markings, Need for Road Markings, Types of Road Markings; Traffic Signs - warrants for signalization, Design of Traffic Signals – Webster Method
Intersection Design: Types of Intersections, Conflicts at Intersections – Requirements of At-Grade Intersections, Types of At-Grade Intersections: Channelized and Un-channelized Intersection, Traffic Islands, Types of Grade

Separated Intersections; Rotary Intersection – Concept of Rotary, Design Factors of Rotary, Advantages and Limitations of Rotary Intersections.

Unit – V Pavement Materials and Design:
Tests on soils: CBR, Field CBR, modulus of sub-grade reaction, Tests on Aggregates: specific gravity, shape (flakiness and elongation indices), angularity number, water absorption, impact, abrasion, attrition, crushing resistance, durability (weathering resistance), stone polishing and skid resistance value of aggregates; Tests on bitumen: spot, penetration, softening point, viscosity, ductility, elastic recovery, flash and fire points, Introduction to modified bituminous binders like crumb rubber modified, natural rubber modified and polymer modified bitumen binders; Bituminous Concrete: Critical parameters controlling bituminous concrete mixture design, aggregate blending concepts
Introduction to Pavement Design: Types of pavements and their typical cross sections: flexible, rigid and composite; IRC 37- 2012 method of flexible pavement design; IRC 58-2015 method of rigid pavement design. Overlay Designs: Types of overlays on flexible and rigid pavements.

Text Books:

1. Khanna, S.K, Justo, A and Veeraragavan, A, 'Highway Engineering', Nem Chand & Bros. Revised Tenth Edition, 2014
2. Kadiyali L.R. and Lal N B, Principles and Practices of Highway Engineering; Seventh Edition, Khanna Publishers, New Delhi, 2018

Code of Provisions:

Design Codes: IRC 37-2012, IRC 58-2018, IRC 81-1997

Reference Books:

1. Papacoastas,C. S. and Prevedouros, Transportation Engineering and Planning, Third Edition, Third impression; Pearson Education, 2018.
2. Khisty C J and Lall B Kent; Transportation Engineering: An Introduction, Third Edition, 1st Indian Adaptation; Pearson India Education Service Pvt. Ltd, New Delhi 2017.
3. Subhash C Saxena, Text Book of Highway and Traffic Engineering; First Edition; CBS Publishers and Distributors. New Delhi, 2014.
4. Venkatramaiah C, Transportation Engineering Volume 1 – Highway Engineering, 1st Edition, Universities Press, 2016
5. Garber, N.J. and Hoel, L.A. Traffic and Highway Engineering, Fourth Edition; Cengage, Learning, Stamford, CT, USA, 2010
6. Partha chakroborty and Animesh Das, Principles of Transportation Engineering, PHI, 2013, Nicholas J Garber and Lester A Hoel, Traffic and Highway Engineering, 5th Edition, Cengage.

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B.Tech in Civil Engineering
VII Semester Syllabus
CE702PC: Estimation, Costing and Project Management

Course Objectives:

- The course provides the process of estimation required for various works in building construction.
- It provides the knowledge of using SOR & SSR for analysis of rates on various works.
- It provides basics of planning tools for construction projects.

Course Outcomes:

- **Estimate** the buildings using approximate methods and detailed methods of estimation
- **Propose** bar bending schedule for structural components of building and **estimate** the earthwork for roads and canals
- **Evaluate** rate analysis for various items of work in buildings
- **Value** the property and **understand** about contracts and specifications
- **Understand** the basics of planning tools for construction projects.

Unit – I:

Estimation of Buildings: General items of work in Building – Standard Units, Principles of working out quantities - Approximate methods of Estimating, Detailed estimate of buildings – Detailed estimate for flat roof building.

Unit – II :

Reinforcement: bar bending and bar requirement schedules for beams, columns, slabs, Isolated footing. **Earthwork** : for roads and irrigation canals.

Unit – III :

Rate Analysis: Preparation of analysis of rates and requirement of materials as per standard data for different items of work in a building, overhead and contingencies.

Unit- IV:

Contracts: Types of construction contracts – Contract Documents – Conditions of contract – Tender form, Tender notice, E-Tender, Work order.

Valuation: Valuation of buildings, types and valuation methods, Fixation of rent, capital gains- valuation of leased properties

Specifications: General specifications of different classes of buildings - Detailed specifications for different items of building construction.

Unit- V :

Construction Project Planning: Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail.

Techniques of Planning: Bar charts, Gantt Charts.

Networks: Basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three-time estimates, analysis, slack computations, calculation of probability of completion

Text Books:

1. Dutta B.N., Estimating and Costing by, UBS publishers,2000.
2. Chakraborthi M., Estimation, Costing and Specifications. Laxmi publications.

3. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016
4. Chitkara,K. K. Construction Project Management. Tata McGraw-Hill Education, 2014
5. C.H.Gopinatha Rao: Valuation Practice of Immovable Properties, fourteenth edition, October 2005

Reference Books:

1. Standard Schedule of Rates and standard data book by Public Works Department.
2. IS. 1200 (Parts I to XXV – 1974/ method of measurement of building and Civil Engineering works– B.I.S.)
3. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015.
4. Birdie G.S, Estimating and Costing, Dhanpat rai publishing company

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B.Tech in Civil Engineering
VII Semester Syllabus

CE711PE: Prestressed Concrete Structures

(Professional Elective-III)

Course Objectives:

- Understand the principles & necessity of pre-stressed concrete structures.
- Know different techniques of pre-stressing.
- Get the knowledge on various losses of pre-stress.
- Understand Analysis and design of pre-stressed concrete members

Course Outcomes:

- **Understand** the knowledge of evolution of process of prestressing.
- **Interpret** the knowledge of various prestressing techniques.
- **Develop** skills in analysis and design of prestressed structural elements as per the IS codal provisions
- **Understand** the concept of transfer of prestress in pretensioned members
- **Analyse** the stress distribution of composite beams and **estimate** the deflection in beams

Unit -I: Introduction:

Historic development- General principles of prestressing pretensioning and post tensioning- Advantages and limitations of Prestressed concrete- General principles of PSC- Classification and types of prestressing- Materials- high strength concrete and high tensile steel their characteristics.

Unit - II: Methods and losses of Prestress:

Methods And Systems of Prestressing: Pre-tensioning and Post tensioning methods and systems of prestressing like Hoyer system, Magnel Blaton system, Freyssinet system and Gifford- Udall System- Lee McCall system.

Losses of Prestress: Loss of prestress in pretensioned and posttesnioned members due to various causes like elastic shortage of concrete, shrinkage of concrete, creep of concrete, relaxation of stress in steel, slip in anchorage, frictional losses.

Unit - III: Flexure & Shear:

Flexure: Analysis of sections for flexure- beams prestressed with straight, concentric, eccentric, bent and parabolic tendons- stress diagrams- Elastic design of PSC slabs and beams of rectangular and I sections- Kern line – Cable profile and cable layout.

Shear: General Considerations- Principal tension and compression- Improving shear resistance of concrete by horizontal and vertical prestressing and by using inclined or parabolic cables- Analysis of rectangular and I beams for shear – Design of shear reinforcements- IS Code provisions**.**

Unit -IV: Transfer of Prestress in Pretensioned Members:

Transmission of prestressing force by bond – Transmission length – Flexural bond stresses – IS code provisions – Anchorage zone stresses in post tensioned members – stress distribution in End block – Analysis by Guyon, Magnel – Anchorage zone reinforcement- IS Provisions

Unit -V: Composite Beams and Deflections:

Composite Beams : Introduction - Different Types- Propped and Un-propped- stress distribution

Deflections: Importance of control of deflections- Factors influencing deflections – Short term deflections of un-cracked beams- prediction of long time deflections- IS code requirements.

