



Shirpur Education Society's

R. C. Patel Institute of Technology,
Shirpur
(An Autonomous Institute)

Course Structure and Syllabus
B. Tech (Civil Engineering)

With effect from Year 2023-24



Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra
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R. C. PATEL
INSTITUTE OF TECHNOLOGY
An Autonomous Institute

Department of Civil Engineering

Vision of the Institute

To become a leading Institute in Technical education fostering innovation, research, ethical values, and sustainable development for the betterment of society.

Mission of the Institute

To impart high quality Technical Education through:

- M1.** Innovative and Interactive learning process and high quality, globally recognized instructional programs.
- M2.** Fostering a collaborative scientific temper among students with ethical responsibility towards the society.
- M3.** Preparing students from diverse backgrounds to have aptitude for employment, entrepreneurship and research with a spirit of Professionalism.
- M4.** To contribute to nation's sustainable development.

Vision of the Civil Engineering

To provide quality Civil engineering education with socio-moral values catering to the need of nation and globe.

Mission of the Civil Engineering

M1: Provide civil engineering education with technical and ethical excellence.

M2: Empower students through innovation, research, and sustainable engineering design.

M3: Prepare civil engineers with research skills and entrepreneurial career mindset.

Program Educational Objectives (PEOs) of the Department

PEO 1 Graduates will apply scientific, mathematical, and engineering principles to solve complex civil problems ethically and sustainably.

PEO 2 Graduates will design and implement resilient civil solutions addressing societal needs through innovation, collaboration, and environmental responsibility.

PEO 3 Graduates will exhibit professional competence, communication, teamwork, and lifelong learning for career advancement, entrepreneurship, and higher education.



**R. C. PATEL
INSTITUTE OF TECHNOLOGY**
An Autonomous Institute

Department of Civil Engineering

Program Specific Outcomes (PSOs)

PSO 1- Graduates will apply core Civil Engineering principles to survey, plan, analyze, design, and manage infrastructure systems using innovative, sustainable, and efficient approaches for real-world challenges.

PSO 2- Graduates will uphold ethical professional practice, collaborate effectively in teams, and communicate clearly to enhance employability skills while fostering entrepreneurial ventures in diverse civil engineering contexts.

Semester-VII													
S.No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credit
				L	T	P	Continuous Assessment (CA)				ESE		
							TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Best of (TT1 & TT2)			
[A]			[B]	[C]	[A+B+C]								
1	PC	PCCE7010T	Geotechnical Engineering	3	1		20	15	15	15	65	100	4
2	PCL	PCCE7010L	Geotechnical Engineering Laboratory			2	25				25	50	1
3	PC	PCCE7020T	Public Health Engineering	3			20	15	15	15	65	100	3
4	PCL	PCCE7020L	Public Health Engineering Laboratory			2	25				25	50	1
5	PC	PCCE7030T	Water Resource Engineering	3	1		20	15	15	15	65	100	4
6	PE	PECE7040T	Professional Elective Course - III	3			20	15	15	15	65	100	3
7	OE	OECE7050T	Open Elective Course - I	3			20	15	15	15	65	100	3
8	PJ	PJCE7060L	Project Stage-II			8	25				25	50	4
Total				15	2	12	175	75	75	75	400	650	23

Prepared by

Dean Academic/Dy. Director

Checked by

C.O.E.

BOS Chairman

Director



Semester-VIII													
S. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credit
				L	T	P	Continuous Assessment (CA)				ESE		
							TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Best of (TT1 & TT2)			
							[A]			[B]	[C]	[A+B+C]	
1	PE	PECE8010T	Professional Elective Course - IV	3			20	15	15	15	65	100	3
2	PE	PECE8020T	Professional Elective Course - V	3			20	15	15	15	65	100	3
3	INT	INTCE8030L	Internship			20	150				150	300	10
Total				06	0	20	190			30	280	500	16

1. * Professional Elective Courses offered for the students doing Internship at institute level.
2. # Professional Elective Courses offered for the students doing Internship at Industry. These courses are to be studied in self Study mode using NPTEL/Swayam platform.
3. Students doing internship at industry shall submit certificate of NPTEL examination OR they have to appear examinations conducted by institute like TT1, TT2 and ESE.
4. List of NPTEL courses will be declared by concerned BOS at the beginning of semester.



Prepared by



Dean Academic/Dy. Director



Checked by



C.O.E



BOS Chairman



Director



List of Elective Subjects

Semester-V-Professional Elective Courses-I

S. No.	Course code	Course Title
1	PECE5050	Smart city Planning
2	PECE5051	Construction Equipment's and Automation
3	PECE5052	Prefabricated Structure
4	PECE5053	Repairs & Rehabilitation of Structure

Semester-VII-Professional Elective Courses-III

S. No.	Course code	Course Title
1	PECE7040T	Integrated Watershed Management
2	PECE7041T	Construction Economics & Finance
3	PECE7042T	Planning for Sustainable development
4	PECE7043T	Numerical Method for Civil Engineering
5	PECE7044T	Ground water Engineering

Semester-VII- Open Elective Courses-I

S. No.	Course code	Course Title
1	OECE7050T	Product Lifecycle Management
2	OECE7051T	Management Information System
3	OECE7052T	Operations Research
4	OECE7053T	Cyber Security and Laws
5	OECE7054T	Personal Finance Management
6	OECE7055T	Energy Audit and Management
7	OECE7056T	Disaster Management and Mitigation Measures
8	OECE7057T	Science of Well-being
9	OECE7058T	Research Methodology
10	OECE7059T	Public Systems and Policies

Semester-VI-Professional Elective Courses-II

S. No.	Course code	Course Title
1	PECE6050	Traffic Engineering & Management
2	PECE6051	Geographical Information System
3	PECE6052	Town & Urban Planning
4	PECE6053	Advanced Design of RC Structure

Semester-VIII-Professional Elective Courses-IV

S. No.	Course code	Course Title
1	PECE8010T	Dams & Hydraulic structure
2	PECE8011T	Introduction to Earthquake Engineering
3	PECE8012T	Environmental Impact Assessment and Audit
4	PECE8013T	Structural Audit
5	PECE8014T	Solid Waste Management
6	PECE8015T	NPTEL /Swayam Course

Semester-VIII- Professional Elective -V

S. No.	Course code	Course Title
1	PECE8020T	Metro Construction Technology
2	PECE8021T	Air Pollution Control
3	PECE8022T	Software Application in Structural Engineering
4	PECE8023T	Coastal Engineering
5	PECE8024T	Data Analytics in Civil Engineering
6	PECE8025T	NPTEL /Swayam Course



SEM

VII

Program : Civil Engineering	BTECH	Semester: VII
Geotechnical Engineering (PCCE7010T)		
Geotechnical Engineering Laboratory (PCCE7010L)		

Pre-requisite – Engineering mechanics, strength of mechanic's fluid mechanics and engineering geology.

Course Objectives

1. To provide students with basic understanding of physical and mechanical properties of soil, together with knowledge of basic engineering procedures.
2. To identify factors controlling soil behavior and methods to determine soil properties.
3. Students will acquire basic knowledge in engineering design of geotechnical systems.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Use knowledge of science, mathematics, and engineering within the context of geotechnical engineering applications.	3	Apply
CO2	Outline the origin and classification of different soils and evaluate their engineering properties.	4	Analyze
CO3	Calculate geostatic stresses in soils and describe the methods of soil compaction and stabilization.	3	Apply
CO4	Calculate consolidation using Terzaghi's theory.	3	Apply
CO5	Determine shear stress parameters of soils and earth pressure using Rankine's theory.	3	Apply

Course Content

Unit-I	Introduction of Soil and Geotechnical Properties	08 Hrs
Soil as engineering material, soils of India, geotechnical problems, three phase system, definitions and functional relationships. Geotechnical properties, engineering properties, volume weight relationships. Atterberg's limits, sieve analysis, identification of soil, I.S. classification system		
Unit-II	Flow through Soil, Compaction and Consolidation	08 Hrs
Flow of water through soils, soil water, capillarity, Darcy's law laboratory measurement of permeability. Soil compaction, M.D.D. and O.M.C., standard Proctors test heavy compaction test, concept of stabilization, different methods of stabilization Consolidation Theory, Terzaghi theory, consolidation test, time fitting curves, rate of settlements, Normal consolidated and over consolidated deposits, Pre consolidation pressure.		
Unit-III	Shear Resistance and Shear Strength of soil	08 Hrs
Shear resistance in soil, pore pressure and effective stresses failure theories, Mohr - Coulomb's law of shear strength direct shear test, triaxial test, unconfined compression test, vane shear test, drained loading, and factors affecting the shear strength.		
Unit-IV	Soil Investigation and Bearing Capacity of Soil	08 Hrs
Soil exploration, subsurface exploration, trial pits, representative and undisturbed samples, bore hole sampling, laboratory evaluation of foundation parameters, field testing, penetration tests, plate load test, bore hole tests. Bearing capacity of soil, load settlement curve, local and general shear, Terzaghi's bearing capacity analysis, bearing capacity factors, Mayorhoff		

equations, rectangular, square and round footings, effects of water table and depth, bearing capacity of layered soils, effect of eccentricity.

Unit-V	Elastic Settlement and Special Foundation.	07 Hrs
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Elastic settlement, contact pressure, elastic stresses and strains, pressure bulb, elastic settlement, empirical relation for settlement of busses, total and differential settlement, tolerable settlement, I.S. criteria, effect of lowering water table. Introduction of pile foundation, purpose of piles, pile classification, Foundation on black cotton soils, characteristics of black cotton soil, problems, swelling potential, under-reamed piles, design principles and construction techniques.

