School of Engineering & Technology

Course Structure for Undergraduate Programme of Bachelor of Civil Engineering
(B.Tech.)

Semester-VII

Sr. No.	Course Code	Theory Paper/Practical	Teaching Scheme (Hrs./Week)				Credits	Duration University Exam. (Hrs.)	CIA	Examination Scheme			Total Marks
			L	P	T	Total				T	P/O	TW	
01	YCE701	Environmental Engineering-II	03	--	01	04	04	3	50	50	--	--	100
02	YCE702	Dams & Hydraulic Structures	03	--	01	04	04	3	50	50	--	--	100
03	YCE703	Reinforced Cement Concrete-II	03	--	01	04	04	3	50	50	--	--	100
Elective-I			03	--	--	03	03	3	50	50	--	--	100
04	YCE704	Advanced Concrete Technology											
05	YCE705	Air Pollution and Control											
06	YCE706	Quality and Safety Management in Construction**.**											
07	YCE707	Remote Sensing and GIS											
Elective-II			03	--	--	03	03	3	50	50	--	--	100
08	YCE708	Advanced Geotechnical Engineering											
09	YCE709	Earthquake Engineering											
10	YCE7010	Rural Planning and Village Development											
11	YCE7011	Optimization Techniques											
12	YCE711	Environmental Engineering Lab-II	--	02	--	02	01	3	--	--	25	25	50
13	YCE712	Reinforced Cement Concrete Lab-II	--	02	--	02	01	3	--	--	25	25	50
14	YCE713	Project Stage-I	--	02	--	02	01	3	--	--	25	25	50
		Total	**15**	**04**	**03**	**24**	**21**		**250**	**250**	**75**	**75**	**650**

Sandip University

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School of Engineering & Technology

Course Structure for Undergraduate Programme of Bachelor of Civil Engineering
(B.Tech.)

School: School of Engineering & Technology	**Programme: Civil Engineering**
Year :Fourth Year	**Semester - VII**
Course: Environmental Engineering -II	**Course Code: YCE701**
Theory: 3Hrs/Week & 1 Tutorial	**University Theory Examination: 50 Marks**
Max. Time for Theory Exam.: 3 Hrs.	**Continuous Internal Assessment: 50 Marks**

Objectives	
1	To understand various chemical, physical & biological tests for carrying out treatment of sewage.
2	To Design sewer system & their appurtenances.
3	To Know various waste water treatment techniques, processes of sewage based on various types of impurities.
4	To familiar with the basic concept of Rural Sanitation & septic tank.
5	To Understand Solid Waste Management concept, its collection system & Processing Techniques.

Unit Number	**Details**	**Hours**
I	**Introduction to Sewage & its Characteristics:-** **Sewage:** Definition & Composition, Sources, Necessity of treatment, Requirement of a sewage management system. **Characteristics of Sewage:** Physical, Chemical and Biological characteristics, Interpretation and practical significance of test results, Sampling, analysis of sewage for pH, Suspended Solid, Total Solids, COD, BOD, Chlorides and Sulphates, Relationship between TOC, COD & BOD, Population Equivalent(P_E) & Relative stability. **Zones of Pollution**: Degradation, Active decomposition, recovery, clear water. Self-Purification of Natural Streams, Oxygen Deficit Curve-"Streeter & Phelps equation (without derivation and numerical).	9
II	**Sewer Design** – Estimation of dry weather and rain water flow, hydraulic formulae, minimum and maximum velocity of flow, Forms of sewers, Design of storm water drains. **Construction of Sewers** – Factors affecting selection of material for sewer construction, materials & shape of sewers, Structural Loads on Sewers, Maintenance, Cleaning and ventilation of Sewers. **Appurtenances** – Purposes and location of Inlets, catch pits, cleanouts, manholes, drop-manholes, lamp-holes, flushing devices, grease and oil traps, inverted siphons.	9
III	**Preliminary & Secondary Treatment of Sewage** Theory and design of Screen chamber, Grit Chamber, Grease Removal – Necessity, Skimming Tanks, Vacuum Floatation, and Disposal of skimming. Sedimentation – Characteristics of settleable solids, Types of settling –Discrete, Flocculent and Compression Settling, Chemical aided settling, coagulants used.	9

	Activated sludge process: Design of ASP, sludge volume index, sludge bulking & control. Types of ASP. **Trickling filter**: Biological principle, different T.F media & their characteristics, design of standard rate and high rate filters using NRC formula, single stage & two stage filters, recirculation, ventilation, operational problems, control measures, theory of rotating biological contractors.	
IV	**Oxidation pond:** Bacteria –algae symbiosis, design, advantages & disadvantages of oxidation ponds. **Aerated lagoons:** Principle, aeration method, advantages & disadvantages of aerated lagoons. **Rural Sanitation:** Pit privy, aqua privy, bio-gas recovery, Septic tank including soak pit & design problems (as per relevant I.S. Code), Sludge collection and disposal.	9
V	**Solid Waste Management System:-** **Sources & Characteristics:** Physical, chemical & biological Analysis **Collection of solid waste:** Types of collection system (Hauled Container System & Stationary Container System) and services, frequency of collection, methodology involved in setting up collection bins. **Disposal of solid wastes:** Different methods, sanitary landfill, composting, incineration.	9
	Total	**45**

Outcomes	
After successful completion of this course the student will be able to	
1	Implement various chemical, physical & biological tests for carrying out treatment of sewage as per need & conveyance.
2	Apply the knowledge of different components of sewer in construction, testing & maintenance of sewers.
3	Able to understand & design waste water treatment unit based on various types of impurities for the disposal of sewage.
4	Plan for rural sanitation provisions & perform functional design of septic tank.
5	Understand Solid Waste Management system & its Processing Techniques for the safe disposal of solid waste in environment.

Reference Books	1. Punmia & Jain, "Waste Water Engineering", Laxmi Publications, New Delhi. 2. Modi P.N., "Sewage Treatment & Disposal and Waste Water Engineering", Standard Publications, New Delhi. 3. Pevy, Rowe & Tchobanoglous, "Environmental Engineering", McGraw Hill International, New Delhi 4. Garg S.K., "Sewage Disposal & Treatment & Air pollution Engineering", Khanna Publisher, New Delhi 5. Hammer & Hammer, "Water & Waste Water Engineering", Prentice Hall International, New Delhi

	6. Sincero & Sincero, "Environmental Engineering – A Design Approach", Prentice Hall International, New Delhi 7. Waste Water Treatment & Disposal – Metcalf & Eddy - TMH publication 8. Waste Water Treatment – Rao & Dutta.
School: School of Engineering & Technology	**Programme: Civil Engineering**
Year: Fourth Year	**Semester - VII**
Course: Dams and Hydraulic Structures	**Course Code: YCE702**
Theory: 3Hrs/Week & 1 Tutorial	**Max. University Theory Examination: 50 Marks**
Max. Time for Theory Exam.:3 Hrs.	**Continuous Internal Assessment: 50 Marks**

Objectives	
1	To understand conceptually design of dams.
2	To understand mechanism of spillway and energy dissipation.
3	To analyze problems related to reservoir planning and sedimentation.
4	To study Canal regulation structures.

Unit Number	Details	Hours
I	**Introduction to dams** Introduction, Historical development of dams, Different terms related to dams, Types of dams, their advantages and disadvantages, selection of site for dam, site Investigations. **Gravity Dams** Introduction, Design of gravity dam, principal and shear stresses, failure of dam and its stability, elementary & practical profile of the gravity dam, joints, galleries, shafts, foundation treatment.	9
II	**Embankment Dams** Introduction, Types of embankment dams, factors affecting design of embankment dam, causes of failure of embankment dams, criteria of design of earth dams, computation of free board in embankment dam, stability analysis of the earth dam **Spillways and Energy Dissipation** Introduction,Types of spillways, design aspects of ogee spillway, spillway gates, jump-height curve and tail water curves, different types of energy dissipaters.	9
III	**Diversion Headworks** Introduction, Design aspects of subsurface flow on permeable foundation, Bligh's, Lane's and Khosla's theories for design of floor for subsurface flow, Planning and layout of the diversion headwork, component parts of diversion headwork, types of weir & barrages, causes of failure of weirs and their remedies, silt control, location of headworks.	9

IV	**Canal Regulation Structures** Introduction, Necessity, location and types of canal falls, design aspects of Sarda type fall, functions and design aspects of head regulator and cross regulator, canal escapes, canal outlets. **Cross-Drainage Structures** Introduction, Types of cross-drainage structures, selection of suitable type, classification of aqueducts, design aspects of cross-drainage structures.	9
V	**Reservoir Planning & Sedimentation** Introduction, Types of reservoirs, investigations for reservoir planning, site selection, storage zones, yield, mass inflow curve, determining capacity of reservoir, apportionment of total cost of a multipurpose reservoir, determination of life of reservoir, control of sediment, reservoir losses, control of evaporation loss.	9
	Total	**45**

Course Outcomes	
1	Analyze and design various types of dams
2	Design spillways and energy dissipation structures
3	Concepts of Canal Regulation Structures.
4	Analyze problems related to Reservoir planning and sedimentation
5	Concepts of Diversion headwork's.