Text Books:

1. Krishna Raju, Prestressed concrete, Tata Mc Graw Hill Book – Co. New Delhi.
2. S. Ramamrutham, Prestressed concrete, Dhanpat Rai & Sons, Delhi.

Reference Books:

1. Lin T.Y. and Burn, Design of prestress concrete structures by, John Wiley, New York.
2. Rajagopalan N., Prestressed Concrete, Narosa Publishing House

Code Books:

1. IS 1343 (2012), Code of practice for Prestressed Concrete

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B.Tech in Civil Engineering
VII Semester Syllabus
CE712PE: Environmental Impact Assessment
(Professional Elective-III)

Course Objectives:

- Learns various aspects of Environment Impact Assessment methodologies, impact of development activities.
- Analyzes the impact on surface water, Air and Biological Environment.

Course Out comes:

- **Identify** the environmental attributes to be considered for the EIA study.
- **Formulate** plan for EIA studies.
- **List** the suitable methodology and prepare EIA report.
- **Choose** the right methodology among available alternatives
- **Understand** Air Act, Water Act, Wildlife Acts.

Unit – I: Basic Concepts & Methodologies of EIA :

Elements of EIA, Functions of EIA process, Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmentalparameters.EIA Methodologies, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/benefit Analysis.

Unit- II: EIA on Vegetation and Wildlife:

Prediction and Assessment of developmental activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation.

Unit- III: EIA on Soil, Water and Air Quality:

Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures-EIA on Soil quality, water quality and air quality, Methodology for Assessment.

Unit – IV: Environmental Audit & Environmental Legislation Objectives:

Environmental Audit, Types of environmental Audit, Audit protocol, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report, Post Audit activities.

Unit – V: Environmental Acts:

The Environmental Protection Act, The water Act, The Air (Prevention & Control of pollution Act, Wild life Act. Case studies and preparation of Environmental Impact assessment statement for variousIndustries.

Text Books:

1. Anjaneyulu Y., Environmental Impact Assessment Methodologies, 2nd Edition, Taylor&Francis. publications
2. Barthwal, R. R. Environmental Impact Assessment, New Age International Publications

Reference Books:

1. Khitoliya R.K., Environmental Pollution, S. Chand,2014.
2. Glynn, J. and Gary, W. H. K., Environmental Science and Engineering, Prentice Hall Publishers
3. Suresh K. Dhaneja, Environmental Science and Engineering, S.K. Kataria& Sons Publication. NewDelhi.
4. Bhatia, H. S., Environmental Pollution and Control,Galgotia Publication (P) Ltd, Delhi.
5. Wathern, P., Environmental Impact Assessment: Theory & Practice, Publishers- Rutledge, London,1992.

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B.Tech in Civil Engineering
VII Semester Syllabus
CE713PE: Ground Improvement Techniques
(Professional Elective - III)

Course Objectives:

- To understand the importance of ground improvement and know various ground improvement techniques available to date.
- To know various ground improvement techniques available to date.
- To select designing suitable ground improvement technique for given soil conditions.

Course Outcomes:

- **Understand** the need and objectives of ground modification
- **Identify** the different methods of soil densification for given soil
- **Know** the objectives & techniques of various dewatering methods
- **Select** different physical and chemical modifications based on soil suitability
- **Know** the importance of soil reinforcement and its applications

UNIT - I : Introduction to Engineering Ground Modification:
Need and objectives, Identification of soil types, In situ and laboratory tests to characterize problematic soils; Mechanical, Hydraulic, Physico-chemical, Electrical, Thermal methods, etc. and their applications.

UNIT – II : Mechanical Modification:
Principles of soil densification – Properties of Compacted soil, Compaction control tests, Specification of compaction requirements, Blasting Vibro-compaction, Dynamic Tamping and Compaction piles.

UNIT – III : Hydraulic Modification:
Objectives and techniques, traditional dewatering methods and their choice, Design of dewatering system, Electro-osmosis, Filtration, Drainage and seepage control with Geo-synthetics, Preloading and vertical drains, Electro-kinetic dewatering.

UNIT - IV : Physical and Chemical Modification:
Modification by admixtures, Shotcreting and Guniting Technology, Modification at depth by grouting, Crack Grouting and compaction grouting, Jet grouting, Thermal Modification, Ground freezing.

UNIT – V : Modification by Inclusions and Confinement:
Soil reinforcement, reinforcement with strip, bar, mesh, sheet and grid reinforced soil. In-situ ground reinforcement, ground anchors, rock bolting and soil nailing.

Text Books:

1. Hausmann, M. R., Engineering Principles of Ground Modifications, 2017, McGraw Hill publications
2. Patra, N.R., Ground Improvement Techniques, 2012, Vikas Publications
3. Purushothama Raj, Ground Improvement Techniques, 2016, Laxmi Publications, India

Reference Books:

1. Moseley M. P. and Krisch .K., Ground Improvement, 2nd Edition, Taylor and Francis publications, 2006.
2. Krisch K. & Krisch F, Ground Control and Improvement, John Wiley & Sons ,1994.
3. Nicholson, P.G, Soil Improvement and Ground Modification methods, Elsevier Publishers. 2015.

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B.Tech in Civil Engineering
VII Semester Syllabus
CE714PE: Sustainable Materials & Green Buildings
(Professional Elective - III)

Course Objectives:

- Explores the concept of sustainability and dwell in detail on the growing popularity of sustainability and its implications for the practice of engineering, particularly for the built environment (civil engineering).

Course Outcomes:

- **Examine** the properties of common construction materials and understand the transition toward sustainable materials
- **Assess** material properties, mechanical tests and quality control tests for, concrete, masonry, glass, plastics, iron and steel, paints and protective coatings, bituminous products, gypsum products, resilient flooring, and carpeting.
- **Appraise** appropriateness and sustainability of materials for construction projects.
- **Select** the sustainable materials based on the international standard practices and certification.
- **Explain** about innovative sustainable construction materials and their uses in construction.

Unit I:
Introduction: Embodied energy, Operational energy in Building and Life cycle energy. Ecological foot print, Bio-capacity and calculation of planet equivalent.
Role of Material: Carbon from Cement, alternative cements and cementitious material, Alternative fuel for cements for reduction in carbon emission. Sustainability issues for concrete.

Unit II:
Role of quality, minimization of natural resource utilization, High volume fly ash concrete, geo-polymer concrete etc. concrete with alternative material for sustainability. Reduction in water consumption in concrete, Recycled aggregate, Energy for grinding crushing of cement aggregate etc. and reduction. Operational energy in building role of materials and thermal conductivity.

Unit III:
Clay Bricks, Types kilns, Comparative energy performance emission performance and financial performance, Indoor air quality
Paints, Adhesive and sealants for use in building, Volatile organic content (VOC) emission issues and indoor air quality for Sustainability and Health hazard

Unit IV:
Operational energy reduction and net zero building, Optimization for design of building for energy efficiency and example of optimization through use of Evolutionary genetic algorithm.
Radiation budget, Surface water balance, Effects of trees and microclimatic modification through greening

Unit V:
Use of Building Integrated Photo Voltaic (BIPV) and other renewable energy in buildings, basic concepts and efficiency. Energy codes ECBC requirement, Concepts of OTTV etc. Green Performance rating, requirements of LEED, GRIHA etc.

Text Books:

1. Mike Montoya , Green Building Fundamentals, Pearson, 2nd edition, 2010.
2. Charles J. Kibert, Sustainable Construction - Green Building Design and Delivery John Wiley & Sons, 2nd edition, 2008..

Reference Books:

1. Jason F. McLennan,The Philosophy of Sustainable Design, Ecotone Publishing Co., 2004.
2. Regina Leffers, Sustainable Construction and Design, Prentice Hall, 2009.