Reference Books:

1. Soil Mechanics and Foundations, Muni Budhu, John Wiley and Sons Inc
2. Foundation Analysis and Design, J.E.Bowles, McGraw Hill International
3. Foundation Design Manual, DhanpatRai Publication, N. V. Nayak
4. Design aids in soil mechanics and foundation engineering, Kaniraj S.R., Tata McGraw Hill Publishing Company Ltd.
5. Foundation Design and Construction, M.J.Tomlinson, ELBS Publication

Text Books:

1. Basic and Applied Soil Mechanics by Gopal Ranjan and Rao, New Age International Publishers.
2. Principles of foundation engineering by B. M. Das, Cengage Learning (Thompson)
3. Soil Mechanics and foundation Engineering, Dr.K.R.Arora, Standard Publishers Distributors

List of Experiments:

Lab course work shall consist of Following experiment complete any 07 from list

1. Field density by core cutter method, and Sand replacement method.
2. Sieve analysis and particle size determination or hydrometer analysis.
3. Specific gravity determination by voluminometer / pycnometer.
4. Determination of liquid limit and plastic limit.
5. Determination of shrinkage limit.
6. Determination of co-efficient of permeability by constant head or by variable head permeameter.
7. Direct shear test.
8. Unconfined compression test.
9. Vane shear test.
10. Standard Proctor's test (MDD / OMC)
11. Modified Proctor's test (MDD / OMC)

Program : Civil Engineering	TY BTECH	Semester: VII
Public Health Engineering (PCCE7020T)		
Public Health Engineering Laboratory (PCCE7020L)		

Prerequisite: *Basic concepts of Environmental Engineering*

Course Objectives

- 1 To apply knowledge of mathematics, physics, chemistry, and microbiology to solve and analyze engineering problems related to water and wastewater collection, transport, quality and treatment.
- 2 To understand the sources, effects, prevention and control measures of water pollution and its legislative aspects.
- 3 Recognize public health and environmental objectives related to water supply and wastewater disposal.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Develop strategies that incorporate environmental and ecological factors to plan public water supply requirements.	5	Evaluate
CO2	Apply BIS standards to assess water quality and determine the appropriate treatment method.	3	Apply
CO3	Analyze source water characteristics and evaluate the best available technologies (BAT) for its physical and chemical treatment.	4	Analyze
CO4	Evaluate wastewater characteristics and recommend the best available technologies (BAT) for its physical, chemical, and microbiological treatment.	5	Evaluate
CO5	Design strategies to address contemporary global water and wastewater challenges by identifying underlying causes and patterns related to water shortage, reuse, and emerging contaminants.	4	Analyze

Course Content

Unit-I	Introduction of water quality	08 Hrs
A) Water quality parameters, Water quality standards; conventional contaminants and emerging contaminants; Water treatment: Source selection process, selection of treatment chain, plant siting, and Treatability studies. Water intake structures: intake structures, such as river intake, canal and reservoir intake B) General considerations for source of drinking water; Water demand, Population forecasting: arithmetical increase method geometrical increases method, incremental increase method.		
Unit-II	Introduction to Principals of Water Treatment process	08 Hrs
Principles of Water Treatment process: Historical overview of water treatment, Considerations for layout of treatment plant, Sedimentation, Coagulation & Flocculation processes, Disinfection/ Chlorination, Water Softening, Filtration, removal of Dissolved Solids, Fluoride, Iron and Manganese etc. Aeration tank, Sedimentation tank.		
Unit-III	Water Treatment Process	08 Hrs
A. Filtration: theory of filtration, mechanism of filtration, filter materials, types of filters, rapid Sand Filter, Slow Sand Filter, multimedia and dual media filters, components- under drainage system, working and cleaning of filters. Operational troubles, design of filters-RSF and SSF. Design of under drainage system. B: Disinfection- objectives, theory, types of disinfection, chlorination. C: Water Softening - lime soda, zeolite, and ion exchange processes, Quantity estimation of lime soda process, re-carbonization. Demineralization methods		
Unit-IV	Sewage Treatment Process	10 Hrs
Definition of sewage, Necessity of sewage treatment, Requirement of a sewage management system. Composition of sewage, Characteristics of sewage – Physical (Colour,		

Odour, Solids and Temperature), Chemical (Organic - Carbohydrates, Fats, Oil and Grease, Pesticides, Phenols, Proteins, Surfactants. Inorganic – Alkalinity, Chlorides, Heavy Metal, Nitrogen, pH, Phosphorous, Sulphur, Toxic Compounds, Gases – Hydrogen Sulfide, Methane, Oxygen), Biological Characteristics.

Unit-V	Preliminary & Secondary Treatment of Sewage	08 Hrs
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Preliminary & Secondary Treatment of Sewage – Screening – Purpose, Classification, Types, Cleaning, Design Consideration & Management of screenings material
Comminutors – Purpose and types Grit Removal – Purpose, Quality and quantity of grit, Types Biological Treatment of Sewage – Objective and classification.

Reference Books

- 1 E W Steel and Terence J McGhee: Water supply and Sewerage” Tata McGraw Hill Publishing Co.
- 2 Water supply and Sanitary Engineering by J S Birdie, Dhanpat Rai and Sons Publication, New Delhi
- 3 Physici-chemical processes for water quality control by Walter J Weber, Wiley Inter-Science Publications.
- 4 Manual on Water Supply & Treatment, Central Public Health & Environmental Engineering, Organization, Ministry of Urban Affairs, Government of India.
- 5 Benergee & Jain, “Handbook of Technical Analysis”, Jain Brothers New Delhi.
- 6 Laboratory Manual for Environmental Quality Testing, Environmental Protection Research Foundation, Sangli.

Text Books

- 1 Environmental Modelling: Finding Simplicity in Complexity by John Wainwright and Mark Mulligan, John Wiley & Sons, Ltd.

- 2 Building Environmental Models: A Primer on Simplifying Complexity by Mulligan, M. and Wainwright, J., John Wiley & Sons, Ltd, Chichester.
- 3 Earth-system science, in Blackwell Companion to Environmental Geography by Wainwright, J., Blackwell, Oxford.
- 4 Water and Wastewater Treatment by Schroeder E D., McGraw-Hill.

List of Experiments

Term work shall consist of performing experimental sets from the list below.

1. Determination of pH in given water and wastewater samples.
2. Determination of Turbidity and Optimum Dose of Coagulant.
3. Determination of Alkalinity and Acidity of given samples (water and wastewater)
4. Determination of Carbonate and Non-carbonate Hardness of water/wastewater samples.
5. Determination of Chlorine Demand and Residual Chlorine of water.
6. Determination of Dissolved Oxygen (DO) present in the given water samples.
7. Site Visit Report: A complete report on a site visit to a Municipal Water & Wastewater Treatment Plant.

Program : Civil Engineering	BTECH	Semester: VII
Water Resource Engineering (PCCE7030T)		

Pre-requisite: - Basic Environmental Science

Course Objectives

- 1 To understand and analyze the hydrologic cycle and key hydrological processes relevant to water resources engineering.
- 2 To evaluate hydrological parameters and apply them in the planning and management of water resources systems.
- 3 To understand and select appropriate irrigation, drainage techniques, and applications of hydraulic machines in water resource engineering.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain hydrology cycle and water distribution on Earth.	2	Understand
CO2	Describe evaporation and calculate runoff water.	3	Apply
CO3	Draw Hydrograph and find volume of runoff	3	Apply
CO4	Describe the basic aquifer parameters and groundwater resources.	2	Understand
CO5	Assess water requirements of crops. Explain hydrology cycle and water distribution on Earth.	5	Evaluate

Course Content

Unit-I	Hydrology	08 Hrs
Hydrology and Water resources development, Hydrologic cycle, applications of hydrology and hydrological cycle. Precipitation: Forms of precipitation, different types of rain and measurement of precipitation (recording and non-recording type gauge), rain gauge network and presentation of precipitation data: mass curve and hyetograph, presentation of rainfall data, mean precipitation over an area, depth area distribution curves and frequency of rainfall.		
Unit-II	Evapotranspiration, Infiltration and Runoff	07 Hrs
Evaporation and evapotranspiration: Evaporation process, Evaporimeters, reduction in evaporation measurement of evapotranspiration. Infiltration, Introduction to stream gauging and introduction to methods of discharge and stage measurement in streams. Runoff: Different routes of runoff, rainfall runoff correlation, Strange's tables, factors effecting runoff, flow distribution curve, flow mass curve and uses.		
Unit-III	Hydrograph	08 Hrs
Introduction, Factors affecting Flood Hydrograph, Components of a hydrograph, Base flow separation, Effective rainfall, Unit Hydrograph, Use and Limitations of unit hydrograph, Derivation of unit hydrograph, Synthetic Unit Hydrograph, Instantaneous Unit Hydrograph, Flood Studies: Design Flood and method of its estimation, empirical formula, frequency analysis, Gumbels and Log Pearson distribution, Muskingum methods.		
Unit-IV	Ground water hydrology	09 Hrs
Ground water hydrology: Occurrences and distribution of ground water, specific yield of aquifers, movement of ground water, Darcy's law, permeability, safe yield of basins, hydraulics of wells under steady flow in confined and unconfined aquifers, well loss,		

specific capacity of well, well irrigation: introduction to tube wells and open wells. Water logging and drainage: Causes, preventive and curative measures of water logging, design and spacing of the tile-drains.

Unit-V	Irrigation methods	10 Hrs
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Introduction to irrigation: Necessity, benefits, Ill effect, irrigation systems and methods and their classifications. Soil-water-plant relationships: Classification of soil water, saturation capacity, Field capacity, determination of field capacity, quality of irrigation water. Water requirement of crops: Limiting soil moisture condition, depth of irrigation water and frequency, principal Indian crops and their seasons, base period, duty of water and delta, factors affecting & methods of improving the duty of water, intensity of irrigation, paleo irrigation, kor depth and kor period, outlet factor, capacity factor, time factor, crop ratio, overlap allowance, calculations of canal capacities, application of water, warabandi, National Water Policy.