Recommended Books	1. USBR, Design of Gravity Dams, Design manual for concrete gravity dams, , Denver, Colorado, (1976). 2. Sherad J L, Woodward R J Gizienski, S C and Clevenger W A, Earth and Earth and Rock fill dams, John Wiley and Sons Inc.,USA, (1963). 3. Creager William P., Justin Joel D, Hinds Julian, Engineering for dams, Nem Chand and Bros, Roorkee (U P), (1995). 4. Asawa G L, Irrigation Engineering, New Age International (P)Ltd, New Delhi, (1996). 5. Garg S K, Irrigation Engineering and Hydraulic Structures, Khanna Publishers, New Delhi, (1999). 6. Varshney R S , Gupta S C and Gupta S L, Theory and design of Irrigation Structures Vol II, Nem Chand Bross, Civil Lines, Rroorkee-247667, India, (1993).

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School: School of Engineering and Technology	**Programme: B.Tech. Civil Engineering**
Year: Fourth Year	**Semester - VII**
Course: Reinforced Cement Concrete II	**Course Code:YCE703**
Theory: 3Hrs/Week & 1 Tutorial	**Max. University Theory Examination: 50 Marks**
Max. Time for Theory Exam.: 3 Hrs	**Continuous Internal Assessment: 50 Marks**

Objectives	
1	To analyze and design Prestress Concrete members
2	To analyze and design frames subjected to earthquake load.
3	To analyze and design cantilever type retaining wall.
4	To design combined footing

Unit Number	Details	Hours
I	**Prestressed concrete - Introduction** Introduction, Basic concepts, materials-various Pretensioning and post tensioning systems, concept of losses, Stress calculations, and concept of cable profile.	10
II	**Prestressed concrete – Analysis & Design** Design of post tensioned prestressed concrete simply supported rectangular and flanged sections for flexure and shear including end block. Design of one way and two way post tensioned slabs (Single panel only)	8
III	**Earthquake force calculation and analysis and design of frames** Review of methods of analysis for frames subjected to gravity and lateral loads. Earthquake loads by seismic coefficient method. Estimation of combined effect of lateral forces and vertical loading on multi storeyed frames. Design any intermediate continuous beam of the frames for combined effect of loadings	8
IV	**Earth retaining structures** Introduction, Functions and types of retaining walls. Analysis and design of RCC cantilever type of retaining wall for various types of backfill conditions.	9
V	**Combined footings** Introduction, necessity and types of combined footings, design of slab type and slab-beam type of combined footing.	9
	Total	**44**

Course Outcomes	
1	Students will be able to analyze and design Prestress Concrete members
2	Students will be able to analyze and design frames subjected to earthquake load.
3	Students will be able to analyze and design cantilever type retaining wall.
4	Students will be able to design combined footing.
5	Students will be able to handle the design of complete RCC structure

Reference Books	1. Limit state theory and design of reinforced - Dr. V. L. Shah and Dr S. R. Karve - Structures Publications , Pune 2. Fundamentals of Reinforced Concrete- N.C. Sinha, S.K. Roy – S. Chand & Co. Ltd 3. Advanced design of structures- Krishnaraju - Mc Graw Hill 4. Design of Prestressed concrete structures- T. Y. Lin. 5. Prestressed Concrete- N. Krishna Raju – Tata Mc Graw Hill Publication Co. 6. Comprehensive RCC Design - Punmia, Jain & Jain - Laxmi Publications. 7.Design of design of reinforced Concrete structures- M. L. Gambhir -PHI 8.Reinforced Concrete, Vol I- Dr.H J. Shah Charotar Publishing House 9. Prestressed Concrete – A Fundamental Approach- Edward Nawy – PHI. 10.Reinforced concrete design- Pillai and Menon TMH

I.S. Codes	1. IS: 456: Indian Standard code of practice for plain and reinforced concrete, BIS, New Delhi. 2. IS: 1343: Indian Standard code of practice for Prestressed concrete, BIS, New Delhi. 3. IS: 1893: Indian Standard Code of practice for criteria for Earthquake resistant design of structures, BIS, New Delhi.

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School: School of Engineering & Technology	**Programme: Civil Engineering**
Year : Fourth Year	**Semester - VII**
Course: Elective-I(Advanced Concrete Technology)	**Course Code:YCE704**
Theory: 3Hrs/Week	**Max. University Theory Examination: 50 Marks**
Max. Time for Theory Exam.: 3 Hrs	**Continuous Internal Assessment: 50 Marks**

Course Objectives	
1	To understand the properties of ingredients of concrete.
2	To study different types of special concretes.
3	To study mix proportioning for different types concrete as per standard guidelines.
4	To study fibre reinforced concrete and its properties.
5	To study non-destructive testing and microstructural analysis of concrete.

Unit Number	**Details**	**Hours**
I	Cement and its types: hydration of cement, types of pozzolanic materials and its behavior in cementitious medium. Aggregate: Grading curves of aggregates, Bulking of sand, different types of waste/ by-products as aggregate replacement materials, alkali aggregate reaction. Concrete: fresh and hardened properties of concrete, w/b ratio, gel space ratio, aggregate cement bond strength, maturity concept, effect of admixtures. Guidelines for Quality control & Quality assurance of concrete (site visit to RMC plant).	10
II	Self-compacting concrete, High strength concrete, High performance concrete, Light weight concrete, vacuum concrete, mass concrete, waste material based concrete, sulphur concrete and sulphur infiltrated concrete, Jet cement concrete (ultra-rapid hardening), gap graded concrete, Self-curing concrete, Pervious concrete, Geo polymer concrete, underwater concreting . Pumpable concrete manufacturing method and equipments used.	10
III	Concrete mix proportioning and design of fly ash/GGBS based cement concrete mixes, self-compacting concrete, pumpable concrete mixes, high strength concrete mixes.	12
IV	Historical development of fibre reinforced concrete, properties of metallic fibre, polymeric fibres, carbon fibres, glass fibres, basalt fibres and naturally occurring fibres. Properties of hardened fibre reinforced concrete, behavior under compression, tension and flexure of steel fibres and polymeric fibres in concrete. GFRC, SFRC, SIFCON, SIMCON -development, constituent materials, casting, quality control tests and physical properties.	10
V	Advanced non-destructive testing methods: Ultrasonic pulse velocity test, ground penetration radar, probe penetration, break off maturity method, stress wave propagation method, electrical/magnetic methods, nuclear methods and infrared thermographs. Smart Sensors in wet concrete.	10

	Microstructural analysis of concrete: X-ray Diffractometer test, Scanning electron microscopy test.	
	Total	**52**

Course Outcomes	
1	Students will be able to understand chemistry, properties and classification of cement, aggregates, concrete.
2	Students will be able to understand different types of special concretes.
3	Students will be able to design mix proportioning for different types concrete as per standard guidelines.
4	Students will be able to understand fibre reinforced concrete and its properties.
5	Students will be able to understand non-destructive testing and microstructural analysis of concrete

Recommended Books	1. Concrete Technology --M.S. Shetty, S. Chand Publications. 2. Concrete Technology -- A R Santhakumar, Oxford University Press. 3. Concrete technology -- M. L. Gambhir, Tata Mcgraw Hill Publications. 4. Fiber Reinforced Cement Composite- P. N. Balguru & P. N. Shah
Reference Books	1. Properties of concrete by A. M. Neville, Longman Publishers. 2. Structural Diagnosis ---- R. N. Raikar 3. Design of concrete mixes by Raju N Krishna, CBS Publisher 4. I.S. Codes: 456, 383, 10262-2009, IS 9103, .