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B.Tech in Civil Engineering
VII Semester Syllabus
CE715PE: Irrigation and Hydraulic Structures
(Professional Elective - IV)

Course Objectives:

- To study various types of storage works
- To understand the components of gravity dam
- To understand the components of earthen dams and spillways
- To know the principles of Diversion head works and its components
- To know the concepts of canal regulation and cross drainage works

Course Outcomes:

- **Classify** various types of reservoirs and calculate their life period
- **Analyze** the components of gravity dams
- **Discuss** the concepts of earth dams, spillways , spillway gates and energy dissipators
- **Design** the components of diversion head work .
- **Understand** the principles of canal regulation works and cross drainage works and their design

Unit – I :

Storage Works: Reservoirs - Types of reservoirs, selection of site for reservoir, zones of storage of a reservoir, reservoir yield, estimation of capacity of reservoir using mass curve and analytical method.

Reservoir Sedimentation: Life of Reservoir, Types of dams under various considerations, factors affecting selection of type of dam, factors governing selection of site for a dam.

Unit - II :

Gravity Dams: Forces acting on a gravity dam, causes of failure of a gravity dam, elementary profile, and practical profile of a gravity dam, limiting height of a low gravity dam, low and high gravity dams stability Analysis, factors of Safety, foundation for a Gravity Dam, various galleries in gravity dams.

Unit - III :

Earth Dams: Types of Earth dams under various considerations, causes of failure of earth dam, criteria for safe design of earth dam, seepage through earth dam-graphical method, measures for control of seepage.

Spillways: Types of spillways under various considerations with their explanation, design principles of Ogee spillways – types of spillway gates. Energy Dissipaters, Significance of Jump Height Curve and Tail Water Rating Curve - USBR and Indian types of Stilling Basins.

Unit - IV :

Diversion Head Works: Types of Diversion head works, layout of diversion head work – components of diversion head works, weirs and barrages. Causes and failure of Weirs and Barrages on permeable foundations, Silt Ejectors and Silt Excluders

Weirs on Permeable Foundations: Creep Theories - Bligh's, Lane's and Khosla's theories, Determination of uplift pressure using above theories - Various Correction Factors – Design principles of weirs on permeable foundations using Creep theories - exit gradient, U/s and D/s Sheet Piles - Launching Apron.

UNIT- V :

Canal Falls: Definition and types of falls and their location, Design principles of trapezoidal notch Fall and Sarada type vertical fall.

Canal Regulation Works: Principles of design of cross regulator and distributary head regulators, types of Canal escapes - types of canal modules, proportionality, sensitivity, setting and flexibility.

Cross Drainage Works: Definition and, Types and their selection, various types of Aqueducts, design considerations for various cross drainage works

Text Books:

1. Santhosh Kumar Garg , Irrigation Engineering and Hydraulic structures, Khanna Publishers.2006
2. Punmia B.C & Lal, Irrigation and water power engineering, Laxmi publications Pvt.Ltd, New Delhi.,2016
3. K.R. Arora, Irrigation, Water Power and Water Resources Engineering, Standard Publishers distributors,2010

Reference Books:

1. Varshney, Gupta & Gupta, Theory and Design of Hydraulic structures. Nem Chand & Bros,2009
2. Sharma R.K. and Sharma T.K. ,Irrigation Engineering, S. Chand Publishers, 2015.
3. Michale A. M., Irrigation Theory and Practice , Vikas Publishing House, 2015.
4. Asawa G.L., Irrigation and water resources engineering, New Age international,2016.

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B.Tech in Civil Engineering
VII Semester Syllabus
CE716PE: Advanced Structural Design
(Professional Elective - IV)

Course Objectives:

- To make the student more conversant with the design principles of critical structures using limit state approach.

Course Outcomes:

- **Analyze** and design of cantilever and counter fort retaining walls.
- **Understanding** behavior of flat slabs and **design** by using direct design method
- **Design** of curved beams and deep beams
- **Design** of Reinforced concrete circular and rectangular water tanks
- **Understanding** IRC loading and **design** of reinforced concrete slab bridge decks

Unit I: Retaining Walls :
Introduction, Design and Detailing of cantilever type of Retaining walls – Stability Check. Principles& Design of Counter fort Retaining walls.

Unit II: Flat Slabs and Ribbed Slabs :
Introduction to Flat slabs: 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

Unit III: Curved Beams and Deep Beams :
Beams Curved in Plan: Introduction – Design Principles – Structural Design of beams circular and semi-circular in plan, continuously and symmetrically supported, rectangular in cross-section.

Deep Beams : Introduction – flexural and shear stresses in deep beams. – I.S. Code provisions – design of simply supported and continuous Deep beams.

Unit IV: Water Tanks:
Design and detailing of RCC circular and rectangular ground level and overhead Water Tanks.

Unit V: Slab Bridges :
Introduction - Definition and basic forms – Components of a bridge - Classification of bridges – IRC Loading Standards and specifications - Design of Reinforced Concrete Slab Bridge decks

Text Books:

1. Krishnam Raju, Advanced RCC, CBS Publishers & distributors, New Delhi. 3rd edition,2016
2. Punmia B. C., Ashok Kumar Jain, Arun Kumar Jain,R.C.C Structures, Laxmi Publications, New Delhi, Tenth edition, 2015.

Reference Books:

1. Sushil Kumar, RCC Designs, standard publishing house, 2014.
2. Sinha N.C. and Roy S.K.,Fundamentals of RCC, S. Chand Publications, New Delhi, 2013.
3. Krishna Raju N., Design of Bridges, Oxford & IBH Publishing Company Pvt. Ltd, New Delhi. Fourth edition 2009

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B.Tech in Civil Engineering
VII Semester Syllabus
CE717PE : Railway and Airport Engineering
(Professional Elective - IV)

Course Objectives:

- To make students understand the engineering techniques to achieve the safe, efficient and economic movement people and goods through railways and airways

Course Outcomes:

- Identify and **understand** permanent way components of railway track
- Carry out **design** of geometrics of railway track
- **Understand** components of airport and functions of aviation organizations
- **Design** Runway and taxiways and lighting systems in airports
- **Understand** the different navigational aids and fundamentals of air traffic control devices.

Unit- I: Introduction to Railway:
Permanent way components – Cross Section of Permanent Way – Functions and types of various Components like Rails, Sleepers and Ballast, Sleeper density, Failures of Rails – Gauge – Creep of Rails - Theories related to creep.

Unit- II: Geometric Design of Railway Track:
Gradients – Grade Compensation – Cant and Negative Super elevation – Cant Deficiency – Degree of Curve, Points and Crossing, Rail Joints & Welding of Joints, Railway station & Yards, Signalizing & interlocking.

Unit- III : Basics of Air Transportation:
History of Air transportation – Global & Indian Level, Growth of air transport and future trends, Aviation organizations and their functions, Air transport and the national economy, Aircraft Characteristics – Air craft controls, Airport Site Selection – Runway Orientation – Basic Runway Length – Corrections for Elevation & Temperature.

Unit- IV: Runways, Taxiways and Terminal Building :
Runways & Taxiways - Runway Geometric Design – Factors Controlling Taxiway Layout – Terminal Area – Apron – Hangar – Blast Considerations, Typical Airport Layouts – Wind Rose Diagram – Runway Lighting system & Marking. The passenger terminal system .The terminal planning process - The apron-gate system

Unit- V: Air traffic Management:
Airways - Navigation aids, Enroute and landing aids, Communication, Navigational Aids, Surveillance System - Air Traffic Control - Ground and Air control Approach and terminal control Air traffic control facilities – Radar Systems call signs Flight traffic mapping Airport Signages Airport Lighting System Air safety & Regulation issues

Text Books:

1. Satish Chandra and Agarwal, M.M. (2007) “Railway Engineering”, Oxford Higher Education, University Press New Delhi.
2. Khanna S.K. and Arora, Airport Planning and Design –, Nem chand Bros.