Reference Books

- 1 A Text Book of Water Power Engineering by Sharma R.K. and Sharma T.K., S Chand Publication
- 2 P. Jayaram Reddi, "A Text Book of Hydrology", Laxmi Publications, New Delhi.
- 3 Varshney R.S., Gupta S.C., Gupta R.L. "Theory and Design of Irrigation Structures, Volume I and II", 1979 Fourth edition. New Chand & Bros., Roorki.
- 4 Mutreja, "Applied Hydrology", Tata McGraw Hill Company, New Delhi.
- 5 Text Books
- 6 Engineering Hydrology by Subramanya K., Tata McGraw-Hill Publishing Company Limited, New Delhi.
- 7 Irrigation, Water Resources and Water Power Engineering by Modi P.N., Standard Book House, Delhi.

Program : Civil Engineering	BTECH	Semester: VII
Professional Elective Course - III (Integrated Watershed Management) (PECE7040T)		

Prerequisites:

- 1 Basic environmental science
- 2 Fundamentals of hydrology
- 3 Introductory geography and land use concepts

Course Objectives

- 1 To learn the various management strategies through different soil and water conservation approaches.
- 2 To provide the technical know-how of analyzing the degradation of soil and water resources.
- 3 To provide a comprehensive treatise on the engineering practices of watershed management for realizing the higher benefits of watershed management.
- 4 To understand land use classification and impact of land use changes on hydrological cycle parameters.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Implement the different soil and water conservation approaches.	3	Apply
CO2	Classify degradation of soil and water resources.	4	Analyze
CO3	Describe the concepts, principles and characteristics of a watershed.	2	Understand
CO4	Implement the concept of watershed planning and development.	3	Apply
CO5	Suggest drought control measures and water conservation structures.	2	Prepare

Course Content

Unit-I	Introduction	09 Hrs
Watershed: Definition, concept, objectives, Introduction to watershed management, Introduction to Integrated approach, Integrated water resources management, Watershed behavior Effects of land use and its changes on hydrological cycle components, Land capability and suitability classification.		
Unit-II	Watershed Planning	08 Hrs
Planning principles – collection of data – present land use – Preparation of watershed development plan – Estimation of costs and benefits – Financial plan – selection of implementation agency – Monitoring and evaluation system.		
Unit-III	Watershed Management	08 Hrs
Participatory watershed Management – run off management – Factors affecting runoff – Temporary & Permanent gully control measures – Water conservation practices in irrigated lands – Soil and moisture conservation practices in dry lands, Erosion process. Control measures for soil erosion.		
Unit-IV	Water Conservation Practices	08 Hrs
In-situ & Ex-situ moisture conservation principle and practices – Afforestation principle – Micro catchment water harvesting – Ground water recharge – percolation ponds – Water harvesting – Farm pond – Supplemental irrigation – Evaporation suppression – Seepage reduction		
Unit-V	Watershed Development Programme	09 Hrs
Drought and its management – causes and impacts, definition, management objectives and strategy – short term and long term measures. National Watershed Development Programme. Watershed based rural development – infrastructure development – Use of		

Aerial photography and remote sensing in watershed management – Role of NGOs in watershed development.

Reference Books

- 1 Gurmel Singh et al. 2004. Manual of soil and water conservation practices. Oxford & IBH publishing Co. New Delhi.
- 2 Suresh, R. 2008. Land and water management principles, Standard Publishers & Distributors, New Delhi.
- 3 Tripathi R.P. and H.P. Singh 2002, Soil erosion and conservation, Willey Eastern Ltd., New Delhi.
- 4 Murthy, V.V.N. 2005, Land and water management, Kalyani publishing, New Delhi.
- 5 Tideman, E.M., “Watershed Management”, Omega Scientific Publishers, New Delhi, 1996.
- 6 Sharda V.N., Sikka A.K. and Juyal G.P. (2006) Participatory Integrated Watershed Management: A Field Manual, Central Soil and Water Conservation Research and Training Institute, 218, Kaulagarh Road, Dehradun.
- 7 Tideman E.M. (1999) Watershed Management—Guidelines for Indian Conditions, Omega Scientific Publishers, New Delhi.

Text Books

- 1 Suresh, R. 2005. Soil and Water Conservation Engineering, Standard Publishers & Distributors, New Delhi.
- 2 Ghanashyam Das, “Hydrology and Soil Conservation Engineering”, Prentice Hall of India Private Limited, New Delhi, 2000. Limit state theory and Design – Dr. V. L. Shah and Dr. S. R., Structures publications, Pune

Program : Civil Engineering	BTECH	Semester: VII
Open Elective Course - I Disaster Management and Mitigation Measures (OECE7050T)		

Course Objectives

1. To provide basic understanding hazards, disaster and various types and categories of disaster occurring around the world.
2. To identify extent and damaging capacity of a disaster.
3. To study and understand the means of losses and methods to overcome /minimize it.
4. To understand roles and responsibilities of individual and various organization during and after disaster.
5. To appreciate the significance of GIS, GPS in the field of disaster management.
6. To understand the emergency government response structures before, during and after disaster

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Describe natural as well as man-made disasters, their extent, and possible effects on the economy.	2	Understand
CO2	Describe the institutional framework and organizational structure in India for disaster management and explain government policies, acts, and various emergency laws.	2	Understand
CO3	Describe the simple do's and don'ts during extreme events and explain the skills required to respond accordingly	2	Understand
CO4	Explain the importance of disaster prevention and various mitigation measures with exposure to disaster hotspots across the globe.	2	Understand

Course Content

Unit-I	General Information about Disaster:	10 Hrs
Brief concept of Hazards, definition and types of Disasters – Natural, Man-made, and hybrid, Groups of Disasters- Natural and Technological, global Scenario, Significance of studying various aspects of disasters, effects of disasters, India's vulnerability to disasters, Impact of disaster on National development. Study of Natural disasters: Flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion etc. Study of Human/Technology Induced Disasters: Chemical, Industrial and Nuclear disasters, internally displaced persons, road and train accidents Fire Hazards, terrorism, militancy, Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.		
Unit-II	Disaster Management:	08 Hrs
Brief Introduction, Disaster management cycle, Evolution of Disaster and Disaster management in India, Disaster management acts, policies and guidelines, laws of emergencies etc. Prior, during and Post disaster management activities: (Preparedness, strengthening emergency centers, Logistics, optimum resource management, emergency response and relief, Training, Public awareness, Research, Reconstruction of essential services and livelihood restoration.		
Unit-III	Unit 3	08 Hrs
Institutional framework and Mechanism for disaster management in India: Institutions in India for dealing with various disasters, Organizational structure, functions and responsibilities of National Institute of Disaster Management (NIDM) and National disaster management authority (NDMA) in India, roles and responsibilities of central and state government during and after disaster, NGO's involved in disasters and their task, Jobs		

carried out by armed forces. Financial Relief During disaster (State, National and International Disaster Assistance)

Unit-IV	Disaster risk reduction and Mitigation	08 Hrs
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Measures:

Need of disaster prevention and mitigation, mitigation guiding principles, challenging areas, structural and non-structural measures for disaster risk reduction. Mitigation measures for flood, earthquake, cyclone monitoring, air quality, water quality, climate change, land use, winter storms and aquatic biology etc. Use of information management, GIS, GPS and remote sensing Mitigation measure. Do's and don'ts in case of disasters and effective implementation of relief aids.

Unit-V	Unit 5 Case studies	08 Hrs
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Case studies on disaster (National /International): Case study discussion of Hiroshima – Nagasaki (Japan), India – Tsunami (2004) , Bhopal gas tragedy, Kerala and Uttara hand flood disaster, Cyclone Phailin (2013), Fukushima Daiichi nuclear disaster (2011), 26th July 2005 Mumbai flood, Chernobyl meltdown and so on. (Discuss case studies on disaster with respect to reason for the disaster, incidents, and effects of disaster, present scenario and safety measures taken)

Reference Books and Reports:

- 1 Disaster Management, by Harsh K.Gupta, Universities Press Publications (2003).
- 2 Disaster Management: An Appraisal of Institutional Mechanisms in India, by O.S.Dagur, published by Centre for land warfare studies, New Delhi, 2011.
- 3 Introduction to International Disaster Management, by Damon Copolla, Butterworth Heinemann Elsevier Publications (2015).
- 4 Disaster Management Handbook, by Jack Pinkowski, CRC Press, Taylor and Francis group (2008).

- 5 Disaster management & rehabilitation, by Rajdeep Dasgupta, Mittal Publications, New Delhi (2007).
- 6 Natural Hazards and Disaster Management, Vulnerability and Mitigation, by R B Singh, Rawat Publications (2006).
- 7 Concepts and Techniques of GIS, by C.P.Lo Albert, K.W. Yonng, Prentice Hall (India) Publications (2006).
- 8 Risk management of natural disasters, by Claudia G. Flores Gonzales, KIT Scientific Publishing (2010).
- 9 Disaster Management – a disaster manger’s handbook, by W. Nick Carter, Asian Development Bank (2008).
- 10 Disaster Management in India, by R. K. Srivastava, Ministry of Home Affairs, GoI, New Delhi (2011)
- 11 The Chernobyl Disaster: Legacy and Impact on the Future of Nuclear Energy, by Wil Mara, Marshall Cavendish Corporation, New York, 2011.
- 12 The Fukushima 2011 Disaster, by Ronald Eisler, Taylor & Francis, Florida, 2013.