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School: School of Engineering & Technology	**Programme: B.Tech[Civil Engineering]**
Year : Final Year	**Semester - VII**
Course: Elective-I (Air Pollution and Control)	**Course Code:YCE705**
Theory: 3Hrs/Week	**Max. University Theory Examination: 50 Marks**
Max. Time for Theory Exam.: 3 Hrs	**Continuous Internal Assessment: 50 Marks**

Objectives	
1	To make the students aware of history of air pollution; definition of air pollution and various types of sources and classification of air pollutants.
2	To make the student aware of the indoor air pollution, sources, causes and effects.
3	To make the student aware of techniques and instrumentation of ambient air monitoring,
4	To make the student aware of effects of gaseous and particulate air pollutants on humans, plants and materials.
5	To make the student aware of dispersion phenomenon of air pollutants covering diffusion and advection, meteorological components, stability of atmosphere and corresponding plume shapes.

Unit Number	**Details**	**Hours**
I	Air quality and standards Meteorology - Air Pollution, Definition, Sources and classification,Its effect on Health, vegetation, materials and atmosphere , Greenhouse effect Air quality standards, Physics of atmosphere, Lapse rate, Inversion, maximum mixing depth, Wind rose, Plume behavior, Greenhouse effect	9
II	Dispersion of pollutants in the atmosphere - Eddy diffusion model, the Gaussian dispersion model, point source, Line source, maximum ground level concentration, Determination of stack height, Effects of inversion trap	9
III	Particulate Matter-Control Equipment for Particulate Matter Definitions of different particulate matter, Distribution and source of SPM, Terminal settling velocity, Settling chambers, cyclone separation ,Wet collectors, Fabric filters, electrostatic precipitators and other removal methods like absorption, Adsorption and precipitation	9
IV	General control of Gaseous pollutants- Principles of absorption, Adsorption, Basic design of absorption and adsorption units, Incineration,Control of SOx, NOx	9
V	Automobile pollution – Motor vehicle emissions, Combustion, Air fuel ratio , Emission of pollutants from automobiles, Alternative fuels and their utilizations ,Strategy for effective control of air pollution in India. Air pollution control act ,Air quality index: categories of air quality index, determination of air quality index (AQI):,National AQI, Extreme value indices, Regional indices	9
	Total	**45**

Course Outcomes	
1	Students should able to understand concept of air pollution and knowledge about air quality management.
2	Student should able to analyze the causes and effects of air pollution.
3	Student should able to develop control technologies for air pollutant emission
4	Student should able to understand the type and nature of air pollutants, the behavior of plumes and relevant meteorological determinants influencing the dispersion of air Pollutants.
5	Student should able to understand air quality model, its definition, types and description of Gaussian based air quality model for point source along with its application.

Reference Books	1. Wark Kenneth and Warner "Air Pollution", C.F., H.R. Publication, 1st Edition, 1978.CPHEEO, 2. Stern A.C., "Air Pollution Vol. I and II", Allied Publishers Limited, 1st Edition, 1994. 3. Martin Crawford, "Air Pollution and Control", Tata McGraw Hill Publication, 1st Edition, 1976. 4. Richard, W. Boubel and Bruce Turner, "Fundamentals of Air Pollution", Academic Press, New York, Third edition, 1994. 5. Noel de Nevers, "Air Pollution control Engg." McGraw-Hill, New York, Second edition, 1995. 6. Rao H.V.N and Rao, M.N., "Air Pollution", Tata McGraw Hill, 1st Edition, 1989. 7. Wark Kenneth and Warner C.F., Air pollution its origin and control. Harper and Row Publishers, New York, 1997. 8. Rao C.S., Environmental pollution control Engineering, New age international Ltd, New Delhi,1995. 9. De Nevers H. Air Pollution Control Engineering, Mc Graw Hill, New York, 1995.

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School: School of Engineering and Technology	**Programme: Civil Engineering**
Year : Final Year	**Semester - VII**
Course: Elective-I (Quality and Construction. Management)	**Course Code:YCE706**
Theory: 3 Hrs/Week	**Max. University Theory Examination: 50 Marks**
Max. Time for Theory Exam.: 3 Hrs	**Continuous Internal Assessment: 50 Marks**

Course Objectives	
1	To understand the Importance of Quality in construction industry.
2	To study different aspects of quality control.
3	To have knowledge about Total Quality Management (TQM) in construction.
4	To study safety aspects in construction industry.
5	To understand the importance of safety awareness and training on construction sites.

Unit Number	**Details**	**Hours**
I	**Introduction:** Definition and Evolution Quality, Quality Guru's and their teachings- Deming, Juran, Philip Crosby, Importance of Quality in Construction industry. **Quality Management:** Concept of Quality Control, Quality Assurance, Quality Management and Total Quality Control, Difference between QC and QA, Designing of quality manuals, checklists and inspection reports, installing the quality assurance system, monitoring and control.	8
II	**TQM:** Total Quality Management (TQM), Need for TQM in construction industry. Development of quality circles, quality inspection team, inspection reports, monitoring and control, Advantages, barriers, principles, steps in implementation, seven types of construction defects. Determining cost of poor quality including hidden cost. Quality functions deployment (QFD). Importance of third party quality audits. Introduction to the Six Sigma concept.	8
III	**Construction Safety Management:** Role of various parties, duties and responsibilities of top management, site managers, supervisors etc. role of safety officers, responsibilities of general Employees, safety committee. Writing safety manuals, preparing safety checklists and inspection reports.	8
IV	**Safety in construction operations:** Safety of accidents on various construction sites such as buildings, dams, tunnels, bridges, roads, etc. safety at various stages of construction. Prevention of accidents. Safety measures. Safety in use of construction equipment e.g. vehicles, cranes, hoists and lifts etc. safety of scaffolding and working platforms. Safety while using electrical appliances. Explosives used.	8
V	**Safety Awareness and Training:** Safety awareness program. Study of safety policies, methods, equipment, PPE, First aid onsite, training provided on any ISO approved construction Company, safety training, incentives and monitoring, safety in offices, working on sites of high rise construction, deep excavation.	8
	Total	**40**

Course Outcomes	
1	Students will be able to understand the Importance of Quality in construction industry.
2	Students will know the different aspects of quality control.
3	Students will have the knowledge about Total Quality Management (TQM) in construction.
4	Students will able to understand safety aspects in construction industry.
5	Students will know the importance of safety awareness and training on construction sites.

Reference Books	1. Projects – Planning, Analysis, Selection, Implementation and Review, PrasannaChandra, Tata McGraw Hill Publications. 2. Construction Management and Planning – B. Sengupta and H. Guha, Tata McGrawHill Publications. 3. Civil Engineering Project Management – C. Alan Twort and J. Gordon Rees, ElsevierPublications. 4. Total Project Management – The Indian Context – P. K. Joy, MacMillian Publications. 5. Principles of Construction Management by Roy Pilcher(McGraw Hill). 6. International Standards Organization – ISO 9001 and ISO 9004. 7. Mantri Handbook – A to Z of Construction – Mantri Publications 8. Juran's Quality Handbook – Joseph M. Juran, A. Blanton. Godfrey – Mcgraw Hill International Edition (1998) 9. Quality Control and Total Quality Management, P.L.Jain, Tata Mcgraw Hill Publ. 10. Construction safety manual published by National Safety Commission of India. 11. Safety Management in Construction Industry – A manual for project managers. NICMAR Mumbai. 12. Construction Safety Handbook – Davies V.S.Thomasin K, Thomas Telford, London. 13. ISI for safety in Construction – Bureau of Indian Standrads. 5. "Safety management" –Girimaldi and Simonds, AITBS, New Delhi.

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School: School of Engineering and Technology	**Programme: B.Tech Civil Engineering**
Year : Fourth Year	**Semester - VII**
Course: Elective – Elective-I(Remote Sensing & GIS)	**Course Code:YCE707**
Theory: 3Hrs/Week	**Max. University Theory Examination: 50 Marks**
Max. Time for Theory Exam.: 3 Hrs.	**Continuous Internal Assessment: 50 Marks**

Objectives	
1	To introduction to the principles of geographic information systems (GIS) and remote sensing, and the application of these techniques to the environmental and life sciences.
2	To structure and format of GIS data, data input and transformation, database compilation, and the use of search criteria and spatial modelling to carry out suitability mapping.

