



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 2025-26



**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.

Final Year B. Tech Civil Engineering - Semester-VII (w. e. f. 2025-26) Scheme-22

S. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Total [A+ Average(B,C)+D]	Credit	Total	
				L	T	P	Continuous Assessment							ESE [D]
							TA [A]	Term Test 1 [B]	Term Test 2 [C]					
							[A]			[C]	[A+B+C]			
1	PC	22PCCE7010T	Geotechnical Engineering	3	-	-	25	10	10	65	100	3	4	
2	PCL	22PCCE7010L	Geotechnical Engineering Laboratory	-	-	2	25	-	-	25	50	1		
3	PC	22PCCE7020T	Public Health Engineering	3	-		25	10	10	65	100	3	4	
4	PCL	22PCCE7020L	Public Health Engineering Laboratory	-	-	2	25	-	-	25	50	1		
5	PC	22PCCE7030T	Construction Safety & Quality control	3		-	25	10	10	65	100	3	3	
# 6	PE	22PECE7010T	Professional Elective Course -III	3	-	-	25	10	10	65	100	3	3	
7	OE	22OECE7050T	Open Elective Course -I	3	-	-	25	10	10	65	100	3	3	
8	PJ	22PJCE7060L	Project Stage-II	-	-	4	25	-	-	25	50	4	4	
Total				15	-	8	200	50	50	400	650	21	21	

TA-Teacher Assessment, ESE- End Semester Examination

Semester VII Elective Course-III #					
S.No	Course code	Course Title	S.No	Course code	Course Title
1	22PECE7010T	Integrated Watershed Management	3	22PECE7030T	Planning for Sustainable development
2	22PECE7020T	Construction Economics & Finance	4	22PECE7040T	Numerical Method for Civil Engineering

Prepared by

Dean Academic/Dy. Director

Checked by

C.O.E



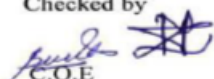
BOS Chairman

Director

Final Year B.Tech Civil Engineering Semester VIII (w.e.f from 2025-26) Scheme 22												
Sr No	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme			ESE (D)	Total [A+ Average (B,C)+D]	Credit
				L	T	P	TA (A)	Term Test 1 (B)	Term Test 2 (C)			
1	PE	22PECE8011T	Structural Audit	3	-	-	25	10	10	65	100	3
		22PECE8012T	Introduction to Earthquake Engineering									
		22PECE8013T	Environmental Impact Assessment and Audit									
		22PECE8014T	Dams & Hydraulic Structures									
		22PECE8015T	Solid Waste Management									
		22PECE8016T	NPTEL / SWAYAM Course#									
2	PE	22PECE8021T	Metro Construction Technology	3	-	-	25	10	10	65	100	3
		22PECE8022T	Air Pollution Control									
		22PECE8023T	Software Application in Structural Engineering									
		22PECE8024T	Coastal Engineering									
		22PECE8025T	Data Analytics in Civil Engineering									
		22PECE8026T	NPTEL / SWAYAM Course#									
3	INT	22INTCE8030L	Internship / Project stage -III	0	-	20	150	-	-	150	300	10
TOTAL				6	0	20	200	20	20	280	500	16

1. @ Any 1 Elective Course
2. * Professional Elective Course offered for the student doing internship at Institute Level
3. # 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.
4. 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.
5. Students undergoing internship have the option to appear for both the NPTEL examination and the End Semester Examination (ESE) Conducted by Institute for the respective course. In such case the better of the two scores (NPTEL or ESE) Shall be considered for final grading
6. 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

SEM

VII

Program : Civil Engineering	BTECH	Semester: VII
Geotechnical Engineering (22PCCE7010T)		
Geotechnical Engineering Laboratory (22PCCE7010L)		

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	To apply the knowledge of science, mathematics and engineering with the context of applications in geotechnical engineering.	3	Learn
CO2	Explain origin and classification of the different soils and to determine engineering properties of soil.	4	Analyze
CO3	Compute geostatic stresses in soils and Describe compaction and soil stabilization.	3	Understand
CO4	Analyze consolidation using Terzaghi's theory.	2	Design
CO5	Measure shear resistance of soil and determine shear stress parameters. Analyze Earth pressure by 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
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.		

References / Text Books / List of experiments / Assignment

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, Dhanpat Rai 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 (22PCCE7020T)		
Public Health Engineering Laboratory (22PCCE7020L)		

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
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.		