(Learners are expected to refer reports published at national and international level and updated information available on authentic web sites)

Program : Civil Engineering	BTECH	Semester: VII
Open Elective Course - I Product Lifecycle Management (OECE7051T)		

Course Objectives

1. To familiarize the students with the need, benefits and components of PLM
2. To acquaint students with Product Data Management & PLM strategies
3. To give insights into new product development program and guidelines for designing and developing a product
4. To familiarize the students with Virtual Product Development

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Describe the phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.	2	Learn
CO2	Illustrate various approaches and techniques for designing and developing products.	3	Apply
CO3	Apply product engineering guidelines / thumb rules in designing products for molding, machining, sheet metal working etc.	3	Apply
CO4	Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant	3	Apply

Course Content

Unit-I	Introduction to Product Lifecycle Management	10 Hrs
	Introduction to Product Lifecycle Management (PLM): Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications PLM Strategies: Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy, Change management for PLM	
Unit-II	Unit 2 Product Design	08 Hrs
	Product Design: Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase, Methodological Evolution in Product Design, Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering and Life Cycle Approach, New Product Development (NPD) and Strategies, Product Configuration and Variant Management, The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process	
Unit-III	Theory of Meteorology	06 Hrs
	Product Data Management (PDM): Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation Virtual Product Development Tools: For components, machines, and manufacturing plants, 3D CAD systems and realistic	

rendering techniques, Digital mock-up, Model building, Model analysis, Modelling and simulations in Product Design, Examples/Case studies.

Unit-IV

Air Pollution

8 Hrs

Integration of Environmental Aspects in Product Design: Sustainable Development Design for Environment, Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies, End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for Product Design.

Analysis and Design of Columns and

Unit-V

8 Hrs

Column footings

Life Cycle Assessment and Life Cycle Cost Analysis: Properties, and Framework of Life Cycle Assessment, Phases of LCA in ISO Standards, Fields of Application and Limitations of Life Cycle Assessment, Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis

Reference Books and Reports:

- 1 Product Life Cycle Managementl, Saaksvuori Antti, Immonen Anselmie, Springer, Dreamtech.
- 2 Product Lifecycle Management: Driving the next generation of lean thinking, Michael Grieve, Tata McGraw Hill, 2006.
- 3 Product Life-Cycle Management: Geometric Variations, François Villeneuve, Luc Mathieu, Max Giordano, Wiley, 2010.

Text Books:

- 1 Product Lifecycle Management: Paradigm for 21st Century Product Realization,
John Stark, Springer-Verlag, 2004.
- 2 Product Design for the environment-A life cycle approach, Fabio Giudice, Guido
La Rosa, Antonino Risitano, Taylor & Francis 2006.

Program : Civil Engineering	BTECH	Semester: VII
Open Elective Course - I Management Information System (OECE7052T)		

Course Objectives

1. The course is blend of Management and Technical field.
2. Discuss the roles played by information technology in today 's business and define various technology architectures on which information systems are built
3. Define and analyze typical functional information systems and identify how they meet the needs of the firm to deliver efficiency and competitive advantage.
4. Identify the basic steps in systems development.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze a real-world problem by formulating it as a Linear Programming Problem and interpreting the solution obtained using the Simplex method or other algorithms.	L4	Analyze
CO2	Determine real-world problems as Transportation Problem and Assignment Problem and solve the decision problem by choosing appropriate algorithm.	L3	Apply
CO3	Determine the decision situations which vary with time and analyse them using principle of dynamic programming to real life situations.	L3	Apply
CO4	Explain reasons of formation of queues, classify various queuing systems and apply parameters defined for various queuing systems for decision making in real life situations.	L2	Understand
CO5	Explain the concept of decision making in situation of competition and recommend strategies in case of two-person zero sum games.	L2	Understand
CO6	Explain the concept of simulation and replacement policy, apply Monte Carlo Simulation technique to systems such as inventory and queuing, and determine optimal replacement age.	L2	Understand

Course Content

Unit-I	Foundation Concepts:	10 Hrs
Foundation Concepts: Information Systems in Business, Functional Area Information System, The Components of Information Systems, Impact of IT on organizations and society, Organizational Strategy, Information systems for strategic advantage		
Unit-II	Information Technologies:	8 Hrs
Information Technologies: Hardware and Software Computer Systems: End User and Enterprise Computing Computer Peripherals: Input, Output, and Storage Technologies Application Software: End User Applications System Software: Computer System Management Data Resource Management: Technical Foundations of Database Management, Managing Data Resources, Big data, Data warehouse and Data Marts, Knowledge Management Networks: The Networked Enterprise (Wired and wireless), Pervasive computing, Cloud Computing models		
	MIS Tools and applications for Decision making:	
Unit-III		08 Hrs
MIS Tools and applications for Decision making: ERP and ERP support of Business Process Reengineering, Business intelligence (BI): Managers and Decision Making, BI for Data analysis and Visualization Artificial Intelligence Technologies in Business		
Unit-IV	Security and Ethical Challenges:	08 Hrs
Security and Ethical Challenges: Security, Ethical, and Societal Challenges of IT. Security Management of Information Technology		
Unit-V	Social Computing (SC):	08 Hrs
Social Computing (SC): Web 2.0 and 3.0, SC in business-shopping, Marketing, Operational and Analytic CRM, E-business and E-commerce – B2B B2C, Mobile Commerce.		

Reference Books and Reports:

1. Management Information Systems, 11th edition by James A O'Brien, George M., Ramesh Behl.
2. Kelly Rainer, Brad Prince, Management Information Systems, Wiley.
3. K.C. Laudon and J.P. Laudon, Management Information Systems: Managing the Digital Firm, 10th Ed., Prentice Hall, 2007.
4. D. Boddy, A. Boonstra, Managing Information Systems: Strategy and Organization, Prentice Hall, 2008

Program : Civil Engineering	BTECH	Semester: VII
Open Elective Course - I Operations Research (OECE7053T)		

Course Objectives

1. To formulate a real-world decision problem as a mathematical programming model.
2. To learn the mathematical tools that are employed to solve mathematical programming models

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze a real-world problem by formulating it as a Linear Programming Problem and interpreting the solution obtained using the Simplex method or other algorithms.	1	Analyze
CO2	Determine real-world problems as Transportation Problem and Assignment Problem and solve the decision problem by choosing appropriate algorithm.	3	Apply
CO3	Determine the decision situations which vary with time and analyse them using principle of dynamic programming to real life situations.	3	Apply
CO4	Explain reasons of formation of queues, classify various queuing systems and apply parameters defined for various queuing systems for decision making in real life situations.	2	Understand
CO5	Explain the concept of decision making in situation of competition and recommend strategies in case of two-person zero sum games.	2	Understand
CO6	Explain the concept of simulation and replacement policy, apply Monte Carlo Simulation technique to systems such as inventory and queuing, and determine optimal replacement age.	2	Understand

Course Content

Unit-I	10 Hrs
Introduction to Operations Research: Concept of decision making. Definition of OR. Formulation of decision problem as OR model, Concept of Optimization, Linear Programming Problem: Mathematical Formulation. Finding optimal solution - Graphical method, Simplex Method, Big M-method, Two Phase Method. Duality, Primal – Dual construction, Symmetric and Asymmetric Dual. Dual Simplex Method.	
Unit-II	08 Hrs
Assignment Problems: Mathematical Formulation, Finding optimal solution - Hungarian Method. Transportation problem: Mathematical Formulation, Finding initial basic feasible solution – Northwest corner rule, row minima, column minima, least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method. Improving the solution.	
Unit-III	06 Hrs
Dynamic Programming: Bellman's Principle of optimality - Applications of dynamic programming- Employment smoothening problem, capital budgeting problem, shortest path problem, cargo loading problem	
Unit-IV	8 Hrs
Queuing Models: Characteristics of queuing models. Single Channel – Single and multi-phase servers, Poisson arrivals, and exponential service time - with infinite population and finite population models – with infinite and finite capacity. Multichannel – Single phase server - Poisson arrivals, exponential service time with infinite population. Game Theory: Introduction. Minimax & Maxim in Criterion and optimal strategy. Solution of games with saddle points, rectangular games without saddle points - 2 x 2 games, dominance principle.	

Approximate methods - Iterative method, $m \times 2$ & $2 \times n$ games -Graphical method and method of sub-games. Expressing game as LPP.

Unit-V

8 Hrs

Simulation: Definition. Types of simulation models. Monte Carlo simulation technique. Applications of simulation - Inventory and queuing problems. Simulation Languages. Replacement Models: Replacement of items that deteriorate with time - when money value is not counted and counted, Replacement of items that fail suddenly – individual and group replacement policy.