Unit Number	**Details**	**Hours**
I	**Introduction to Remote Sensing** - Fundamentals of Remote Sensing (RS), Electromagnetic energy and RS, Sensors, platforms and RS data acquisition systems, Type of RS -multispectral, hyperspectral, thermal sensors, LIDAR, Image Resolution, Radiometric aspects of RS data, Geometric aspects of RS data.	6
II	**Image Processing & Interpretation** - Image enhancement and visualization, Image interpretation techniques – visual image interpretation, Elements of image interpretation.	6
III	**Introduction to Geographic Information System (GIS)** - -Introduction to GIS - Definition & meaning, various applications to engineering fields, GIS vs. Maps – Advantages and disadvantages, Data Models / Structure for GIS –Vector, Raster, etc. Raster versus Vector - advantages and disadvantages, Vector and Raster based data, Data visualization, GIS Components - Hardware and software	6
IV	**Map Projection & Transformations** - Map Projections / spatial referencing - Geoid/Datum/Ellipsoid, Coordinate Systems, Classification of map projections - Polyconic, LCC, Mercator, UTM projections, etc., Map Projections Transformation	6
V	**GIS Applications** Data based creation for urban area analysis, Urban information system for resources and integrated developing planning, Urban modeling, GIS application case studies, Open source GIS – Introduction, advantages & disadvantages, licensing policy, open source GIS software.	6
	Total	**30**

Outcomes	
1	Understanding Remote Sensing and its use in planning.
2	Students will learn GIS as a planning tool.
3	Students will carry out spatial analysis using GIS.
4	Identify specific data and methodologies for effective mapping and evaluation of natural resources.
5	Selecting the type of remote sensing technique / data for required purpose.

Reference Books	1. Lillesand T.M. and Kiefer R.W. "Remote sensing and Image interpretation", John Wiley & Sons, New York, 2000. 2. John R. Jensen, Introductory Digital Image Processing: A Remote Sensing Perspective, 2nd Edition, 1995. 3. Sabins, F.F.Jr, Remote Sensing Principles and Image interpretation, W.H.Freeman & Co, 1978 4. Keith P.B. and Thompson et al. "Remote sensing and water resources management", American Water Resources Association, Urbana Illinois.

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School: School of Engineering & Technology	**Programme: Civil Engineering**
Year: Fourth Year	**Semester -VII**
Course: Elective-II (Advanced Geotechnical Engineering)	**Course Code: YCE708**
Theory: 3Hrs/Week	**Max. University Theory Examination: 50 Marks**
Tutorial :	**Continuous Internal Assessment: 50 Marks**
Max. Time for Theory Exam.:3 Hrs.	

Objectives	
1	To give advanced knowledge of mechanics governing the behaviour of soils to students so that they are able to understand the behaviour of foundations and structures constructed on them.

Unit Number	Details	Hours
I	Fundamental aspects of soil mechanics, characteristics of soil, particulate nature, Weight volume relationship. Soil structure; Clay mineralogy; Soil-air-water interaction; Consistency; Soil compaction; Concept of effective stress.	6
II	Mohr circle and shear strength Stress at a point, failure criteria, the Mohr failure hypothesis, Mohr Coulomb failure criterion, shear strength measurement	9
III	Stress path, Stress path parameters, total and effective stress paths in CU triaxial test, application of stress path in engineering practice, common types of triaxial tests and their stress paths, Skempton's pore pressure equation	9
IV	Shear strength of sands and clays Angle of repose of sands, behaviour of saturated sands during drained and undrained shear, stress-deformation and strength characteristics of saturated clayey soils, use of UU, CU and CD tests in engineering.	9
V	Stability of slopes Infinite slopes and translation slides, finite slopes – forms of slip surface, limiting equilibrium method, total stress and effective stress method of analysis, friction circle method, Taylor's stability number, Bishop's method of stability analysis, use of stability coefficients	9
	Total	**42**

Course Outcomes	
1	Apply the basic concepts of Soil Mechanics to carry out professional engineering activities in the field.
2	Understand the failure of soil in shear
3	Apply stress path in engineering practice.
4	Understand the concept of shear strength
5	Analyze stability of slopes

Reference Books	1. Bolton, M.D. "A guide to soil mechanics", Universities Press 2003. 2. Britto, A.M. & Gunn, M.J. "Critical state soil mechanics via finite elements", Ellis Horwood Ltd (John Wiley & Sons). 3. Craig, R.F. "Craig's soil mechanics", Spon Press 2004. 4. Das, B.M. "Principles of geotechnical engineering", Thomson Books 2004. 5. Holtz, R.D. & Kovacs, W.D. "An introduction to geotechnical engineering", Prentice Hall, 198. 6. Lambe, T.W. & Whitman, R.V. "Soil Mechanics", John Wiley & Sons, 1979. 7. Mitchell, J.K. & Soga, K. "Fundamentals of soil behaviour", John 8. Wiley & Sons, 2005. 9. Ranjan, Gopal & Rao, A.S.R. "Basic and applied soil mechanics", New Age International Pvt. Ltd., 2004. 10. Wood, D.M. "Soil Behaviour and critical state soil mechanics", Cambridge University Press

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School: School of Engineering and Technology	**Programme: B.Tech Civil Engineering**
Year: Fourth Year	**Semester: VII**
Course: Elective-II (Earthquake Engineering)	**Course Code:YCE709**
Theory: 3 Hrs/Week	**Max. University Theory Examination: 50 Marks**
Max. Time for Theory Exam.: 3 Hrs	**Continuous Internal Assessment: 50 Marks**

Course Objectives	
1	To study the importance of the earthquake engineering.
2	To study the different types of dynamic loads, concept of damping, and analysis of SDOF system subjected to different types of dynamic loads.
3	To calculate frequency and mode shapes for the MDOF system, analysis of MDOF system subjected to different types of dynamic loads
4	To study the causes of earthquake, types of earthquakes, seismic waves, structure of earth, and measurement of earthquake magnitude and intensity.
5	To study the concept of Response Spectrum, ground motion parameters, characteristics of response spectrum, and various methods to construct response spectrum

Unit Number	**Details**	**Hours**
I	Engineering seismology: Earthquake, causes of earthquake, earthquakes and seismic waves, elastic rebound theory, seismic zoning maps of india, scale and intensity of earthquakes, seismic activity, measurements of earth quakes, seismometer, strong motion accelerograph of ground motion, parameters , analysis of earthquakes waves, Earthquake motion, Introduction to Tsunami. ,	**8**
II	Vibration of structures under ground motion: Elastic vibration of simple structures, free vibrations of simple structures, Steady state forced vibrations, response spectrum representations; relation between the nature of the ground motion and structural damage.	**8**
III	Earthquake analysis: Methods of analysis, selection of analysis, equivalent lateral force procedure seismic base shear, seismic design co-efficient, vertical distribution of seismic forces and horizontal shear, twisting moment, overturning moment, vertical seismic load and orthogonal effects lateral deflection, P-Δ characteristics effect, earthquake records for design, factors affecting accelerogram characteristics. Introduction to various softwares used for earthquake analysis of structures.	**8**
IV	Guidelines for earthquake resistant design, earthquake resistant masonry buildings, Design consideration Earthquake resistant design of R.C.C. buildings, material properties, lateral load analysis, capacity based design and detailing- rigid frames, Shear walls. Detailing of RCC and masonry buildings, provisions of IS- 13920,IS – 4326	**8**

V	Fundamentals of seismic planning: selection of materials and types of construction form of superstructure, framing systems and seismic units, devices for reducing Earthquake loads. Vibration control techniques: vibration control, tuned mass dampers, principles and application, basic concept of seismic base isolation, various systems- case studies, Important structures.	8
	Total	**40**

Course Outcomes	
1	Students will have thorough knowledge of general principles related to earthquake.
2	Students will be able to analyse SDOF system subjected to different types of dynamic loads.
3	Students will be able to analyse MDOF system subjected to different types of dynamic loads.
4	Students will be able to analyse the structure subjected to ground motion and calculate earthquake forces.
5	Students will have thorough knowledge of Vibration control techniques.

Reference Books:	1. Pankaj Agarwal & Manish Shrikande - Earthquake Resistant Design, Printice Hall Publishers. 2. Minoru Wakabayashi- Design of earthquake resistant structures. 3. A.K.Chopra, - Strucutural Dynamics for Earthquake Engineering", Prentice – Hall. 4. R.W.Clough and Penzium, - Dynamics of structures. Mc Graw – Hill, 2nd edition. 5. N.M Newmark and E.Rosenblueth, - Fundamentals of Earthquake Engineering, Prentice hall. 6. David Key, - Earthquake design practice for buildings. Thomas Telford, London. 7. R.L. Wegel, - Earthquake Engg; Prentice Hall 12nd edition.