Reference Books:

1. Saxena S.C. and Arora S., A Text Book of Railway Engineering, Dhanpat rai and Sons, New Delhi.
2. Subramanian K. P., Highway, Railway, Airport and Harbour Engineering. Scitech Publications
3. Chadula S.P., A text book of Transportation Engineering, S. Chand & Co. Ltd. 2001.

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B.Tech in Civil Engineering
VII Semester Syllabus
CE718PE: Health Monitoring of Structures
(Professional Elective - IV)

Course Objectives:

- To learn the fundamentals of structural health monitoring.
- To Studythevariousvibration-basedtechniquesforstructuralhealthmonitoring
- To learn the structural health monitoring using fiber-optic and Piezoelectric sensors.
- To Study the structural health monitoring using electrical resistance and electromagnetic techniques.

Course Outcomes :

- **Diagnosis** the distress in the structure understanding the causes and factors
- **Assess** the health of structure using static field methods
- **Assess** the health of structure using dynamic field tests
- **Suggest** repairs and rehabilitation measures of the structure
- **Identify** the testing techniques and repair materials

Unit--I : Structural Health Monitoring:

Definition of structural health monitoring (SHM) - Objectives- Need -Steps involved in SHM-Motivation for SHM - SHM as a way of making materials and structures smart - SHM and biomimetics - Process and pre usage monitoring as a part of SHM - SHM as a part of system management - The most remarkable characters of SHM Birth of the SHM community.

Unit-II: Vibration-Based Techniques for SHM:

Basic vibration concepts for SHM -Local and global methods - Damage diagnosis as an inverse problem - Model-based damage assessment - General dynamic behavior - State- space description of mechanical systems - Neural network approach to SHM - The basic idea of neural networks - Detection of delimitation in a CFRP plate with stiffeners.

Unit-III: Fiber-Optic Sensors:

Classification of fiber-optic sensors - Intensity-based sensors - Phase- modulated optical fiber sensors - or interferometers -Wavelength based sensors - or Fiber Bragg Gratings (FBG) - The fiber Bragg grating as a strain and temperature sensor - Orientation of the optical fiber optic with respect to the reinforcement fibers - Fiber Bragg gratings as damage sensors for composites -Measurement of strain and stress variations.

Unit-IV: SHM with Piezoelectric Sensors:

The use of embedded sensors as Acoustic Emission (AE) detectors - Available industrial AE systems- New concepts in acoustic emission - State-the-art and main trends in piezoelectric transducer-based acousto-ultrasonic SHM research -The full implementation of SHM of localized damage with guided waves in composite materials - Available industrial acousto ultrasonic systems with piezoelectric sensors.

Unit-V: SHM using Electrical Resistance:

Composite damage - Electrical resistance of unloaded composite - Percolation concept - Anisotropic conduction properties in continuous fiber reinforced polymer - Influence of temperature - Composite strain and damage monitoring by electrical resistance -Randomly distributed fiber reinforced polymers - Damage localization.

Low Frequency Electromagnetic Techniques: Theoretical considerations on electromagnetic theory, Maxwell's equations, Dipole radiation, Surface impedance, Diffraction by a circular aperture, Eddy currents, Polarization of dielectrics, Applications to the NDE/NDT domain, Dielectric materials, Conductive materials, Hybrid method, Signal processing, Time-frequency transforms, The continuous wavelet transform, The discrete wavelet transform, Multi resolution, Denoising, Application to the SHM domain, General principles, Magnetic method, Electric method, Hybrid method.

Text Books:

1. Daniel Balageas, Claus-Peter Fritzen, Alfredo Giiemes, Structural Health Monitoring, Wiley-ISTE, 2006.
2. Douglas E Adams, Health Monitoring of Structural Materials and Components-Methods with Applications, John Wiley and Sons,2007.
3. IS 13311:1992(Part -1) code for Non Destructive Testing of Concrete Methods of Test

Reference Books:

1. Ouli J.P., and Duan Z.D., Structural Health Monitoring and Intelligent Infrastructure, Vol-1, Taylor and Francis Group, London, U.K,2006.
2. Victor Giurglutiu, Structural Health Monitoring with Wafer Active Sensors, Academic Press Inc, 2007.
3. Gandhi. M.V. and Thompson B.D., "Smart Materials and Structures," Springer,1992.
4. Chang Fu Ko, "Structural Health Monitoring: Current Status and Perspectives", Technomic, Lancaster,1997.

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Open Elective for other Departments
VII Semester syllabus
CE721OE: Finite Element Methods
(Open Elective -III)

Course Objectives:

- Understand in general how finite elements obtain approximate solutions to differential equations
- Appreciate the structure of a typical finite element program
- Gain experience of finite element analysis applied to classical geotechnical problems (e.g. settlement, seepage, consolidation, slope stability)
- Gain insight into the soil properties needed for finite element analysis

Course Outcomes:

- **Understand** the fundamental theory of the Finite Element Method
- **Recal**l the finite element properties
- **Develop** element stiffness and nodal load matrices
- **Understand** the assemblage of finite elements
- **Apply** the finite element theory to solve soil behavior under external loads.

Unit-I : Introduction to FEM:

Concepts of FEM, Steps involved in Finite Element Analysis Procedure, Merits and Demerits. Concept of an element, various element shapes, Displacement models, Principles of Elasticity, Stress equations, Strain-Displacement relationships in matrix form, Equations of equilibrium and compatibility conditions for 2-D,3-D Problems, Plane stress, Plane strain and axi-symmetric bodies of revolution with axi-symmetric loading.

Unit-II: Finite Element Formulation:

Principle of minimum potential energy , Principles of virtual displacements, Raleigh Ritz Method, Weighted Residual Method, Galerkin's Method, , generalized coordinates, Shape functions, Convergent and Compatibility requirements, Geometric invariance, Natural coordinate system - area and volume coordinates.

Unit-III: Formulation of Stiffness Matrix:

Bar Elements: Concept, stiffness matrix for a 2- noded bar element, axial bar subjected to point loads, surface forces and body forces-constant cross section and varying cross section bar.

Truss Elements: Transformation Matrix, stiffness matrix of truss member in local and global coordinates, analysis of trusses with kinematic indeterminacy not exceeding three.

Unit-IV: Assemblage of Elements:

Beam Elements : Shape functions ,Beam element stiffness Matrix, element load vector and analysis of continuous beams with kinematic indeterminacy not exceeding three.

Plane Frame Elements: Element Stiffness Matrix, in local coordinates, Transformation or rotation and stiffness matrix, load vector in global coordinates.

Unit-V: CST and Rectangular Elements:

Determination of strain –displacement matrix, shape functions, determination of element stiffness and load matrices, assembling global stiffness and load matrices

Iso-parametric Elements: Concept, Different isoparametric elements for 2D analysis, shape functions using Iso- parametric elements , Lagrangian elements, Serendipity elements, formulation of stiffness matrix for 4-noded isoparametric quadrilateral elements.

Text Books:

1.Chandrupatla. T R and Belegundu, A D "Introduction to Finite Elements in Engineering", 2009
2.Krishna Murthy, C. S. - Finite element analysis - Theory and programming, Tata McGraw- Hill,1994
3.P.Seshu " Finite Element Analysis", Prentic Hall of India Private India Limited, New Delhi, 2010

Reference books:

1. Desai, C. S. and J.F, Abel, Introduction to the Finite Element Method, Van Nostrand Reinhold Company (1972).
2. Reddy, J. N. Introduction to the Finite Element Method - McGraw-Hill Publishers, 1993.
3. Krishna Murthy, C. S. - Finite element analysis - Theory and programming, Tata McGraw- Hill,1994
4. Zienkiewicz, O. C. - Finite element Methods, McGraw-Hill Publishers, 1971.