Text books:

1. Operations Research, Sharma J. K., Trinity Press
2. Operations Research, Gupta P. K., Hira D. S., S. Chand Limited

Reference Books:

1. Operations Research - An Introduction; Taha, H.A.; Prentice Hall

Program : Civil Engineering	BTECH	Semester: VII
Open Elective Course - I Cyber Security and Laws (OECE7054T)		

Course Objectives

1. To understand and identify different types cybercrime and cyber offences.
2. To recognized Indian IT Act 2008 and its latest amendments
3. To learn various types of security standards compliances

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the different types of cybercrime and security issues E Business.	2	Understand
CO2	Analyze different types of cyber threats and techniques for security management.	1	Analyze
CO3	Analyze the legal requirements and standards for cyber security in various countries to regulate cyberspace.	1	Analyze
CO4	Explain the Information Technology Act and the legal framework of right to privacy, data security, and data protection.	2	Understand

Course Content

Unit-I	Introduction to Cybercrime:	10 Hrs
Cyber Crime, Cyber Law, Cyber Security, History of Cyber Crime, Hacking, Data Theft, Cyber Terrorism, Virus & Worm's, Email Bombing, Pornography, online gambling, Forgery, Web Defacements, Web Jacking, Illegal online Selling, Cyber Defamation, Software Piracy, Electronics/ Digital Signature, Phishing, Password Cracking, Key loggers and Spywares, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing Identity Theft (ID Theft) Cyber offenses: How criminal plan the attacks, Social Engineering, Cyber stalking, Cyber café and Cybercrimes, Botnets, Attack vector		
Unit-II	Cyber Threats Analysis	08 Hrs
Knowledge of Dynamic and Deliberate Targeting Knowledge of Indications and Warning. Knowledge of Internal Tactics to Anticipate and/or, Emulate Threat Capabilities and Actions. Knowledge of Key Cyber Threat Actors and their Equities Knowledge of Specific Target Identifiers and Their Usage Cyber Security Management Knowledge of Emerging Security Issues, Risks, and Vulnerabilities		
Unit-III	Electronic Business and legal issues	08 Hrs
Electronic Business and legal issues. Evolution and development in Ecommerce, Policy Frameworks for Secure Electronic Business, paper vs paper less contracts, E-Commerce models- B2B, B2C, E security. E- Payment Mechanism; Payment through card system, E-Cheque, E-Cash, E-Payment Threats & Protections, Security for E-Commerce.		
Unit-IV	Indian IT Act	08 Hrs
Indian IT Act Cyber Crime and Criminal Justice, Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments Security aspect in cyber LawThe Contract Aspects in Cyber Law , The Security Aspect of Cyber Law, The Intellectual		

Property Aspect in Cyber Law ,The Evidence Aspect in Cyber Law ,The Criminal Aspect in Cyber Law

Unit-V Security Industries Standard Compliances 08 Hrs

IT Security v/s IT Compliance, Cyber Security Standards, critical security controls for cyber security, GRC (Governance, Risk Management, and Compliance), SOX, GLBA, HIPAA, ISO/IEC 27001, NIST Cyber Security Framework (CSF), PCI-DSS. OWASP Top Ten Project, GDPR (General Data Protection Regulation), NIST (National Institute of Standards and Technology), CIS Controls (Center for Internet Security Controls)

Reference Books and Material:

1. Nina Godbole, Sunit Belapure, Cyber Security, Wiley India, New Delhi
2. The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi
3. The Information Technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.
4. E-Commerce Security and Privacy", Anup K. Ghosh, Springer Science and Business Media, 2012
5. Izzat Alsmadi , The NICE Cyber Security Framework Cyber Security Intelligence and Analytics, Springer
6. Cyber Law & Cyber Crimes, Advocate Prashant Mali; Snow White Publications, Mumbai
7. Nina Godbole, Information Systems Security, Wiley India, New Delhi
8. Kenneth J. Knapp, Cyber Security & Global Information Assurance Information Science Publishing.
9. William Stallings, Cryptography and Network Security, Pearson Publication
10. Websites for more information is available on : The Information Technology ACT, 2008- TIFR : <https://www.tifrh.res.in>

Program : Civil Engineering	BTECH	Semester: VII
Open Elective Course - I Personal Finance Management (OECE7055T)		

Course Objectives

1. To create awareness and educate consumers on access to financial services.
2. To make the students understand the basic concepts, definitions and terms related to direct taxation.
3. To help the students compute the Goods and Service Tax (GST) payable by a supplier after considering the eligible input tax credit.
4. To familiarise the students with microfinance for accelerating the expansion of local microbusinesses.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Use a framework for financial planning to understand the overall role finances play in his/her personal life.	3	Apply
CO2	Calculate income from salaries, house property, business/profession, capital gains and income from other sources.	3	Apply
CO3	Calculate the amount of CGST, SGST and IGST payable after considering the eligible input tax credit.	3	Apply
CO4	Describe how Microfinance can help in financial inclusion.	2	Understand

Course Content

Unit-I	Overview of Indian Financial System	10 Hrs
Characteristics, Components and Functions of Financial System. Financial Instruments and Financial Markets, Financial inclusion. Introduction to Personal Finance Person Financial Planning in Action, Money Management Skills, Taxes in Your Financial Plan, Savings and Payment Services. Consumer Credit: Advantages, Disadvantages, Sources and Costs.		
Unit-II	Personal Financial Management Loans	08 Hrs
Personal Financial Management Loans: Home, Car, Education, Personal, Loan against property and Jewel loan. Insurance: Types of Insurance – ULIP and Term; Health and Disability Income Insurance, Life Insurance. Investment: Investing Basics and Evaluating Bonds, Investing in Stocks and Investing in Mutual Funds, Planning for the Future.		
Unit-III	Income Tax Act	08 Hrs
Income Tax Act Basics- Introduction to Income Tax Act, 1961 Heads of Income and Computation of Total Income and Tax Liability- Heads of Income and Computation of Total Income under various heads, Clubbing Provisions, Set off and Carry forward of Losses, Deductions, Assessment of Income and tax liability of different persons. Tax Management, Administrative Procedures and ICDS - TDS, TCS and Advance Tax Administrative Procedures, ICDS.		
Unit-IV	Goods and Services Tax	08 Hrs
GST Constitutional framework of Indirect Taxes before GST (Taxation Powers of Union & State Government); Concept of VAT: Meaning, Variants and Methods; Major Defects in the structure of Indirect Taxes prior to GST; Rationale for GST; Structure of GST (SGST, CGST, UTGST & IGST); GST Council, GST Network, State Compensation Mechanism, Registration. Levy and Collection of GST Taxable event- "Supply" of Goods and Services; Place of Supply: Within state, Interstate, Import and Export; Time of supply: Valuation for		

Small supplies and Composition Scheme: Classification of Goods and Services

08 Hrs

8. Simplified Approach to GST Goods and Services Tax, By S K Mishra , Educreation Publishing.
9. Introduction To Microfinance , By Todd A Watkins , World Scientific Publishing

Program : Civil Engineering	BTECH	Semester: VII
Open Elective Course - I Energy Audit and Management (OECE7056T)		

Course Objectives

1. To understand the importance of energy security for sustainable development and the fundamentals of energy conservation.
2. To identify and describe the basic principles and methodologies adopted in energy audit of a utility
3. To introduce performance evaluation criteria of various electrical and thermal installations to facilitate the energy management.
4. To relate the data collected during performance evaluation of systems for identification of energy saving opportunities.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Identify and describe present state of energy security and its importance.	3	Learn
CO2	Identify and describe the basic principles and methodologies adopted in energy audit of a utility.	3	Learn
CO3	Describe the energy performance evaluation of some common electrical installations and identify the energy saving opportunities.	4	Apply
CO4	Describe the energy performance evaluation of some common thermal installations and identify the energy saving opportunities.	4	Evaluate
CO5	Analyze the data collected during performance evaluation and recommend energy saving measures.	2	Analyze

Course Content

Unit-I

10 Hrs

Energy Scenario: Present Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy Security, Energy Conservation and its Importance, Energy Conservation Act- 2001 and its Features. Basics of Energy and its various forms, Material and Energy balance.

Unit-II

08 Hrs

Energy Audit: Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution. Elements of monitoring & targeting, Energy audit instruments. Technical and economic feasibility, Classification of energy conservation measures. Safety considerations during energy audit. Financial analysis techniques: Simple payback period, NPV, Return on investment (ROI) Internal rate of return (IRR).

Unit-III

08 Hrs

Energy Management and Energy Conservation in Electrical System: Electricity billing, Electrical load management and maximum demand Control; Power factor improvement, Energy efficient equipment's and appliances, star ratings. Energy efficiency measures in lighting system, lighting control: Occupancy sensors, daylight integration, and use of intelligent controllers. Energy conservation opportunities in water pumps, compressor, fan and blower. Industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives.

Unit-IV

08 Hrs

Energy Management and Energy Conservation in Thermal Systems: Review of different thermal loads; Energy conservation opportunities in: Steam distribution system, Steam

leakages, Steam trapping, Condensate and flash steam Recovery system. Waste heat recovery, use of insulation- types and application. Energy conservation opportunities in: Boiler system. Refrigeration system and HVAC system.

Unit-V

08 Hrs

Energy conservation in Buildings: Energy Conservation Building Codes (ECBC): Green Building, LEED rating, Application of Non-Conventional and Renewable Energy Sources, Energy sources and energy management in electric vehicles.

Reference Books:

1. Handbook of Electrical Installation Practice, Geofry Stokes, Blackwell Science.
2. Designing with light: Lighting Handbook, By Anil Valia, Lighting System.
3. Energy Management Handbook, By W.C. Turner, John Wiley and Sons.
4. Handbook on Energy Audits and Management, edited by A. K. Tyagi, Tata Energy Research Institute (TERI).
5. Energy Management Principles, C.B. Smith, Pergamon Press.
6. Energy Conservation Guidebook, Dale R. Patrick, S. Fardo, Ray E. Richardson, Fairmont Press.
7. Handbook of Energy Audits, Albert Thumann, W. J. Younger, T. Niehus, CRC Press.
8. www.energymanagertraining.com
9. www.bee-india.nic.in

Program : Civil Engineering	BTECH	Semester: VII
Open Elective Course - I Science of Well-being (OECE7057T)		

Course Objectives

1. To create consciousness about importance of holistic health and physical as well as mental well-being.
2. To make learners aware of the concepts of Happiness, Gratitude, Self-Compassion, Empathy etc.
3. To introduce the learners to the means of mental and physical well-being, ill effects of mal- practices like alcoholism, smoking etc.
4. To equip the learners to manage and cope up with stress in their daily living.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Describe concepts of holistic health and well-being, differentiate between its true meaning and misconceptions, and explain the benefits of well-being.	2	Understand
CO2	Describe the meaning of happiness, practice gratitude and self-compassion, and analyze incidents from one's own life	2	Understand
CO3	Explain the causes and effects of stress, identify reasons for stress in one's own surroundings and self.	2	Understand
CO4	Describe the importance of physical health and fitness, assess one's lifestyle, and justify its limitations or effectiveness.	2	Understand
CO5	Analyze one's own coping mechanisms, assess their effectiveness, develop and strategize for betterment, and execute them.	1	Analyze