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School: School of Engineering and Technology	**Programme: B.Tech Civil Engineering**
Year : Fourth Year	**Semester -**
Course: Elective II – (Rural Planning & Village Development)	**Course Code: YCE7010**
Theory: 3Hrs/Week	**Max. University Theory Examination: 50 Marks**
Max. Time for Theory Exam.: 3 Hrs.	**Continuous Internal Assessment: 50 Marks**

Objectives	
1	To equip students with the Tools and Techniques of Participative and Integrated District Planning.
2	To expose students to the Rural Development and Management Issues, Initiatives and Strategies.
3	To Study Concepts of planning for rural settlements.

Unit Number	Details	Hours
I	**Introduction** - Meaning and Scope and overview of rural development: Historical perspective – Rural Development Programmes in India.; Rural Area Planning – National policies and programmes of rural development in India, Five year plans on rural planning and development, Rural settlements, typology, structure, spatial significance in metro-regions and interior areas,	8
II	**Rural Institutions and Organizations -** Rural bank, Co-operatives, marketing and public administration Zila Parishad, Block Samity and Gram-Panchayat, powers and function of recently proposed Panchayat Raj Bill. Rationale of principles and techniques of rural planning and development, norms, standard preferences and strategy for rural areas, Improvement of infrastructure and augmentation of housing stock.	8
III	**Technology in Rural Development** - ICT in rural development, Rural Information system, Weather forecasting, disaster minimization, market information, etc. E-Panchayats, energy efficient technologies, Rural energy issues, renewable and alternative sources of energy	8
IV	**Classification of rural settlement & VDP** –Contents of VDP. Other rural region plans (Tribal Sub Plan and Weaker Sector Plan)	8
V	**Schemes for Rural Development -** Rural Infrastructure Development: Bharat Nirman – A business plan for rural infrastructure, Rural Building Centers, PMGSY, IAY, Rajiv Gandhi Technology Mission, Central Rural Sanitation Programme, PURA. Rural Employment Schemes, SAGY, Unnat Bharat Abhiyan	8
	Total	**40**

Outcomes	
1	Students will learn importance of rural aspect in planning
2	Students will learn about urban-rural nexus in planning.
3	Students will learn integrated planning approach
4	Students will learn how to link various government schemes in village development.

Reference Books	1. CHATTOPADHYAY B.C., "Rural Development Planning in India", S. Chand & Co, New Delhi. 2. H.R. HYE, "Integrated Approach to Rural Development", Sterling Publishers, New Delhi. 3. S.M. SHAH, "Rural Development Planning and Reform", Abhinal Publ., New Delhi. 4. H. RAMCHANDRAN, "Village Clusters and rural Development", Concept Publ. Co., New Delhi. 5. GoI Constitution (73rd & 74th Amendment) Act 1992, GoI, New Delhi. 6. Planning Commission Manual of Integrated District Planning. Various Five Year Plans (1st to 12th) Planning Commission, New Delhi

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School: School of Engineering & Technology	**Programme: B.Tech[Civil Engineering]**
Year : Final Year	**Semester - VII**
Course: Elective-II (Optimization Techniques)	**Course Code:YCE7011**
Theory: 3Hrs/Week	**Max. University Theory Examination: 50 Marks**
Max. Time for Theory Exam.: 3 Hrs	**Continuous Internal Assessment: 50 Marks**

Objectives	
1	To introduce various methods for solving optimization problems
2	To educate the basic concepts and advancements of various linear and non-linear programming techniques
3	To introguce various methods for solvig transportation problems, assignment problems and integer programming problems
4	To discuss the dynamic programming method and its applications in various design problems
5	To discuss the basic concepts of genetic algorithm (GA) and its novel variants like Genetic Programming (GP) and Multi-gene Genetic Programming (MGGP)

Unit Number	**Details**	**Hours**
I	Introduction and basic concepts: Historical development, Idea of engineering applications of optimization, Objective function, Constraints, Classification of optimization algorithms, Modelling of problems, principle of modelling. Linear programming: Standard and Canonical forms of linear programming problem (LPP), Formulation of LPP, Graphical solution, Simplex method, Big-M method, Revised simplex method, Duality theory, Dual simplex method.	9
II	Transportation problems: Structure of the problem, Efficient transportation pattern, Northwest Corner rule, Least cost method, Penalty cost method, Stepping stone method. Assignment problems: Hungarian method, Integer Programming: Branch and Bound algorithm.	9
III	Non-linear programming: Non-linear programming, Unconstraint optimization, Fibonacci and Golden Section Search method. Constrained optimization with equality constraint: Lagrange multiplier, Projected gradient method, Constrained optimization with inequality constraint: Kuhn-Tucker conditions, Quadratic programming.	9
IV	Dynamic Programming (DP): Sequential optimization, Representation of multistage decision process, Recursive equations – Forward and backward recursions, Computational procedure in DP, Discrete vs. continuous dynamic programming. Dynamic programming applications: Problem formulation and applications for the design of continuous beam, Optimal geometric layout of a truss, Water allocation as a sequential process, Capacity expansion.	9
V	Genetic Algorithm (GA): Introduction to GA, Difference and similarities between GA and other traditional methods, Basic operations of GA (reproduction, crossover and mutation). Genetic Programming (GP) and Multi-gene Genetic Programming (MGGP): Introduction, Advantages of GP and MGGP over statistical techniques, Working principles, Gene structure, Gene	9

	formation procedure, Optimum values of algorithm parameters, Model formulation and test for optimality, Model validation, and Sensitivity analysis.	
	Total	**45**

Course Outcomes	
After successful completion of the course, students should be able to:	
1	Understand importance of optimization for industrial process management.
2	Apply basic concepts of mathematics to formulate an optimization problem.
3	Apply efficient computational procedures to solve optimization problems.
4	Analyze variety of performance measures for optimization problems.
5	Use software tools (like MATLAB) to implement various optimization techniques.

Text Books	10. Introduction to Optimum Design, J. S. Arora, Elsevier, 2nd Edition, 2004 11. Optimization for Engg. Design: Algorithms & Examples, K. Deb,Prentice Hall India, 2006.
Reference Books	1. Engineering Optimization: Theory & Practice, S. S. Rao, New Age International (P) Ltd, 3rd Edition, 1996, Reprint: June, 2008 2. Multi-Objective Optimization Using Evolutionary Algorithms, K. Deb, John Wiley, 2003 3. Operations Research, F.S. Hiller, G.J. Lieberman, Eighth Edition, McDraw Hill 4. Operations Research by Pravakar Pai, Oxford University Press.
E-Resources	1. https://nptel.ac.in/courses/105108127/ 2. https://nptel.ac.in/courses/111105039/ 3. https://ocw.mit.edu/courses/sloan-school-of-management/15-093j-optimization-methods-fall-2009/lecture-notes/

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School: School of Engineering and Technology	**Programme :Civil Engineering**
Year : Final Year	**Semester: VII**
Course: Environmental Engineering Lab -II Lab	**Course Code: YCE711**
Practical: 2 Hrs./Week	**Term Work:25**
	Practical/Oral: 25 Marks

Practical Objective	
1	To find out amount of solids present in a volume of waste water sample.
2	To Calculate chlorides present in a given waste water sample.
3	To calculate SVI & salt content present in a sample of sewage
4	To get acquainted with various DO, COD & BOD values as per IS specifications.
5	To understand the basic waste water unit operations based on the type of impurities.

Sr. No.	**Description**
1	Determination of Solids -Total solids, suspended solids, and volatile solids, settle able solids & non settle able solids.
2	Determination of chlorides
3	Determination of Sludge Volume Index (SVI) of sewage sample
4	Determination of Dissolved oxygen in sample of sewage.
5	Determination of Bio-Chemical Oxygen Demand (BOD) of sewage sample.
6	Determination of Chemical Oxygen Demand (COD) of sewage sample.
7	Determination of Electrical Conductivity of sewage sample.
8	Visit to Municipal waste water treatment plant / Industrial Effluent treatment plant & submission of field report.

Practical Outcomes
Students will able to develop complete understanding between theory & practical applications related to treatment of waste water engineering.

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School: School of Engineering and Technology	**Programme: B.Tech. Civil Engineering**
Year: Fourth Year	**Semester - VII**
Course: Reinforced Cement Concrete Lab-II	**Course Code:YCE712**
Practical: 2Hrs/Week	**Max. University Theory Examination: 25 Marks**
Max. Time for Practical Exam.: 3 Hrs	**Continuous Internal Assessment: 25 Marks**

Practical Objective	
1	To analyse and design different reinforced cement concrete members.
2	To draw details of the designed reinforced cement concrete members.