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2	0	0	2

Open Electives for other departments
VII Semester Syllabus
CE722OE : Remote Sensing and GIS
(Open Elective -III)

Course Objectives:

- The principles of Photogrammetry
- Principles and applications of Remote sensing
- Introduction to GIS, Spatial Systems, and its applications to Engineering Problems.
- The data types in GIS

Course Outcomes :

- **Identify** the characteristics and principles of photogrammetry
- **Understand** the concepts of remote sensing and to **analyze** the energy interactions in the atmosphere and earth surface features
- **Understand** and **apply** GIS concepts and to **interpret** the images for preparation of thematic maps
- **Analyze** spatial and attribute data for solving spatial problems
- **Recognize** and **apply** the knowledge of GIS data models

Unit – I: Introduction to Photogrammetry:
Principles& types of aerial photograph, geometry of vertical aerial photograph, Scale & Height measurement on single vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of stereoscopy, fiducial points, parallax measurement using fiducial line.

Unit – II: Remote Sensing:
Basic concept of remote sensing, Data and Information, Remote sensing data Collection, Remote sensing advantages & Limitations, Remote Sensing process. Electro- magnetic Spectrum, wavelength regions important to remote sensing, Energy interactions with atmosphere and with earth surface features (soil, water, vegetation), Atmospheric scattering, absorption – Atmospheric windows – spectral signature concepts, Indian Satellites and Sensors characteristics, Resolution, Map and Image, False color composite, introduction to digital data, elements of visual interpretation techniques.

Unit – III: Geographic Information Systems:
Introduction to GIS; Components of a GIS; Geospatial Data: Spatial Data-Attribute data – Joining Spatial and Attribute data; GIS Operations: Spatial Data Input, verification, storage and output- Attribute data Management –Data display- Data Exploration- Data Analysis. Coordinate Systems: Geographic Coordinate System: Map Projections: Types of Map Projections-Map projection parameters- Commonly used Map Projections - Projected coordinate Systems

Unit – IV: Vector Data Model:
Representation of simple features- Topology and its importance; coverage and its data structure, Shape file; Data models for composite features, Object Based Vector Data Model; Classes and their Relationship; The geo-base data model; Geometric representation of Spatial Feature and data structure, Topology rules

Unit – V: Raster Data Model:
Elements of the Raster data model, Types of Raster Data, Raster Data Structure, Data Conversion, Integration of Raster and Vector data. Data Input**:** Metadata, Conversion of Existing data, creating new data; Remote Sensing data, Field data, Text data, Digitizing, Scanning, on screen digitizing, importance of source map, Data Editing

Text Books:

1. Bhatta B, Remote Sensing and GIS ,Oxford Publishers 2015.
2. M. Anji Reddy, Remte sening and Geographic Information system, 2012
3. Kang-Tsung Chang,Introduction to Geographic Information System –, McGrawHill,2015
4. Kumar S, Basics of Remote Sensing, Laxmi Publications

Reference Books:

1. Young K.W. and Lo Albert C. P., Concepts & Techniques of GIS ,, Prentice Hall (India)Publications.
2. Peter A Burragh and Rachael A ,Principals of Geo physical Information Systems.
3. Lillesand and Kiefer , Remote Sensing and GIS, John Willey 2008.

L	T	P	C
0	0	2	1

B.Tech in Civil Engineering
VII Semester Syllabus
CE751PC: Transportation Engineering Lab

Course Objectives:

- To learn laboratory tests and their procedures for coarse aggregate.
- To learn laboratory tests and their procedures for bitumen and bituminous mixes.
- To understand the test procedures for characterization of bituminous mixes

Course Outcomes:

- **Categorize** the tests on materials used in pavement construction.
- **Examine** the tests performed for Bitumen mixes.
- **Prepare** a laboratory report based on the observed results.

I. Tests on Aggregates

1. Specific gravity & Water absorption
2. Shape (Flakiness and elongation indices)
3. Impact Test.
4. Los angeles abrasion test
5. Crushing resistance and durability tests
6. Sieve Analysis and gradation charts (Job mix formula using Rothfuch's charts)

II. Tests on Bitumen and Bituminous Mixes

1. Penetration Test.
2. Softening point Test
3. Ductility Test
4. Kinematic Viscosity Test
5. Marshall's Stability (sample preparation and testing for stability, flow values and mix volumetrics)

Tests for Demonstration

1. Flash and fire point
2. Specific gravity of bitumen
3. Elastic recovery

Text Books:

1. Khanna, Justo and Veeraraghavan, Highway Material Testing manual, Nemch and Brothers.

Code Books:

1. IS 1201 -1220 (1978) "Methods for testing tars and bituminous materials".
2. IS 73: 2013 Specification for Paving grade bitumen.
3. IRC SP 53 -2010 "Guidelines on use of modified bitumen".
4. MS-2 Manual for Marshalls Mix design 2002.
5. IS 2386 Part IV – Methods of Test for Aggregates for Concrete.

Justification:

In a semester it is possible to perform maximum of 12 experiments effectively and hence some of the experiments were included as demonstration experiments for transmitting required knowledge to the students

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B.Tech in Civil Engineering
VII Semester Syllabus
CE752PC: Computer Aided Design Lab (STAAD Pro)

Course Objectives:

- Learn the usage of any fundamental software for design
- Create geometries using pre-processor
- Analyze and Interpret the results using post processor
- Design the structural elements

Course Outcomes :

- **Model** the geometry of real-world structure represents the physical model of structural element/structure
- **Perform** analysis using STAAD software & Interpret the Post-processing results
- **Design** the structural elements and a system as per IS Codes

List f Experiments:

1. Analysis & Design of determinate structures using a software
2. Analysis & Design of fixed & continuous beams using a software
3. Analysis & Design of Plane Frames
4. Analysis & Design of RC space frames subjected to DL & LL
5. Analysis & Design of residential building subjected to all loads (DL,LL, WL)
6. Analysis & Design of residential building subjected to all loads (DL,LL, EQL)
7. Analysis & Design of Roof Trusses
8. Analysis & Design of Steel space frames subjected to DL & LL
9. Design of isolated footing using software

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B.Tech in Civil Engineering
VIII Semester Syllabus
CE811PE: Air Pollution and Control
(Professional Elective-V)

Course Objectives:

- Identify the major air pollutants and their sources and then the transport mechanisms of the pollutants followed by the affected population.
- Predict suitable control mechanisms for particulates and gaseous emissions and to anticipate proper air quality standards.

Course Outcomes:

- **Understand** various types of air pollutants, their sources and effects.
- **Learn** about the dispersion of plume and meteorological parameters
- **Learn** how to the control of particulates and their removal by equipment
- **Develop** control mechanisms for gaseous emissions
- **Analyze** air pollutants by sampling and set air quality standards.

Unit- I: Air Pollution:
Definitions, Composition of Air, Scope, Significance and Episodes, Classification of Air Pollutants, Stationary and mobile sources. Effects of Air Pollutants on man, material and vegetation: Global effects of air pollution, Green House effect, Heat Islands, Acid Rains, Ozone Holes etc.

Unit- II: Meteorology and Plume Dispersion:
Properties of atmosphere, Meteorological factors affecting dispersion of Air Pollutants: Wind direction, Wind Speed ,Mixing Height, Precipitation and Relative Humidity, Atmospheric Stability, Lapse Rates, Temperature inversions, Wind rose diagrams, plume behavior and plume Rise Models.

Unit- III: Control Of Particulates:
Control at Sources, Process Changes, Equipment modifications, Design and operation of control. Settling Chambers, Cyclone separators, Bag Filters, Dry and Wet scrubbers, Electrostatic precipitators.

Unit- IV: Control Of Gaseous Emissions: General Methods of Control of NOx and Sox emissions, In-plant Control Measures, process changes, dry and wet methods of removal and recycling, Adsorption, Absorption, Combustion.

Unit- V: Air Quality Management:
Monitoring of SPM, Sox; NOx and CO Emission Standards. Air sampling: Sampling Techniques, High volume air sampler, Stack sampling, Analysis of Air pollutants, Air quality standards, Air pollution control act.