Course Content

Unit-I	Unit 1	10 Hrs
	Health and well-being: The concept of health, dimensions of health, the notion of well-being, various facets of well-being, relation between health and well-being. Concept of holistic health, its principles and importance, concept and benefits of holistic care, misconceptions about holistic health approach, the application of a true holistic approach to our well-being.	
Unit-II	Unit 2	08 Hrs
	Concepts of happiness: Happiness: what is it and how do we measure it? Philosophical perspectives on happiness, Happiness: Nature or Nurture? Happiness in the modern world: impediments and accelerators, Narrow vs. Broad Band Approaches to Happiness, Benefits of Happiness, Self-Compassion and Gratitude. Misconceptions of happiness.	
Unit-III	Unit 3	08 Hrs
	Stress and mental health/well-being: Nature and concept of stress, meaning and definitions of stress, types of stress, meaning of stressors, types of stressors, symptoms of stress, effects of stress, different models of stress. Sources of stress and how does stress cause illness, various sources of stress, delineate between external and internal sources of stress, differentiate between continuous and discrete stressors, the effects of these stressors on health and well-being, diversity of stressors and their health consequences, relation between stress and illness from different perspectives association between stress related physiological mechanisms and different illnesses.	
Unit-IV	Unit 4	08 Hrs
	Physical Well-being / Health management: concept of health behaviours, dimensions of health behaviours. Health enhancing behaviours: Exercise and Weight control, application and importance of these health enhancing behaviours. Health protective behaviours and	

illness management: concept of illness management, effectiveness of illness management.

Concept of Nutrition, Role of Nutrition, Components of Nutrition, concept of Malnutrition,

Health compromising behaviours: Alcoholism, Smoking and its effects on health.

Unit-V

Unit 5

08 Hrs

Dealing with Difficult Times / Coping mechanisms: The concept of chronic stress, Health and safety risks of chronic stress, Forms and Treatment of chronic stress, Coping with Acute and Chronic stress, theories of the stress-illness link, role of stress in mental disorders. Concept of coping, Ways of coping and stress management, basic knowledge about stress management, various techniques of stress management, stress management programs. Mental strengths and virtues, Hope, Optimism, Resilience – concept, pathways and models, Meditation and Self-introspection.

Reference Books:

1. The pursuit of happiness and the realization of sympathy: Cultural patterns of self, social relations, and well-being by Kitayama, S., & Markus, H. R, Culture and subjective well-being, The MIT Press.
2. Man Adapting by Dubos, R; New Haven: Yale University Press.
3. Happiness a history by McMahon D. M., Atlantic Monthly Press.
4. Well-being: The foundations of hedonic psychology by D. Kahneman & E. Diener & N. Schwarz, New York: Russell Sage
5. Selye H. The Stress of Life. New York; McGraw-Hill; 1984.

Textbooks:

1. The Science of well-being by Felicia Huppert, Nick Baylis, Barry Keverne; Oxford University Press

2. Health and Well-Being: Emerging Trends by S. Ojha, U. Rani Srivastava, Shobhna Joshi, Global Vision Publishing House
3. Positive psychology: The scientific and practical explorations of human strengths by Shane
4. J. Lopez, Jennifer Teramoto Pedrotti, Charles Richard Snyder; Sage Publications.

Program : Civil Engineering	BTECH	Semester: VII
Open Elective Course - I Research Methodology (OECE7058T)		

Course Objectives

1. To understand Research and Research Process
2. To acquaint learners with identifying problems for research and develop research strategies
3. To familiarize learners with the techniques of data collection, analysis of data and interpretation

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the importance of public systems in a fast-changing environment in the global context.	L2	Understand
CO2	Analyze the transformations in public systems with emphasis on current initiatives and emerging challenges in the field.	L4	Analyze
CO3	Explain public policy and its operations with special focus on policy relating to Government finance.	L2	Understand
CO4	Analyze the impact of public policy on firms and the economy at large and work under various fields as policymakers.	L4	Analyze
CO5	Apply analytical skills through Expenditure Policy in public services case studies.	L3	Apply

Course Content

Unit-I	Basic Research Concepts	10 Hrs
Meaning of research, Objectives of research, Types of research, Significance of research process		
Unit-II	Research Methodology	08 Hrs
Identification of research problem, Literature review, Formulation of hypothesis, Formulation of Research design.		
Unit-III	Research and Sample Design	08 Hrs
Meaning of research and sample design, need of research design, Features of good research design, important concepts, Different research designs, Types of sampling designs.		
Unit-IV	Data Collection and Data Analysis	08 Hrs
Types of data, Methods for collecting data: Experiments and surveys, Collection of primary and secondary data, Hypothesis testing and interpretation of Data.		
Unit-V	Interpretation and Report Writing	08 Hrs
Interpretation and drawing conclusions on the research, Preparation of the report, Ethical Issues		

Reference Books:

1. Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers Distributors.
2. Kothari, C.R.,1985, Research Methodology-Methods and Techniques, New Delhi, Wiley Eastern Limited.
3. Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2nd Edition), Singapore, Pearson Education

Program : Civil Engineering		Semester: VII
Open Elective Course - I I Public Systems and Policies (OECE7059T)		

Course Objectives

1. To analyze the transformations in public systems with emphasis on current initiatives and emerging challenges in the field.
2. To understand public systems in a fast-changing environment in the global context.
3. To provide an in-depth understanding of the ills prevailing in the society and aids to identify the solutions for them.
4. To explain public policy and its operations with special focus on policy relating to Government finance.
5. To analyze and evaluate the impact of the public policy on firms and economy at large.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the importance of public systems in a fast-changing environment in the global context.	2	Understand
CO2	Analyze the transformations in public systems with emphasis on current initiatives and emerging challenges in the field.	1	Analyze
CO3	Explain public policy and its operations with special focus on policy relating to Government finance.	2	Understand
CO4	Analyze the impact of public policy on firms and the economy at large and work under various fields as policymakers.	1	Analyze
CO5	Apply analytical skills through Expenditure Policy in public services case studies.	3	Apply

Course Content

Unit-I		10 Hrs
Introduction and Overview of Public Systems: Ideology of Public Systems; Mechanistic and Organic view of Society and Individuals, The Legal Framework; Federal Government; State and Local Governments, Government growth; The size of Government.		
Unit-II	Unit-II	08 Hrs
Public Sector in the Economics Accounts: Public Sector in the circular flow; Public Sector in the National Income Accounts.		
Unit-III	Unit-III	08 Hrs
Public Choice and Fiscal Politics: Direct Democracy; Representative Democracy; The Allocation Function; The Distribution Function; The Stabilization Function; Coordination of Budget Functions; The Leviathan Hypothesis.		
Unit-IV	Unit-IV	08 Hrs
Introduction and Overview of Public Policy: Markets and Government; Social goods and Market failure, Public expenditure and its evaluation; Cost Benefit Analysis, Public policy and Externalities, Taxation Policy and its impact, Income distribution, redistribution and social security issues Fiscal & Budgetary Policy, Fiscal Federalism in India.		
Unit-V	Unit-V	08 Hrs
Case Studies in Expenditure Policy: Public Services A) National Defense B) Highways C) Outdoor Recreation D) Education.		

Reference Books:

1. Introduction to Public Policy by Charles Wheelan, W.W. Norton & Company.
2. Understanding Public Policy by Thomas R. Dye, Prentice Hall.
3. Public Policy-Making: An Introduction by Anderson J.E., Boston, Houghton.

4. Public Administration by Avasthi & Maheshwari, Lakshminarayan Agarwal, Agra.
5. New Horizons of Public Administration by Bhattacharya, Mohit, Jawahar Publishers, New Delhi.
6. Public Administration and Public Affairs by Henry, Nicholas, Prentice Hall of India, New Delhi.
7. Public Finance 10th Edition by Harvey S Rosen and Ted Gayer, McGraw-Hill Education, 2013.
8. Public Finance in Theory and Practice by Musgrave and Musgrave.

Program : Civil Engineering	BTECH	Semester: VII
Project Stage-II (PJCE7060L)		

Course Objectives

1. To implement the solution as per the problem statement.
2. To develop the team building, writing, logical reasoning and management skills.
3. To provide the connections between the designs and concepts across different disciplinary Boundaries.
4. To encourage students to become independent personnel, critical thinkers and lifelong learners

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze the problem statement and produce solution of the problem considering cultural, social, environmental and economic factors using appropriate tool and method.	4	Analyse
CO2	Interpret project based learning that allows students to transfer existing ideas into new applications.	2	Understand
CO3	Apply the ability to work in teams and manage to conduct the project development activity.	3	Apply
CO4	Use different perspectives from relevant disciplines which help them to get internships, jobs, and admission for higher studies.	3	Apply
CO5	Explain the project development in the form of technical writing, and interpret what constitutes plagiarism and the use of proper referencing styles.	2	Understand

Course Content / Guidelines

Project-I work done in VI semester shall be continued as Project-II in semester VII.

Students should complete remaining implementation of ideas given in synopsis/Abstract of Semester VII.

Students / group must plan their execution of project, so that project work should be completed

Before end of semester.

Project-II involves fabrication, design, experimentation, data analysis within realistic constraints

such as economic, environmental, social, ethical, health and safety, manufacturability, and Sustainability. The stage also includes testing, possible results and report writing.

Each project group is required to maintain log book for documenting various activities of Project-II and submit group project report at the end of Semester-VII in the form of Hard bound.