Term Work

Term work shall be based on the syllabus of Reinforced Cement Concrete II. It consists of

1. Assignment on Loss calculation
2. Assignment on stress calculation.
3. Design and detailing of design of Prestressed girder.
4. Assignment on Earthquake force calculation.
5. Design and detailing of frame (beam only).
6. Design and detailing of retaining wall for any type of loading.
7. Design and detailing combined footing.
8. Report on Earthquake analysis of frame by software or computer program
9. Two site visit reports one each of R.C.C. and another P.S.C.

Minimum five full imperial sheets based on four projects of RCC and one project of pre-stressed concrete. Oral Examination will be based on above term work.

Course Outcomes	
1	Students will be able to analyse and design different reinforced cement concrete members
2	Students will be able to draw details of the designed reinforced cement concrete members.

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School: School of Engineering and Technology	**Programme: B.Tech. Civil Engineering**
Year: Fourth Year	**Semester - VII**
Course: Project Stage-I	**Course Code:YCE713**
Practical: 2 Hrs/Week	**Max. University Theory Examination: 25 Marks**
Max. Time for Practical Exam.: 3 Hrs	**Term work: 25 Marks**

Course Objectives
To identify the topic by reviewing latest literature (Journal/ Conferences/ Articles etc.)
Based on literature review carried out on specific topic, setting objectives and developing methodology to carryout project work by experimental / analytical approaches.

Particulars

The Project work will start in semester VII and should involve scientific research, collection and analysis of data, determining solutions bringing out the individuals contribution. Project Stage-I will have mid semester presentation which will include identification of the problem based on the literature review on the topic referring to latest literature available. Project stage-I End semester presentation will include setting objectives on the topic referring to latest literature available and clearly defining the methodology to be adopted for completing experimental/analytical work.

A committee consisting of at least two faculty members including supervisor (preferably specialized in the respective stream) shall continuously assess the presentation and award marks to the students based on merit of topic of presentation at mid and End of semester.

Termwork assessment will be carried out by the respective supervisor based on the progress of work, quality of submitted report, documentation of literature review etc.

Each project can be undertaken by a group not exceeding 05 students.

Course Outcomes

The student will be able to identify topics in areas of their interest, also take up critical review of literature on the chosen topic so as to decide topic for carrying out independent project work by experimental / analytical approaches. Student will be able to do documentation and presentation of the review.

At the end of the course, students will demonstrate the ability to identify problems related to Civil Engineering based on latest literature review.

Students will be able to identify appropriate techniques, to solve the problem.

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School of Engineering & Technology

Course Structure for Undergraduate Programme of Bachelor of Civil Engineering

(B. Tech.)

Semester-VIII

Sr. No.	Course Code	Theory Paper/Practical	Teaching Scheme (Hrs./Week)				Credits	Duration University Exam. (Hrs.)	CIA	Examination Scheme			Total Marks
			L	P	T	Total				T	P/O	TW	
01	YCE801	Quantity Surveying, Contracts and tenders	03	02	01	06	05	3	50	50	--	50	150
02	YCE802	Highway Engineering	03	02	01	06	05	3	50	50	--	50	150
Elective-III			03	--	--	03	03	3	50	50	--	--	100
03	YCE803	Numerical Methods											
04	YCE804	Construction Management											
05	YCE805	Solid Waste Management											
06	YCE806	Hydropower Engineering											
07	YCE811	Project Stage – II	--	06	--	06	03	3	--	--	50	100	150
		Total	**09**	**10**	**02**	**21**	**16**		**150**	**150**	**50**	**200**	**550**

CIA1: Home Assignment
CIA2: Mid Term Examination
CIA3: Seminar PPT
CIA4: Research Based Activity

CIA1	CIA2		CIA3	CIA4
10%	**A -10%**	**B-10%**	**10%**	**10%**

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Item No.: 31-B-589/18 - G – Consideration and approval of the syllabus of Course "Quantity Surveying, Contracts and tenders", "Highway Engineering"," Numerical Methods"," Construction Management", "Solid Waste Management"," Hydropower Engineering"," Project Stage – II" of Bachelor of Technology in Civil Engineering Semester –VII" , A.Y. 2018-19

Note: The syllabus of the course namely "Quantity Surveying, Contracts and tenders", "Highway Engineering"," Numerical Methods"," Construction Management", "Solid Waste Management"," Hydropower Engineering"," Project Stage – II" Semester –VIII as approved by the Board of Studies in Civil Engineering is as follows:

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School: School of Engineering & Technology	**Programme: B.Tech[Civil Engineering]**
Year :Fourth Year	**Semester -VIII**
Course: Quantity Surveying, Contracts & Tenders	**Course Code: YCE801**
Theory: 3Hrs/Week , 1Hr./Week Tutorial, 02Hrs/Week Practical	**Max. University Theory Examination: 50 Marks**
Max. Time for Theory Exam.: 3 Hrs	**Continuous Internal Assessment: 50 Marks** **Term work: 50 Marks**

Objectives	
1	To prepare preliminary estimate
2	To prepare the tender document
3	To understand the concept of rate analysis
4	To Estimate the bill of quantities

Unit Number	Details	Hrs
I	**Introduction**: Importance and purpose of the subject, Units of measurement as per I.S.1200. Items of work and Description of items of work, administrative approvals, technical sanction, preliminary estimates. objectives, and its methods Earthwork estimates in road, hill roads and canals, mass haul curves, methods of consumptions of Earthwork.	9
II	**Detailed estimates**, Objects, importance, accuracy. Methods of detailed estimates, Detailed estimates of load bearing and framed structures. Calculation of reinforcing steel with Bar bending Schedule.	9
III	**Tenders and Contracts:** Method of carrying out works, tender notice, acceptance of tender, essentials of contract, type of contracts, contract documents, land acquisition act, Legal aspects of various contract provisions, Arbitration. **Rate Analysis**: Introduction, Purpose and principles of CSR, Factors affecting analysis of rates, labour guidelines from National Building Organization, market rates of materials and labour, Rate analysis of major items of work.	9
IV	**Specifications**: IS 1200 Introduction, Purpose and principles of specifications writing, Types of specifications, writing and developing detailed specifications of Important items of building and road work. **Cost Accounting:** Various methods, classification of cost, direct and indirect charges, and distribution of overheads, M.A.S. Account, issue rates and stores Account.	9
V	**Valuation:** - Purpose of valuation, Factors affecting property price and cost, Types of Value. Real Estate, Tenure of land, Free hold and lease hold, sinking fund, Depreciation, and its methods, Capitalised value, Methods of valuation, Net & Gross income, Rent fixation.	9
	Total	**45**

Quantity Surveying, Contracts & Tenders Lab

Sr. No.	Description
NOTE:	***Minimum 8 practical assignment based on :***
1	Preliminary estimate using Plinth area method.
2	Detailed estimate of Load bearing structure & Detailed estimate of Frame structure.
3	Calculation of steel with Bar bending Schedule.
4	Detailed estimate of earthwork of road for Approximate 1km length.
5	Draft Detailed specification for 8 major items.
6	Analysis the unit rate of 8 major items of work contained.
7	Draft a short tender notice for proposed work.
8	Calculation of annual and total Depreciation and book value of the end of each year.
9	Fixation of standard rent of property.
10	Market survey for material and labour rates for various items.
11	Detailed planning and estimate of plumbing work.
12	Detailed estimate of building using estimate software.
13	Arbitration Case Study.

Course Outcomes	
1	Prepare the preliminary estimate for administrative approval & technical sanction for a civil engineering project.
2	Write the specification of the works to be undertaken, prepare the tender documents, fill the contracts and make use of knowledge of different contract submission & opening in awarding the work to the contractor.
3	Use the technique of Rate analysis in estimating the exact cost of material & manpower and hence the entire project.
4	Use the concept of SD, EMD, MAS, Running Bill, Final Bill during the entire project.
5	Estimate the bill of quantities using different techniques of preliminary & detailed estimation of buildings & roads.

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Reference Books	1. Estimating and Costing by Dutta 2. Estimating & Costing by Chakraborty 3. Valuation by Roshan Namavati 4. Philosophy of Valuation. – S. S. Rathore.