Text Books:

1. Rao M.N. and Rao H.V.N, Air Pollution. Tata Mc. Graw Hill Company.
2. Murali Krishna KVSG, Air Pollution & Control. USP publications.

Reference Books:

1.Wark and Warner, Air Pollution. Harper & Row Publishers, New York.
2. TrivedyR.K.and GoetP.K, An introduction to Air Pollution, B.S. Publications.

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B.Tech in Civil Engineering
VIII Semester Syllabus

CE812PE: Finite Element Methods for Civil Engineering

(Professional Elective-V)

Course Objectives:

- Understand in general how finite elements obtain approximate solutions to differential equations
- Appreciate the structure of a typical finite element program
- Gain experience of finite element analysis applied to classical geotechnical problems (e.g. settlement, seepage, consolidation, slope stability)
- Gain insight into the soil properties needed for finite element analysis

Course Outcomes:

- **Understand** the fundamental theory of the Finite Element Method
- **Recal**l the finite element properties
- **Develop** element stiffness and nodal load matrices
- **Understand** the assemblage of finite elements
- **Apply** the Finite Element theory to solve soil behavior under external loads.

Unit-I : Introduction to FEM:

Concepts of FEM, Steps involved in Finite Element Analysis Procedure, Merits and Demerits. Concept of an element, various element shapes, Displacement models, Principles of Elasticity, Stress equations, Strain-Displacement relationships in matrix form, Equations of equilibrium and compatibility conditions for 2-D,3-D Problems, Plane stress, Plane strain and axi-symmetric bodies of revolution with axi-symmetric loading.

Unit-II: Finite Element Formulation:

Principle of minimum potential energy , Principles of virtual displacements, Raleigh Ritz Method, Weighted Residual Method, Galerkin's Method, , generalized coordinates, Shape functions, Convergent and Compatibility requirements, Geometric invariance, Natural coordinate system - area and volume coordinates.

Unit-III: Formulation of Stiffness Matrix:

Bar Elements: Concept, stiffness matrix for a 2- noded bar element, axial bar subjected to point loads, surface forces and body forces-constant cross section and varying cross section bar.

Truss Elements: Transformation Matrix, stiffness matrix of truss member in local and global coordinates, analysis of trusses with kinematic indeterminacy not exceeding three.

Unit-IV: Assemblage of Elements:

Beam Elements : Shape functions ,Beam element stiffness Matrix, element load vector and analysis of continuous beams with kinematic indeterminacy not exceeding three.

Plane Frame Elements: Element Stiffness Matrix, in local coordinates, Transformation or rotation and stiffness matrix, load vector in global coordinates.

Unit-V: CST and Rectangular Elements:

Determination of strain –displacement matrix, shape functions, determination of element stiffness and load matrices, assembling global stiffness and load matrices

Iso-parametric Elements: Concept, Different iso-parametric elements for 2D analysis, shape functions using Iso- parametric elements , Lagrangian elements, Serendipity elements, formulation of stiffness matrix for 4-noded iso-parametric quadrilateral elements,

Text Books:

1.Chandrupatla. T R and Belegundu, A D "Introduction to Finite Elements in Engineering", 2009
2.Krishna Murthy, C. S. - Finite element analysis - Theory and programming, Tata McGraw- Hill,1994
3.P.Seshu " Finite Element Analysis", Prentic Hall of India Private India Limited, New Delhi, 2010

Reference books:

1. Desai, C. S. and J.F, Abel, Introduction to the Finite Element Method, Van Nostrand Reinhold Company (1972).
2. Reddy, J. N. Introduction to the Finite Element Method - McGraw-Hill Publishers, 1993.
3. Krishna Murthy, C. S. - Finite element analysis - Theory and programming, Tata McGraw- Hill,1994
4. Zienkiewicz, O. C. - Finite element Methods, McGraw-Hill Publishers, 1971.

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B.Tech in Civil Engineering
VIII Semester Syllabus
CE813PE: Watershed Management
(Professional Elective-V)

Course Objectives:

- To understand different watershed behavior
- To be able to interpret runoff data and quantify erosion by using various modeling methods.
- To understand land use classification and impact of land use changes on hydrological cycle parameters.

Course Outcomes :

- **Understand** the concepts of watershed and its characteristics
- **Identify** the causes and principles of soil erosion
- **Design** of rainwater harvesting structures.
- **Discuss** the concepts of Artificial recharge and its methods
- **Adapt** principles of reclamation of saline soils

Unit – I: Introduction:
Concept of watershed development, objectives of watershed development, need for watershed development in India, Integrated and multidisciplinary approach for watershed management. concept of sustainable development. Hydrology of small watersheds.
Characteristics of Watershed: Size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics, basic data on watersheds.

Unit - II: Principles of Soil Erosion:
Causes of soil erosion, types of soil erosion, estimation of soil erosion from small watersheds, Control of soil erosion, methods of soil conservation – structural and non-structural measures.

Unit – III: Rain Water Harvesting:
Principles of water harvesting, methods of rainwater harvesting, design of rainwater harvesting structures.

Unit - IV: Artificial Recharge:
Artificial recharge of groundwater in small watersheds-, methods of artificial recharge.

Unit - V: Reclamation Of Saline Soils:
classification based on salinity -Micro farming -types- biomass management on the farm.

Text Books:

1. Murthy, V.V.N. and Jha M.K., Land and Water Management, Kalyani Publishers, 2015
2. Madan Mohan Das and Saikia M.D., Watershed Management by, Prentice Hall of India, 2013
3. Muthy, J. V. S, Watershed Management, New Age International Publishers,2013

Reference Books:

1.Black. P E, Watershed Hydrology, Prentice Hall Englewood Cliffs, 1991
2.Suresh.R, Watershed Hydrology, Standard Publishers and Distributors, Delhi, 2007.

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B.Tech in Civil Engineering
VIII Semester Syllabus
CE814PE : Traffic Engineering
(Professional Elective-V)

Course Objectives:

- To make students understand the engineering techniques to achieve the safe, efficient and economic movement people and goods on roadways.

Course Outcomes:

- **Understand** the traffic stream variables and their role in traffic engineering
- Conduct traffic surveys and **analyse** them for required traffic management measures
- **Assess** the LOS for freeways and highways based on traffic surveys
- Carry out Signal **design** based on turning movements at an intersection
- **Apply** traffic management measures to mitigate traffic problems.

Unit-I: Traffic Studies-I :
Basic principles of Traffic, Volume, Speed and Density; Definitions and their interrelationships; traffic surveys for measurement of density - Traffic Volume studies - Objectives, Methods of Volume counts, Presentation of Volume Data; Speed studies- Types of Speeds, Objectives, Methods of speed studies, Statistical Methods for speed data Analysis, Presentation of speed data. Delay Studies; Origin and Destination Studies.

Unit-I: Traffic Studies -II :
Parking Studies: parameters of parking, definitions, Parking inventory study, Parking survey by Patrolling method; Analysis of Parking Survey data; Accident studies- Causative factors of Road accidents, Accident data collection: Accident analysis and modeling;, Identification of accident prone locations - Road Safety Auditing, Measures to increase Road safety.

Unit-III: Capacity Studies:
Capacity and LOS Analysis: Introduction to Traffic capacity, Analysis concepts, Level of Service, Basic definitions, V/C ratio and its use in capacity analysis - Factors affecting Capacity and LOS, Capacity of Urban/Rural Highway, With or without access control, Basic freeway segments - Service flow rate of LOS, Lane width or Lateral clearance adjustment; Heavy vehicle adjustment; Driver population adjustment.

Unit-IV: Signal Design:
Signal Designing – Fixed Time signals, Determination of Optimum Cycle length and Signal setting for Fixed Time signals, Signal Phase diagrams - Warrants for Signals, Time Plan Design for Pre-Timed Control- Lane group analysis, Saturation flow rate, and Adjustment factors, Uniform and Incremental Delay, Vehicle Actuated Signals, Signal Coordination.