Domain knowledge (any beyond) needed from the following areas for the effective Implementation of the project:

Experimental design / Theoretical Analysis/ software analysis / Fabrication of model, structural design, Hydraulic design, construction management, Environmental studies, sustainable development, Smart city planning, Advanced Transportation system, Structural audit, comparative study, case study, field/ market survey, Smart material, Economical study etc.

Guidelines:

The main purpose of this activity is to improve the students' technical skills, communication skills by

Integrating writing, presentation and teamwork opportunities.

Each group will be reviewed twice in a semester and marks will be allotted based on the various

Points mentioned in the evaluation scheme.

-In the first review of this semester, each group is expected to complete 70 % of project.

(May Consist theoretical design of project, block diagram and components required for design, Experimental work, using software, comparative study/analysis/ filed work etc.

-In the second review of this semester, each group is expected to complete 100 % of project.

(May consist theoretical design of project, block diagram and components required for design, Experimental work, using software, comparative study/analysis/ filed work etc.

The students may use this opportunity to learn different computational techniques towards Development of a product. Interaction with alumni mentor will also be appreciated for the improvement of project.

Assessment Criteria:

At the end of the semester, after confirmation by the project guide, each project group will Submit project completion report in prescribed format for assessment to the departmental Committee (including project guide).

Assessment of the project stage (at the end of the semester) will be done by the departmental Committee (including project guide).

The candidate must bring the project part- 1 report and the final report completed in all respect while appearing for End Semester Examination.

Oral examination should be conducted by Internal and External examiners. Students have to give presentation and demonstration based on their project.

Prescribed project report guidelines:

Every group should prepare hard bound report (preferable Latex/ word file format) of about minimum 40pages on the work carried out by a batch of students in respect of the project

work done during

Semester-VII. Project Report should include appropriate content for:

- Title
- Abstract
- Introduction
- Problem identification and project objectives
- Literature Survey
- Related Theory
- Project design and Implementation details
- Case study/Analysis/Design Methodology
- Project Outcomes
- Result and Conclusion
- Future scope
- References

Assessment criteria for the departmental committee (including project guide) for Continuous Assessment:

Assessment criteria for the departmental committee (including project guide) for End Semester Exam:

Each group will be reviewed twice in a semester by faculty guide and faculty coordinator based on the following criteria:

Project progress

Documentation/Technical paper writing

Key findings

Validation of results

Product development

Each review consists of 25 marks. Average of the marks scored in both the two reviews will be Considered for final grading. The final certification and acceptance of TW ensures the satisfactory Performance on the above aspects.

Table -1 Log Book Format

S. No.	Week (Start date : End date)	Work done	Sign of Guide	Sign of Coordinator
1				
2				

Table -2 Continuous Assessment Sheet

S. No.	Exam Seat	Name of Student	Student Attendance	Log book Maintenance	Literature Review	Depth of Understanding	Report	Total
			5	5	5	5	5	25

Table -3 Evaluation Sheet

S. No.	Exam Seat	Name of Student	Project Selection	Design simulation /Logic	Hardware programing/ Experimental work	Result verification	Presentation	Total
			5	5	5	5	5	25

SEM

VIII

Program : Civil Engineering	BTECH	Semester: VIII
NPTEL-Environmental Remediation of Contaminated Sites (PECE8010T)		

Course Objectives

1. To introduce students to the nature, sources, and behavior of contaminants in soil and groundwater systems
2. To develop understanding of environmental laws, regulations, and standards governing contaminated site management and remediation.
3. To familiarize students with risk assessment concepts, including human health and ecological risk assessment for contaminated sites.
4. To provide knowledge of conventional and advanced remediation technologies for soil, groundwater, and sediments.
5. To enable students to analyze, compare, and select appropriate remediation methods based on site conditions, contaminant characteristics, and risk levels.
6. To build the ability to apply remediation principles in real-world case studies, integrating technical, environmental, and sustainability considerations.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the foundational concepts, scope, and principles of environmental risk assessment and remedial alternatives.	2	Understand
CO2	Apply legal and scientific frameworks to environmental risk assessment and remediation decision-making processes.	3	Apply
CO3	Analyze practical applications and challenges associated with environmental risk management using real-world examples.	4	Analyse
CO4	Evaluate suitable remedial alternatives based on regulatory, scientific, and environmental risk considerations.	5	Evaluate

Course Content

Unit-I	Unit 1	08 Hrs
Introduction to environmental remediation, including legal concepts, types of laws, regulations, and basics of hazardous waste management and corrective actions.		
Unit-II	Unit 2	08 Hrs
Study of risk assessment covering terminology, history, human health risk assessment steps, ecological risk, and risk-based corrective action.		
Unit-III	Unit 3	08 Hrs
Overview of remedial options such as plume containment, pump and treat methods, source control, permeable reactive barriers, and monitored natural attenuation.		
Unit-IV	Unit 4	10 Hrs
Understanding soils and sediments including excavation techniques, landfill types, containment systems, and solidification/stabilization methods. Introduction to bioremediation and phytoremediation, including their mechanisms, processes, and practical examples.		
Unit-V	Unit 5	08 Hrs
Study of thermal processes (incineration, desorption, oxidation) and soil washing techniques with design considerations.		

Program : Civil Engineering	BTECH	Semester: VIII
Professional Elective Course - IV NPTEL- Professional Elective Course-IV Structural Audit (PECE8010T)		

Course Objectives

1. Gain the knowledge of Bye laws, procedure of Structural audit and study the typical problems in structures.
2. Aware of causes and types of deterioration in structures.
3. Develop skills for use of various Non-destructive tests required during auditing of structures.
4. Acquire knowledge of legal procedure to conduct structural audits.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Students will able to learn the different Bye laws, procedure of Structural audit and study the typical problems in structures.	3	Learn
CO2	Students will able to aware of causes and types of deterioration in structures	4	Understand
CO3	Students will able to understand the use of various Non-destructive tests required during auditing of structures	4	Understand
CO4	Students will able to prepare detailed Structural audit report.	2	Analyse

Course Content

Unit-I	Introduction to structural audit	06 Hrs
a) Introduction to Structural Audit: Objectives, Bye-laws, Importance, various Stages involved, b) Visual inspection: scope, coverage, limitations, Factors to be keenly observed. Aspects of audit of Masonry buildings, RC frame buildings, Steel Structures		
Unit-II	Causes and types of deterioration in Structures	12 Hrs
a Causes of deterioration of concrete structures: Permeability of concrete, capillary porosity, air voids, Micro cracks and macro cracks, corrosion of reinforcing bars, sulphate attack, alkali silica reaction, b. Effects of environmental condition- moisture, temperature, chemicals, wear, erosion and loading on serviceability and durability.		
Unit-III	Strength Evaluation of Existing Structures	06 Hrs
Reserve strength, identification of critical sections, structural system and its validation, evaluation of damage in RC structures		
Unit-IV	Structural audit approach	6 Hrs
Guidelines of Statutory Bodies, Legal aspects, Responsibility of calling Structural Audit, Scope of Investigation		
Unit-V	Structural Audit Report	6 Hrs
Study of sample Structural audit report for up-gradation of existing building, Audit for continuation of usage of old Buildings, Audit for Buildings damaged due to Earthquakes, Fire,		

References / Text Books / List of experiments / Assignment

Reference Books:

1. Properties of Concrete by A M Neville, Longman
2. R. N. Raikar, Learning from Failures, R & D Centre, (SDCPL)
3. R. N. Raikar, Diagnosis and treatment of structures in Distress, R & D Centre, (SDCPL)
4. Demolition of Structures, Report by Mr. Girish Kulkarni, Mumbai
5. Structural Audit, Report by Mr. Umesh Dhargalkar, Mumbai
6. Indian Standard codes related with non-destructive testing, Government Resolutions related to Structural Audits (BMC Act, etc.), Field manuals and reports by Expert Consultants.

Program : Civil Engineering	BTECH	Semester: VIII
Professional Elective Course - V NPTEL- Maintenance and Repair of Concrete Structures (PECE8020T)		

Prerequisite: *Basic concepts of Building Construction & Materials*

Course Objectives

1. To understand the causes and mechanisms of corrosion and deterioration in reinforced concrete structures.
2. To study the effects of environmental and load-related factors on the performance of cementitious systems..
3. To learn non-destructive testing (NDT) techniques for assessment and diagnosis of concrete structures.
5. To analyze condition assessment data and select appropriate repair and rehabilitation strategies.
6. To understand surface repair methods, materials, and design considerations for concrete structures.
7. To introduce strengthening and stabilization techniques for beams and columns to improve structural performance.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply engineering principles and technical knowledge to perform tasks and solve practical problems in the internship environment.	3	Apply
CO2	Analyze specialized or emerging technologies used in the organization to determine their suitability and effectiveness for specific engineering applications	4	Analyse
CO3	Evaluate personal skill gaps and professional growth needs, and develop strategies for continuous improvement and life-long learning.	5	Evaluate
CO4	Create ethical, socially responsible, and environmentally conscious engineering solutions or recommendations based on the internship experience.	6	Create

Course Content

Unit-I	Unit 1	08 Hrs
cover the introduction, significance, and mechanisms of corrosion, specifically focusing on embedded metal corrosion.		
Unit-II	Unit 2	08 Hrs
detail the deterioration of cementitious systems due to sulphate attacks, acid attacks, alkali-silica reactions (ASR), and shrinkage.		
Unit-III	Unit 3	08 Hrs
focus on concrete assessment using non-destructive tests (NDT), load effects, and surface repair strategies, including analysis and material requirements.		
Unit-IV	Unit 4	10 Hrs
discuss strengthening and stabilization techniques, including beam shear, column, and flexural strengthening.		
Unit-V	Unit 5	08 Hrs
Strengthening and stabilization: Beam shear, column, and flexural strengthening.		