School: School of Engineering and Technology	**Programme: B.Tech. Civil Engineering**
Year: Fourth Year	**Semester – VIII**
Course: Highway Engineering	**Course Code:YCE802**
Theory: 3Hrs/Week & 1Hr./Week Tutorial 2Hrs/Week Practical	**Max. University Theory Examination: 50 Marks**
Max. Time for Theory Exam.: 3 Hrs	**Continuous Internal Assessment: 50 Marks** **Term work: 25 Marks**

Objectives	
1	To understand the road network and planning.
2	To understand and design highway geometrics.
3	To enable the students to have a strong analytical and practical knowledge of traffic flow.
4	To study various highway materials and their suitability under different conditions.
5	Analysis of various stresses and design of highway pavement and its construction.

Unit Number	Details	Hours
I	**Introduction to Highway Engineering:** Characteristics of road transport; Scope of Highway Engineering; Highway planning- Classification of roads, roads patterns; Highway planning in India.	6
II	**Alignment & Geometric design of Highways.** Highway Alignment- requirement, factors controlling , aligning roads on hilly areas, Engineering surveys ; Highway cross section elements; Sight distance; Design of horizontal alignment; Design of vertical alignment.	10
III	**Traffic Engineering** Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control devices; Accident studies, types of road intersections; parking studies; highway lighting.	10
IV	**Pavement Design** **A. Materials-** Soil, Aggregates, Bituminous Binders & Paving Mixes, Portland cement and cement concrete. **B. Flexible Pavement-** Introduction, Components and there function, factors affecting design and performance, design guidelines for flexible pavements as per IRC 37-2012. **C. Rigid Pavement-** rigid pavements- component and functions; factors affecting design; design guidelines for concrete pavements as per IRC 58-2015 (steps only); joints in CC pavements.	12
V	**A. Highway Construction** General features of highway construction; Embankment and subgrade; Excavation of earth; Construction of flexible pavement, Construction of cement concrete pavement.	7

	B. Highway Maintenance: Pavement failures- causes, symptoms and remedies. Routine maintenance, periodic maintenance, special repairs.	
		Total **45**

Highway Engineering Lab

Expt. No.	Title of Experiment
	A. Practical's: **I. Tests on Aggregate (Any Five) :** 1. Aggregate Impact Value Test 2. Aggregate Crushing Strength Test 3. Los Angeles Abrasion Test 4. Shape Test (Flakiness Index and Elongation Index) 5. Specific Gravity and Water Absorption Test. 6. Stripping Value Test
	II. Tests on Bitumen (Any Five): 1. Penetration Test 2. Ductility Test 3. Viscosity Test (Tar Viscometer) 4. Softening Point Test 5. Flash Point & Fire Point Test 6. Specific Gravity Test 7. Bitumen Extraction Test
	III. Tests on Aggregate Bitumen Combined: 1. Marshall Stability Test **IV. Tests on Soil Subgrade:** 1. California Bearing Ratio Test (CBR Test)
	B. Technical visits to: 1) Road Construction and/or RAP Site 2) Hot Mix Plant with detailed report

Course Outcome	
1	Student will be able to understand the planning of highway networks.
2	Student will be able to understand and design highway geometrics.
3	Students will be able to define and analyze traffic flow characteristics.
4	Design flexible and rigid pavements.
5	Understand the principles of construction and maintenance of highways

Reference Books	1.Highway engineering – S.K. Khanna, C.E.G. Justo & A. Veeraragavan, Nem Chand and Brothers, Roorkee 2 Huang, Y.H. Pavement Analysis and Design, Pearson Prentice Hall, New Jersey, USA, 2004. 3. Principles and practices of Highway engineering –Dr. L.R. Kadiyali, Khanna Publishers Delhi. **Codes:** 1. I.S. 1201 TO 1220-1978, IS 73, IS 2386 PART I to V 2. I.R.C. 58- 2015, IRC 37-2012 3. I.R.C.82-1982

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School: School of Engineering & Technology	**Programme: B.Tech Civil Engineering**
Year :Fourth Year	**Semester – VIII**
Course: Elective-I (Numerical Methods)	**Course Code:YCE803**
Theory: 3 Hrs/Week	**Max. University Theory Examination: 50 Marks**
Max. Time for Theory Exam.: 3 Hrs	**Continuous Internal Assessment: 50 Marks**

Course Objectives
The objective of this course is to provide students with fundamental knowledge of numerical methods and how to apply this knowledge to the solution of structural engineering problems.

Unit Number	Details	Hours
I	Fundamentals of numerical methods; Error analysis, Curve fitting; Interpolation and extrapolation. Eigen value problems. Solution of structural engineering problem using eigen value concept.	10
II	Root finding. Bisection Methods, False position Methods, Newton – Raphson Methods. Newton's forward and backward differences formulae to compute first and higher order derivatives – The Trapezoidal rule – Simpson's rule	10
III	Numerical Solutions Of Ordinary Differential Equations Solution by Taylor's series – Euler's method – Improved and modified Euler method – Runge-Kutta methods of fourth order (No proof)	10
IV	Regression Analysis Least square method Lagranges method, Spline interpolation .	6
V	Finite Difference scheme - Implicit & Explicit scheme. Regression Analysis Computer algorithms; Numerical solution for different structural problems .	6
	Total	**42**

Course Outcomes	
1	Students will be able to use Eigen value concept in engineering problem solution.
2	Students will be able to use ordinary differential equations concept in engineering problem solution
3	Students will be able to use Regression analysis concept in engineering problem solution.
4	Students will be able to solve different structural problems using numerical solution

Reference Books	1. George W. Collins, II, Fundamental Numerical Methods and Data Analysis. 2. Martin J. Mohlenkamp, Todd Young, Introduction to Numerical Methods and Matlab Programming for Engineers 3. Elements of Matrix and Stability Analysis of Structures by Manicka Selvam

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School: School of Engineering and Technology	**Programme: Civil Engineering**
Year : Second Year	**Semester - VIII**
Course: Elective-I (Construction Management)	**Course Code: YCE804**
Theory: 3 Hrs/Week	**Max. University Theory Examination: 50 Marks**
Max. Time for Theory Exam.: 3 Hrs	**Continuous Internal Assessment: 50 Marks**

Course Objectives	
1	To understand the role of construction industry in the country.
2	To study construction scheduling, work study and work measurement.
3	To have knowledge about labour lawas and financial aspects of the construction industry.
4	To study risk management and value engineering.
5	To understand the material management and human resource management concepts in constuction industry.

Unit Number	Details	Hours
I	**Overview of construction sector:** Role of construction industry in infrastructure development, components of infrastructure sector, construction industry nature, characteristics, size, structure, role in economic development, construction management – necessity, applications, project management consultants – role, types, selection and appointment process, project overruns and means to combat them, project monitoring and reporting systems, managerial correspondence and communications, generation and identification of project investment opportunities.	8
II	**Construction scheduling, work study and work measurement:** **Construction project scheduling –** purpose, factors affecting scheduling, time as a control tool, work breakdown structure, project work breakdown levels, line of balance technique, repetitive project management **Work study and work measurement-** Definition, objectives, basic procedure of work study, symbols, activity charts, string diagrams, time and motion studies.	8
III	**Labour laws and financial aspects of construction projects:** Need and importance of labour laws, study of some important labour laws associated with construction sector- workman's compensation act 1923, Building and other construction workers act 1996, child Labour act, interstate migrant workers act **Financial aspects of construction projects-** Capital investments: importance and difficulties, means of finance, working capital requirements, project cash flow projections and statements, project Balance sheet, profit loss account statements.	8
IV	**Elements of risk management and value engineering** **Risk management-** Introduction, principles, types, origin, risk control, use of mathematical models: sensitivity analysis, break even analysis, simulation analysis, decision tree	8

	analysis, risk identification, analysis and mitigation of project risks, role of Insurance in risk management. **Value engineering-** Meaning of value, value analysis, value engineering and value management, Energy resources, consumption patterns, energy cost escalation and its impact.	
V	**Materials management and human resource management** **Materials management-** Materials flow system, role of materials management in construction management and its linkage with other functional areas, vendor networking, Buyer-seller relationships, EOQ model and its variations, material codification and classification, concept of logistics and supply chain management. **Human resource management-** Human Resource in Construction Sector, Staffing policy and patterns, Human Resource Management Process, Human Resource Development Process, Performance Appraisal and Job Evaluation, Training and Career planning.	8
	Total	**40**

Course Outcomes	
1	Students will understand the role of construction industry in the country.
2	Students wilol be able to carryout construction scheduling, work study and work measurement.
3	Students will have knowledge about labour lawas and financial aspects of the construction industry.
4	Students will be able to carryout risk management and know the concept of value engineering.
5	Students will be able to understand the material management and human resource management concepts in constuction industry.