Unit-V: Transportation System Management:
Measures for Improving vehicular flow – one way Streets, Signal Improvement, Parking Management, Reversible lanes- Reducing Peak Period Traffic - Strategies for working hours - Introduction to Intelligent Transportation systems - Congestion Pricing – Role of ITS in congestion pricing - Differential Toll Policies

Text Books:

1. Kadiyali.L.R.,Traffic Engineering and Transportation Planning, Khanna Publishers
2. Roger P. Roess, William R. Shane. Mc.,. Prassas, Elena S, Traffic Engineering, Prentice Hall, 1977.

Reference Books:

1. Papacosta.C. S., Fundamentals of Transportation Engineering, Prentice Hall India.
2. Louis J. Pignataro, Traffic Engineering. Theory & Practice, Prentice Hall Publication.
3. JotinKhisty.C, Transportation Engineering - An Introduction, Prentice Hall Publication
4. Shane. Mc & Rogers, Fundamentals of Traffic Engineering.
5. Fred Mannering & Walter Kilareski, Principles of Highways Engineering and Traffic Analysis -, John Wiley & Sons Publication Highway Capacity Manual -2000.

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B.Tech in Civil Engineering
VIII Semester Syllabus
CE 815PE: Pavement Design
(Professional Elective-VI)

Course Objectives:

- To study factors affecting pavement design, assess material characteristics and design of flexible, rigid pavements and low volume roads

Course Outcomes:

- **Understand** various factors to be considered in analysis and design of pavements.
- **Analyze** stresses in pavements
- **Understand** material properties and assess their strength
- **Design** a flexible pavement and rigid pavements using IRC, AASHTO, PCA practices.
- **Design** low volume roads.

Unit- I: Factors Affecting Pavement Design:
Variables Considered in Pavement Design, Types of Pavements, Functions of Individual Layers, Classification of Axle Types of Rigid Chassis and Articulated Commercial Vehicles, Legal Axle and Gross Weights on Single and Multiple Units, Tire Pressure, Contact Pressure, EAL and ESWL Concepts, Traffic Analysis: ADT, AADT, Truck Factor, Growth Factor, Lane, Directional Distributions & Vehicle Damage Factors.

Unit- II: Stresses in Pavements:
Vehicle-Pavement Interaction: Transient, Random & Damping Vibrations, Steady State of Vibration, Experiments on Vibration, Stress Inducing Factors in Flexible and Rigid pavements. Stresses In Flexible Pavements: Visco-Elastic Theory and Assumptions, Layered Systems Concepts, Stress Solutions for One, Two and Three Layered Systems, Fundamental Design Concepts. Stresses In Rigid Pavements: Westergaard's Theory and Assumptions, Stresses due to Curling, Stresses and Deflections due to Loading, Frictional Stresses, Stresses in Dowel Bars & Tie Bars

Unit- III: Material Characteristics:
CBR and Modulus of Sub grade Reaction of Soil, Mineral aggregates – Blending of aggregates, binders, polymer and rubber modified bitumen, Resilient, Diametral Resilient and Complex (Dynamic) Moduli of Bituminous Mixes, Permanent Deformation Parameters and other Properties, Effects and Methods of Stabilization and Use of Geo Synthetics.

Unit- IV: Design of Flexible Pavements:
Flexible Pavement Design Concepts, Asphalt Institute's Methods with HMA and other Base Combinations, AASHTO, IRC Methods Design of Rigid Pavements: Calibrated Mechanistic Design Process, PCA, AASHTO & IRC Specifications, and Introduction to Prestressed and Continuously Reinforced Cement Concrete Pavement Design.

Unit-V: Design of Pavement for Low Volume Roads:
Pavement design for low volume roads, rural road designs – code of practice. Design of Overlays: Types of Overlays, Suitability, Design of overlays.

IRC Codes:

IRC 37-2012, IRC 58- 2015 & IRC SP 72- 2007.

Text Books:

1. Pavement Design by R,Srinivasa Kumar, Orient Blackswan Private Limited - New Delhi, 2013.
2. Principles of Pavement Design by E.J. Yoder & M.W. Witczak, Wiley India Pvt. Ltd, 2012

Reference Books:

1. Pavement Analysis and Design, Yang H Haung, Pearson Publishers, 1992.
2. Concrete Pavements, A F Stock, Elsevier, Applied Science Publications, 1988.
3. Pavement and Surfacings for Highways and Airports, Micheal Sargious, Applied Science Publications, 1975.

L	T	P	C
3	0	0	3

B.Tech in Civil Engineering
VIII Semester Syllabus
CE816PE: Solid Waste Management
(Professional Elective – VI)

Course Objectives:

- Define the terms and Understands the necessity of solid waste management
- Explain the strategies for the collection of solid waste
- Describe the solid waste disposal methods
- Categorize Hazardous Waste

Course Outcomes:

- **Identify** the physical and chemical composition of solid wastes
- **Understand** the functional elements for solid waste management.
- **Apply** the techniques and methods used in transformation, conservation, and recovery of materials from solid wastes.
- **Identify** and design waste disposal systems
- **Learn** hazardous Waste Management.

Unit – I: Solid Waste:

Definitions, Types of solid wastes, sources of solid wastes, Characteristics, and perspectives; properties of solid wastes, Sampling of Solid wastes, Elements of solid waste management - Integrated solid waste management, Solid Waste Management Rules 2016.

Unit – II: Engineering Systems for Solid Waste Management:

Solid waste generation; on-site handling, storage and processing; collection of solid wastes; Stationary container system and Hauled container systems, Route planning - transfer and transport.

Unit – III: Engineering Systems for Resource and Energy Recovery:

Processing techniques; materials recovery systems; recovery of biologicalconversion products – Composting, pre and post processing, types of composting, Critical parameters, Problems with composing - recovery of thermal conversion products; Pyrolisis, Gasification, RDF - recovery of energy from conversion products; materials and energy recovery systems.

Unit – IV: Landfills:

Evolution of landfills – Types and Construction of landfills – Design considerations – Life of landfills- Landfill Problems – Lining of landfills – Types of liners – Leach ate pollution and control – Monitoring landfills – Land fill sreclamation.

Unit – V: Hazardous Waste Management:

Sources and characteristics, Effects on environment, Risk assessment, Disposal of hazardous wastes – Secured landfills, incineration – Monitoring, Biomedical waste disposal, E-waste management, Nuclear Wastes.

Text Books:

1. Tchobanoglous G, Theisen H and Vigil SA 'Integrated Solid Waste Management, Engineering principles and Management Issues' McGraw-Hill, 1993.
2. Vesilind PA, Worrell W and Reinhart D, 'Solid Waste Engineering' Brooks/Cole Thomson Learning Inc., 2002.

Reference Books:

1. Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, 'Environmental Engineering', McGraw Hill Inc., New York, 1985.
2. Qian X, Koerner RM and Gray DH, 'Geotechnical Aspects of Landfill Design and Construction' Prentice Hall, 2002.

L	T	P	C
3	0	0	3

B.Tech in Civil Engineering
VIII Semester Syllabus
CE817PE : Ground Water Hydrology
(Professional Elective-VI)

Course Objectives:

- To explain the concepts of Groundwater Development and Management
- To demonstrate and derive the basic equations used in groundwater development and management.
- To conduct the investigations and field studies for basic ground water studies.

Course Outcomes:

- **Explain** the concepts of ground water occurrence and its movement
- **Analyze** the steady flow pumping test data
- **Understand** the unsteady flow and its analysis
- **Discuss** the concepts of surface and subsurface investigations.
- **Interpret** the saline water intrusion problems in costal aquifers

Unit I: Ground Water Occurrence and Ground Water Movement:
Ground Water Occurrence: Ground water hydrologic cycle, origin of ground water, rock properties effecting ground water, Vertical distribution of ground water, zone of aeration and zone of saturation, geologic formation as aquifers, types of aquifers, porosity, specific yield and specific retention.