Reference Books

1. B. Vidivelli & S. Sridharan Corrosion and Protection of Steel in Concrete, Covers corrosion mechanisms, embedded metal corrosion, durability issues.
2. R. N. Swamy (Ed.), The Alkali–Silica Reaction in Concrete Detailed reference for ASR, deterioration mechanisms.
3. M. Neville Properties of Concrete, Best reference for sulphate attack, acid attack, shrinkage, durability.
4. . P. Kumar Mehta & Paulo J. M. Monteiro, Concrete: Microstructure, Properties, and Materials Excellent for deterioration mechanisms and material behavior.

Text Books

1. R. T. L. Allen & S. C. Edwards Repair of Concrete Structures, Condition assessment, surface repair strategies, materials, and methods.
2. BRE Digest / Concrete Society Technical Reports (TR 22, TR 54), Practical guidance on inspection, repair, and strengthening.
3. Malhotra & Carino, Handbook on Non-destructive Testing of Concrete, Standard reference for NDT methods and interpretation.
4. J. H. Bungey, S. G. Millard & M. G. Grantham Testing of Concrete in Structures, Covers NDT, assessment, and load effects.

Program : Civil Engineering	BTECH	Semester: VIII
Professional Elective Course - V Metro Construction Technology (PCCE8020T)		

Course Objectives:

1. To develop civil engineering graduates having clear understanding of Metro construction technology.
2. To apply the knowledge of structural design in Metro construction.
3. Understand the concept of underground construction methods.
4. Able to Design precast concrete and understand fundamentals of metro rail

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the importance of Advance method of construction technology	2	Understanding
CO2	To apply the knowledge of structural design in Metro construction	3	Applying
CO3	Understand the concept of underground construction methods.	1	Remember
CO4	Able to Design precast concrete and understand fundamentals of metro rail	5	Evaluating

Course Content

Unit-I	Metro Projects Fundamentals	08 Hrs
Concept of rapid transit systems, requirements of rapid transit systems. Types of rapid transit systems, concept of metro rail transit system, terminology of metro construction, advantages and disadvantages of metro, metro construction projects in India		
Unit-II	Underground Construction	08 Hrs
Need for underground construction, fundamentals of underground constructions, planning for underground construction, site preparations, characteristics of soil and basics of geotechnical engineering, methods of underground construction, top-down construction method, bottom-up construction method, safety during underground construction, worker's health and safety provisions, regulations of underground construction		
Unit-III	Tunnel Construction	08 Hrs
Fundamentals theories of tunnel construction, types of tunnels, different cross-sections of underground tunnels, methods of tunnel boring, tunnel boring machine (TBM), parts of TBM, working procedure of TBM, procedure of tunnel construction using TBM, stations construction during tunnels, removal and dumping of excavated materials		
Unit-IV	Precast Concrete Technology	08 Hrs
Fundamentals of pre-cast concrete technology, Requirements of precast concrete elements in metro construction, Theories of formwork for precast concrete, curing of precast concrete, Admixtures and ingredients of precast concrete, Transportation off precast segments, Precast segments of tunnel, Precast bridge segments, Fundamentals of precast concrete bridge construction		
Unit-V	Metro rail	06 Hrs

Fundamentals of railway construction, terminology of railway and its components, Railway systems, Railway track construction, Components of railway track, Rail signalling, Introduction to electric supply for metro rail

Text Books:

1. M Ramachandran, Metro Rail Projects in India: a Study in Project Planning, Oxford University Press, New Delhi, 2011.
2. R K Goel, B Singh and J Zhao, Underground Infrastructures: Planning, Design and Construction, Butterworth-Heinemann, Oxford, 2012.
3. S Chandra, Railway Engineering, Oxford University Press, New Delhi, 2008.
4. K S Elliott, Precast Concrete Structures, CRC Press, Boca Raton, 2016.
5. K N Jha, Construction Project Management: Theory and Practice, Pearson Education, New Delhi, 2015

Program : Civil Engineering	BTECH	Semester: VIII
Internship (INTCE8030L)		

Course Objectives

1. To expose students to the industrial environment and develop professional competence through real-world experience.
2. To enhance practical technical skills and encourage the application of academic knowledge in industry settings.
3. To familiarize students with current technologies and practices relevant to their field of study.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply theoretical knowledge to real-world engineering problems through hands-on experience in industry or field settings.	L3	Apply
CO2	Apply technical knowledge and problem-solving approaches to address complex engineering problems in an industrial environment.	L3	Apply
CO3	Analyze organizational structures, workflows, and technologies to understand industry practices and operational challenges.	L4	Analyze
CO4	Develop technical documentation, reports, and presentations reflecting experiential learning and problem-solving approaches.	L6	Create
CO5	Discuss career goals and identify areas for personal and professional development based on internship exposure.	L2	Understand

Course Content / Guidelines

Industry Internship Guidelines:

1. The Training and Placement (T&P) cell of the institute will arrange internships for students in industries/organizations after the seventh semester.
2. Students are expected to accept internship offers regardless of the company, job profile, location, or stipend offered.
3. Alternatively, students can individually apply by submitting "Student Internship Program Application" (available on Institute Website) for industry internships, adhering to the prescribed guidelines as follows:
4. Only T&P department granted internship will be considered.
5. The internship duration should be of minimum 12 Weeks.
6. Each student needs to take prior permission from T&P department before proceeding for any internship opportunity on his/her own.
7. Each student will be monitored twice (virtually/through online meetings) during the internship period in the presence of an industry mentor and the departmental faculty mentor and the concerned TPC.
8. If any student wants to withdraw from the Internship, he/she can only be allowed within two weeks of joining the same. Such students will have to continue the semester VIII academic activities regularly along with In-house internship.

Expected Activity in Industry Internship:

- Students may choose to work on innovation or entrepreneurial activities resulting in start-ups or undergo internships with Industry / NGO / Government organizations/Micro/Small/Medium enterprises to prepare for the industry.
- Every student is required to prepare a file containing documentary proofs of the activities done by him. The evaluation of these activities will be done twice (virtually/through online

meetings) during the internship period by the committee constituted by the Head of the Department which shall include Industry mentor, faculty mentor and Department T&P Co-ordinator (TPC). The final evaluation criteria is as given below:

Table 1. Evaluation Criteria of Industry Internship

Internship Objectives and Goals (5 Marks)	Internship Experience Skills Gained/Enhanced (10 Marks)	Professional Development and Growth (5 Marks)	Internship Report (5 Marks)	Presentation (5 Marks)

Industry Internship Report:

1. Upon completion of the internship, students should prepare a comprehensive report that reflects their observations and learnings during the internship period. Students can consult their Industrial Supervisor, Faculty Mentor, or T&P Co-ordinator/Officer for guidance on selecting special topics and problems for the report.
2. The internship report will be evaluated based on the following criteria:
3. Adequacy and purposeful write-up.
4. Variety and relevance of learning experiences.
5. Practical applications and connections with the fundamental theories and concepts covered in the course (semester I to VII).

In-house Internship

The in-house internship provides students with research-oriented opportunities to cultivate a research mindset. It serves as an extension of the project completed in VI and VII semesters (Project Stage-I & II) or offers new objectives provided by the department or research guide.

1. The in-house internship can be pursued individually or as a group activity.
2. If extending a project from Stage II, at least one student in the group must have participated in Stage I & II.

3. If working on the topic offered by the department or in-house mentor, a group of fresh students can form a team.
4. The maximum group size is limited to four students.
5. In case of extension of project stage II, the outcomes should be in the form of product development/technology transfer along with patent and copyright / one research publication (UGC care listed journal/conference). Students can work jointly with any government funding agency or industry. In such cases, a detailed project report shall be submitted after verification by the in-house mentor and industry/funding agency mentor/authority. In case of standalone/non-sponsored activity, i.e. without any funding agency/industry collaboration, the detailed project report shall be submitted after verification by the in-house mentor.
6. If pursuing a Topic offered by the department or in-house mentor, the outcome of the in-house internship should include the publication of a research paper, preferably in an SCI/Scopus/UGC care listed/indexed Journal/Conference. The detailed project report must be submitted and verified by the in-house mentor.
7. All the designated work shall be submitted to the department in the form of a report in hardbound as well as soft copy.

Evaluation Scheme:

III. Continuous Assessment (A):

- a. Each in-house internship activity will be reviewed twice in the semester. In the first review, at least 40% work shall be completed including the Introduction/Scope of the work, literature survey, problem definition and objectives. The remaining 60% of work shall be completed in the second review including implementations, key findings, publications &/patenting &/copyright &/product development etc.
- b. A logbook of the work done must be maintained by each group.

IV. End Semester Examination(C): Departmental committee appointed by The Head (Including an in-house mentor & two senior faculties) will evaluate in-house Internship as per Tables 2, 3, 4, 5 & 6.

Assessment Formats:

Table 2. Log Book Format

Week (Start Date: End Date)	Work Done	Sign of in-house mentor	Sign of Coordinator

Table 3. First Review

Topic Identification & Validation (5 Marks)	Literature Survey (10 Marks)	Problem Definition (5 Marks)	Objectives (5 Marks)

Table 4. Second Review (Objectives given by department/in-house mentor)

Implementation (5 Marks)	Publications (10 Marks)	Presentation (5 Marks)	Report (5 Marks)

Table 5. Second Review (in-house internship)

Product Development/Technology Transfer (10 Marks)	Publication/Patent/Start- up/company registration (10 Marks)	Presentation & Report (5 Marks)

Table 6. End Semester Examination

Topic Identification & Validation (5 Marks)	Literatu re Survey & Problem Definitio n (5 Marks)	Objectives & Implementation/Prod uct Development (5 Marks)	Presentati on (5 Marks)	Report, Publications/Patent/I PR documents (5 Marks)