Reference Books	1. Projects – Planning, Analysis, Selection, Implementation and Review, Prasanna Chandra, Tata McGraw Hill Publications. 2. Construction Management and Planning – B. Sengupta and H. Guha, Tata McGraw Hill Publications. 3. Civil Engineering Project Management – C. Alan Twort and J. Gordon Rees, Elsevier Publications. 4. Total Project Management – The Indian Context – P. K. Joy, MacMillian Publications. 5. Materials Management–Gopalkrishnan & Sunderasan,Prentice Hall Publications. 6. Human Resource Management – Biswajeet Pattanayak, Prentice Hall Publishers. 7. Labour and Industrial Laws – S. N. Mishra, Central Law Publications. 8. Principles of Construction Management by Roy Pilcher (McGraw Hill).

Sandip University

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School: School of Engineering & Technology	**Programme: B.Tech [Civil Engineering]**
Year : Final Year	**Semester - VIII**
Course: Elective-I Solid Waste Management	**Course Code: YCE805**
Theory: 3Hrs/Week	**Max. University Theory Examination: 50 Marks**
Max. Time for Theory Exam.: 3Hrs	**Continuous Internal Assessment: 50 Marks**

Objectives	
1	To study the functional elements of SWM.
2	To impart students with the skill of design and operation of SWM
3	To understand basics of biomedical waste management system.

Unit Number	Details	Hours
I	Solid Waste, Solid Waste Management & Indian Scenario - Solid Waste: Sources, Types, Composition, Quantities, Physical, Chemical and Biological properties. Functional elements, Potential of disease, Nuisance and other problems. Solid Waste Management: Objectives, Functional elements, Environmental impact of mismanagement, Factors affecting. Indian Scenario: Present scenario and measures to improve system for different functional elements of solid waste management system, Legislative provisions ,Economy and financial aspects of solid waste management	8
II	Solid Waste Generation Rate & Transfer Station Solid Waste Generation Rate: Definition, Typical values for Indian cities, Factors affecting. Storage and collection: General considerations for waste storage at source, Collection components, Types of collection systems. Transfer station: Meaning, Types, Capacity, Location and Economic analysis Waste - Collection system design, Transportation of solid waste: Means and methods, Routing of vehicles	8
III	Waste Processing Techniques & Material Recovery and Recycling Waste Processing Techniques: Purpose, Mechanical volume and size reduction, component separation techniques. Material Recovery and Recycling: Objectives, Recycling program elements, Commonly recycled materials and processes Energy recovery from solid waste: Parameters affecting, Fundamentals of thermal processing, Biomethanation, Pyrolysis, Incineration, Refuse derived fuels, Planning and design of incineration facility, Energy recovery	8
IV	Composting of Solid Waste Landfills Benefits, Processes, Stages, Technologies, Factors affecting, Properties of compost. Vermicomposting Site selection, Types, Principle, Processes, Land filling methods, Leachate and landfill gas management, Design of a landfill facility	8
V	Hazardous Waste Management Biomedical Waste Introduction to hazardous waste , Definition, Characterization and composition ,Storage and transportation of hazardous waste ,Labeling of hazardous waste ,Physical,Chemical and Biological treatment of hazardous waste , Bioremediation of hazardous waste , Nuclear waste and Radio – Active waste , E-waste management, Treatment of Bio medical waste, Biomedical waste legislation in India	8
	Total	**40**

Outcomes	
1	Student will be able to examine physical and chemical composition of solid wastes.
2	Student will be able to analyze activities associated with the management of solid waste.
3	Student will be able to understand method to recover materials, conserve products, and to generate energy from solid and hazardous wastes.
4	Student will be able to locate waste containment systems as per regulatory standards.
5	Define and explain important concepts in the field of solid waste management and suggest suitable technical solutions for treatment of municipal and industrial waste.

Reference Books	1. Bhide. A.D. And Sundaresan. B.B, "Solid Waste Management", Indian National Scientific Documentation Centre, 1st Edition, 1983. 2. CPHEEO, "Manual on Municipal Solid waste management", Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000 3. George Tchobanoglous, "Integrated Solid Waste Management", Tata McGraw-Hill Publishing Company Limited, 1st Edition, 1993. 4. Vesilind, Worrell, and Reinhart, "Solid Waste Engineering", Cengage Learning India Pvt. Ltd., 5. G. Masters, "Introduction to Environmental Engineering and Science", Pearson Education, 2004 6. Peavy, Rowe and Tchobanoglous, "Environmental Engineering", Tata McGraw-Hill Publishing Company Limited, 1st Edition, 1985. 7. David Rimbers, Municipal Solid Waste Management: Pollution Technologies Review, Noyes Data Corporation, London. 1990. 8. Solid Waste Management –CPHEEO Manual, New Delhi, 2006 9. MSW Rules 2016

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School: School of Engineering & Technology	**Programme: Civil Engineering**
Year: Fourth Year	**Semester -VIII**
Course: Elective-I (Hydropower Engineering)	**Course Code: YCE806**
Theory: 3Hrs/Week	**Max. University Theory Examination: 50 Marks**
Max. Time for Theory Exam.:3 Hrs	**Continuous Internal Assessment: 50 Marks**

Objectives	
1	To give advanced knowledge of Hydropower Projects to the students such that they will be capable to execute, operate and maintain hydropower project.

Unit Number	Details	Hours
I	Hydropower Plants Hydrological Analysis, Classification of hydropower plants - Run of river plants, Storage or Valley dam plants, Pumped storage plants, Introduction to micro hydro, Base load and Peak load plants, advantages and disadvantages, Components of hydropower plants.	6
II	Load Assessment Estimation of electrical load on turbines. Load factor, Plant factor, peak demand and utilization factor, load curve, load duration curve, Prediction of load, Tariffs, Hydro-Thermal Mix, Combined Efficiency of Hydro-Thermal-Nuclear Power Plants.	9
III	Water Conductor System and Powerhouse Water Conductor System – Alignment, Intake Structures- Location and Types, Trash Rack. Penstock and pressure shaft, Types of Powerhouses, Typical layout of powerhouse, Components, Power plant equipments, Instrumentation and control.	9
IV	Turbines Classification, Principles and design of impulse and reaction turbines, Selection of Turbine, Specific Speed, Governing of turbines, Water hammer, Hydraulic Transients and Surge tanks, Draft tubes, Cavitation.	9
V	Economics of Hydroelectric Power Hydropower - Economic Value and Cost and Total Annual Cost. Economic considerations – pricing of electricity, laws and regulatory aspects, Policies, Electricity act – 2003, Investment in the power sector, Carbon credits, Participation of private sector.	9
	Total	**42**

Course Outcomes	
1	Understand the working principle of hydropower plant
2	Analyze the electrical load on turbine
3	Understand the instrumentation in hydropower plant
4	Understand working of turbines
5	Understand economics of hydropower project

Reference Books	1. Water Power Engineering – M. M. Dandekar and K. N. Sharma 2. Handbook of Hydroelectric Engineering – P.S. Nigam 3. Modern Power System Planning – Wang 4. Hydropower Resources in India – CBIP

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School: School of Engineering and Technology	**Programme: B.Tech. Civil Engineering**
Year: Fourth Year	**Semester - VIII**
Course: Project Stage-II	**Course Code:YCE811**
Practical: 6 Hrs/Week	**Max. University Theory Examination: 50 Marks**
Max. Time for Practical Exam.: 3 Hrs	**Term work: 100 Marks**

Course Objectives
To carryout experimental/analytical work as per methodology defined for topic identified in Project stage- I and to solve the identified problem.
To develop skills to analyze and discuss the test results and make conclusions.

Particulars

Project Stage – II will be related to experimantal/analytical work carried on the topic identified in Semester VII. The student should continue the project work on the selected topic as per the formulated objectives and methodology.

Mid semester presentation should include the detail report on the experimental/analytical work carried out showing the progress of the project work.

At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department.

A committee consisting of at least two faculty members including supervisor (preferably specialized in the respective stream) shall assess the final report under termwork and award marks to the students based on merits of topic at the end of semester. Termwork assessment will be carried out by the respective supervisor of the students based on the progress of work, quality of submitted report, documentation etc. Publication related to the project work should be assesed under termwork.

The students will be evaluated based on the final report and the viva-voce examination by a panel of examiners including one external examiner.

Course Outcomes
Students will be able to carryout experimental/analytical work as per methodology defined for topic and perform critical analysis of results. On completion of the project work students will be in a position to take up any challenging practical problem and find better solutions.