Ground Water Movement: Permeability, Darcy's law, storage coefficient, Transmissivity, Differential equation governing ground water flow in three dimensions derivation, ground water flow equation in polar coordinate system, ground water flow contours and their applications.

Unit II: Analysis of Pumping Test Data-Steady flow :
Analysis of Pumping Test Data-I: Steady flow ground water flow towards a well in confined and unconfined aquifers-Dupit's and Theism's equations, assumptions, formation constants, yield of an open well, well interface and well tests.

Unit III: Analysis of Pumping Test Data-Un-steady flow :
Analysis of Pumping Test Data-II: Unsteady flow towards well-Non-Equilibrium equations, Thesis solution, Jocob and Chow's simplifications, Leaky aquifers.

Unit IV: Surface and Sub-Surface Investigations :
Surface Investigations: surface methods of exploration-Electrical resistivity method and Seismic refraction methods.

Sub-Surface Investigations: Subsurface methods geophysical logging and resistivity logging. Concept of artificial recharge of ground water, recharge methods, Applications of GIS and RS in artificial recharge of ground water along with case studies.

Unit V: Saline Water Intrusion Management :
Saline Water Intrusion in Aquifer: Definition of saline water intrusion, occurrence of saline water intrusion, Ghyben-Herzberg relation, Shape of interface, control of saline water intrusion. Ground water basin management-definition and concepts, case studies.

Text Books:

1. Raghunath. H.M., Ground water Hydrology, Wiley Eastern Ltd.2007
2. David Keith Todd, Ground water Hydrology, John Wiley & Sons, New York**,** 2004

Reference Books:

1. Karanth. K R, Ground Water Assessment, Development and Management, Mc.Graw Hill Publications.2015
2. Willes .R. & Yeh. W.W.G., Groundwater System Planning & Management, Prentice Hall,2017

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B.Tech in Civil Engineering
VIII Semester Syllabus
CE818PE: Earth and Rock Fill Dams and Slope Stability
(Professional Elective-VI)

Course Objectives:

- Have an understanding of seismic design concepts and current practices for earth dams and other similar structures to enable them to plan and direct the construction activity appropriately.
- Understand the soil dynamic testing procedure and methodology of seismic design to be able to execute a proper design.
- Have a clear understanding of design methodology and the interpretation in the seismic codes.

Course Outcomes:

- **Understand** the design aspects of earthen dams
- **Analyze** different types of slope failures and their prevention methods
- **Explain** the factors that may affect the stability of slopes.
- **Select** an appropriate slope stability analysis method subject to geometry of slope, material properties
- **Know** the design requirements of rockfill dams

Unit – I :Earth and Rockfill Dams:
General features, Selection of site; Merits and demerits of the earth and rock fill dams, Classification of earth dams, Causes of failure, Safe design criteria. Instrumentation in earth dams: Pore pressure measurements, Settlement gauges, Inclinometers, Stress measurements, Seismic measurements.

Unit – II: Failures, Damages and Protection of Earth Dams:
Nature and importance of failure, Piping through embankment and foundations, Methods of seepage control through embankments and foundations, Design Criteria for filters, Treatment of upstream and downstream of slopes, Drainage control, Filter design.

Unit – III : Slope Stability Analysis:
Types of Failure: Failure surfaces - Planar surfaces, Circular surfaces, Non-circular surfaces, Limit equilibrium methods, Total stress analysis versus effective Stress analysis, Use of Bishop's pore pressure parameters, Short term and Long term stability in slopes. Taylor Charts.

Unit – IV: Methods of Slope Stability:
Method of Slices, Effect of Tension Cracks, Vertical Cuts. Bishop's Analysis, Bishop and Morgenstern Analysis, Non-circular Failure Surfaces: Janbu Analysis, Sliding Block Analysis, Seismic stability, Stabilization of slopes: Soil reinforcement (geo-synthetics/soil nailing/micro piles etc), soil treatment (cement/lime treatment), surface protection (vegetation/erosion control mats / shotcrete).

Unit – V: Rockfill Dams:
Requirements of compacted rockfill, Shear strength of rockfill, rockfill mixtures, rockfill embankments, Earth-core rockfill dams, Stability, Upstream & Downstream slopes.

Text Books:

1. Sherard, Woodward, Gizienski and Clevenger. Earth and Rock fill Dams. John Wiley &. Sons. 1963
2. Bharat Singh and Sharma, H. D. – Earth and Rock fill Dams, 1999

Reference Books:

1. Sowers, G. F. and Salley, H. I. – Earth and Rockfill Dams, Willams, R.C., and Willace, T.S. 1965.
2. Abramson, L. W., Lee, T. S. and Sharma, S. - Slope Stability and Stabilization methods – John Wiley & sons. (2002)
3. Bromhead, E. N. (1992). The Stability of Slopes, Blackie academic and professional, London.
4. Christian, Earth & Rockfill Dams – Principles of Design and Construction, Kutzner Publishers, Oxford and IBH.
5. Ortiago, J. A. R. and Sayao, A. S. F. J. - Handbook of Slope Stability.

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B.Tech in Civil Engineering
VIII Semester Syllabus
MS803HS: Professional Practice Law & Ethics

Course Objectives:

- To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession
- To develop some ideas of the legal and practical aspects of their profession.
- To create awareness on professional ethics, Codes of Ethics, Industrial Standards.
- To create awareness on Law of Contract
- To Create awareness on Industrial disputes and Arbitration
- To Create awareness on Industrial relations in India and Intellectual Property Rights

Course Outcomes:

- **Understand** the importance of professional practice, Law and Ethics in their personal lives and professional careers.
- **Learn** the rights and responsibilities as an employee, team member and a global citizen
- **Know** about the resolution of industrial disputes
- **Know** about the portfolio management of different Intellectual Property Rights
- **Know** about corporate social responsibility.

Unit I: Professional Practice and Ethics :

Definition of Ethics, Professional Ethics - Engineering Ethics, Personal Ethics; Code of Ethics - Profession, Professionalism, Professional Responsibility, Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures. Introduction to GST- Various Roles of Various Stake holders

Unit II: Law of Contract :

Nature of Contract and Essential elements of valid contract, Offer and Acceptance, Consideration, Capacity to contract and Free Consent, Legality of Object. Unlawful and illegal agreements, Contingent Contracts, Performance and discharge of Contracts, Remedies for breach of contract. Contracts-II: Indemnity and guarantee, Contract of Agency, Sale of goods Act-1930:General Principles, Conditions & Warranties, Performance of Contract of Sale

Unit III: Arbitration, Conciliation and ADR(Alternative Dispute Resolution) System :

Arbitration–meaning, scope and types–distinction between laws of 1940 and 1996; UNCITRA L model law–Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements–essential and kinds, validity, reference and interim measures by court; Arbitration tribunal–appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.

Unit IV: Industrial Relations and Labour Laws:

Engagement of Labour Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Minimum Wages Act 1948

Unit V: Law Relating to Intellectual Property:

Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970

Text Books:

1. R. Subramanian, Professional Ethics, Oxford University Press, 2nd Edition, 2017.
2. Ravinder Kaur, Legal Aspects of Business, Cengage Learning, 4th Edition, 2016.
3. CB Mamoria, SatishMamoria, P Subbarao "Dynamics of Industrial Relations" Himalaya Publishing House. 16th Edition, 2016.

Reference Books:

1. Wadhera, Intellectual Property Rights, Universal Law PublishingCo, 5th Edition, 2004
2. T. Ramappa, Intellectual Property Rights Law in India, Asia LawHouse, 1st Edition, 2010
3. S C Srivastava, Industrial Relations and Labor Laws, Vikas Publications, 7th Edition, 2020.