References / Text Books / List of experiments / Assignment

Reference Books

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

Text Books

- Environmental Modelling: Finding Simplicity in Complexity by John Wainwright and Mark Mulligan, John Wiley & Sons, Ltd.
- Building Environmental Models: A Primer on Simplifying Complexity by Mulligan, M. and Wainwright, J., John Wiley & Sons, Ltd, Chichester.
- Earth-system science, in Blackwell Companion to Environmental Geography by Wainwright, J., Blackwell, Oxford.
- 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
Construction Safety & Quality control (22PCCE7030T)		

Course Objectives

1. Introduce students to the importance of safety and hazard identification in construction sites
2. Understanding the importance of quality control and quality assurance principles in construction projects
3. To familiarize students with government safety policies, regulations, and compliance requirements in construction industry

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Students will understand construction site hazards and apply safety measures using Personal Protective Equipment (PPE) and emergency preparedness protocols	4	Apply
CO2	Students will apply safety practices during excavation, scaffolding, formwork, concreting, and demolition activities in construction projects	4,	Apply
CO3	Students will analyze quality control standards (ISO 9001, IS codes) and apply quality assurance procedures in construction project monitoring	3	Analyze

Course Contents

Unit 1 Introduction to Construction Safety Policy 6 Hours

Basics of construction site hazards, include physical hazards (Material & Person falls,), health hazards (chemicals, noise), environmental hazards weather, and ergonomic hazards (heavy lifting) types of accidents, causes and prevention, and safety. Government policies include Building Workers Act 1996 and Factories Act 1948. Use of Personal Protective Equipment (PPE). Emergency preparedness and fire safety. Site awareness requires safety meetings, signage, training, and worker participation programs.

Unit 2 Safety in Construction & Demolition Practices 6 Hours

Safety measures during excavation, scaffolding, formwork, concreting, working at heights, Demolition of different methods as per Structure and select suitable method for dismantling. Safety practices systematically protect workers across construction activities, ensuring compliance and productivity. Reuse of Demolished material, Environmental impacts.

Unit 3 Introduction to Quality Control and Assurance 7 Hours

Define quality concepts, standards (ISO 9001,) and the difference between quality control (QC) and quality assurance (QA) in construction and Importance and stages of (QC) in construction projects. IS codes, quality policies, and documentation procedures and Quality Reports.

Unit 4 Real time Monitoring of Important Construction Projects 7 Hours

Introduction to Emerging trends in construction Project using AI & IOT Internet of Things based sensors and devices for continuous monitoring of construction quality parameters including temperature, humidity, and structural integrity its impact of technology in construction projects. Real-time data acquisition systems and wireless sensor networks for automated record keeping of quality control in construction sites.

Unit 5 Quality Audits 7 Hours

Principles of Construction quality audits, checklists, and Third Party Technical Audit Importance, Case studies, and construction failures and lessons learned.

Reference Books:

1. Griffith, A. and Howarth, T. 2001. Construction Health and Safety Management, Longman Scientific & Technical, London.
2. Burke, R. 2013. Project Management Planning and Control Techniques, John Wiley & Sons, Chichester.
3. Jha, K.N. 2011. Construction Project Management: Theory and Practice, Pearson Education India, New Delhi.
4. Varghese, K. 2018. Construction Equipment Planning and Methods, PHI Learning Private Limited, Delhi

Text Books:

1. Construction safety and Management by Kumar neeraj Jha/Dilip patel Publisher Perason ISBN **978-9356060449**
2. Construction safety by R. K. Mishra Publisher AITBS India. ISBN **937473494X**
3. Quality control in Civil Engineering by A,K,Watal & Mahesh Sharma standard publication India
4. Quality assurance and quality control by VVN Prabhakar rao Mahi Publication India

Program : Civil Engineering	BTECH	Semester: VII
Professional Elective Course - III (Integrated Watershed Management) (22PECE7010T)		

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 analysing 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.		

References / Text Books / List of experiments / Assignment

Reference Books

- Gurmel Singh et al. 2004. Manual of soil and water conservation practices. Oxford & IBH publishing Co. New Delhi.
- Suresh, R. 2008. Land and water management principles, Standard Publishers & Distributors, New Delhi.
- Tripathi R.P. and H.P. Singh 2002, Soil erosion and conservation, Willey Eastern Ltd., New Delhi.
- Murthy, V.V.N. 2005, Land and water management, Kalyani publishing, New Delhi.
- Tideman, E.M., “Watershed Management”, Omega Scientific Publishers, New Delhi, 1996.
- 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.
- Tideman E.M. (1999) Watershed Management—Guidelines for Indian Conditions, Omega Scientific Publishers, New Delhi.

Text Books

- Suresh, R. 2005. Soil and Water Conservation Engineering, Standard Publishers & Distributors, New Delhi.
- 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 (22OECE7050T)		

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		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 Measures:	08 Hrs
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	Case studies	08 Hrs
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)		

References / Text Books / List of experiments / Assignment

Reference Books and Reports:

- Disaster Management, by Harsh K.Gupta, Universities Press Publications (2003).
- Disaster Management: An Appraisal of Institutional Mechanisms in India, by O.S.Dagur, published by Centre for land warfare studies, New Delhi, 2011.
- Introduction to International Disaster Management, by Damon Copolla, Butterworth Heinemann Elsevier Publications (2015).
- Disaster Management Handbook, by Jack Pinkowski, CRC Press, Taylor and Francis group (2008).
- Disaster management & rehabilitation, by Rajdeep Dasgupta, Mittal Publications, New Delhi (2007).
- Natural Hazards and Disaster Management, Vulnerability and Mitigation, by R B Singh, Rawat Publications (2006).
- Concepts and Techniques of GIS, by C.P.Lo Albert, K.W. Yonng, Prentice Hall (India) Publications (2006).
- Risk management of natural disasters, by Claudia G. Flores Gonzales, KIT Scientific Publishing (2010).
- Disaster Management – a disaster manger’s handbook, by W. Nick Carter, Asian Development Bank (2008).
- Disaster Management in India, by R. K. Srivastava, Ministry of Home Affairs, GoI, New Delhi (2011)
- The Chernobyl Disaster: Legacy and Impact on the Future of Nuclear Energy, by Wil Mara, Marshall Cavendish Corporation, New York, 2011.
- 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 (22OECE7051T)		

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.	L2	Understand
CO2	Illustrate various approaches and techniques for designing and developing products.	L3	Apply
CO3	Apply product engineering guidelines / thumb rules in designing products for moulding, machining, sheet metal working etc.	L3	Apply
CO4	Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant.	L3	Apply

Course Content

Unit-I	Introduction to Product Lifecycle Management	10 Hrs
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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
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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
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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
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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.

Unit-V	Analysis and Design of Columns and Column footings	8 Hrs
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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

References / Text Books / List of experiments / Assignment

Reference Books and Reports:

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

Text Books:

- Product Lifecycle Management: Paradigm for 21st Century Product Realization, John Stark, Springer-Verlag, 2004.
- 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 (22OECE7052T)		

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	Explain how information systems Transform Business.	L2	Understand
CO2	Use information systems concepts to assess their effects on organizational operations.	L3	Apply
CO3	Describe IT infrastructure and its components and its current trends.	L2	Understand
CO4	Explain principal tools and technologies for accessing information from databases to improve business performance and decision making.	L2	Understand
CO5	Use enterprise-wide knowledge management systems to show their benefits for business operations.	L3	Apply

Course Content

Unit-I	Foundation Concepts:	10 Hrs
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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
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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

Unit-III	MIS Tools and applications for Decision making:	08 Hrs
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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
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Security and Ethical Challenges: Security, Ethical, and Societal Challenges of IT. Security Management of Information Technology

Unit-V	Social Computing (SC):	08 Hrs
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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:

- Management Information Systems, 11th edition by James A O'Brien, George M., Ramesh Behl.
- Kelly Rainer, Brad Prince, Management Information Systems, Wiley.
- K.C. Laudon and J.P. Laudon, Management Information Systems: Managing the Digital Firm, 10th Ed., Prentice Hall, 2007.
- 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 (22OECE7053T)		

Course Objectives

- To formulate a real-world decision problem as a mathematical programming model.
- 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 - 2×2 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.

References / Text Books / List of experiments / Assignment

Text books:

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

Reference Books:

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

Program : Civil Engineering	BTECH	Semester: VII
Open Elective Course - I Cyber Security and Laws (22OECE7054T)		

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)		

References / Text Books / List of experiments / Assignment

Reference Books and Material:

- Nina Godbole, Sunit Belapure, Cyber Security, Wiley India, New Delhi
- The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi
- The Information Technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.
- E-Commerce Security and Privacy", Anup K. Ghosh, Springer Science and Business Media, 2012
- Izzat Alsmadi , The NICE Cyber Security Framework Cyber Security Intelligence and Analytics, Springer
- Cyber Law & Cyber Crimes, Advocate Prashant Mali; Snow White Publications, Mumbai
- Nina Godbole, Information Systems Security, Wiley India, New Delhi
- Kenneth J. Knapp, Cyber Security & Global Information Assurance Information Science Publishing.
- William Stallings, Cryptography and Network Security, Pearson Publication
- Websites for more information is available on : The Information Technology ACT, 2008-TIFR : <https://www.tifrh.res.in>
- Website for more information, A Compliance Primer for IT professional: <https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer-professionals-33538>

Program : Civil Engineering	BTECH	Semester: VII
Open Elective Course - I Personal Finance Management (22OECE7055T)		

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
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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
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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
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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
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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 GST- Valuation rules, taxability of reimbursement of expenses; Exemption from GST: Small supplies and Composition Scheme: Classification of Goods and Services

Unit-V	Introduction to Micro – finance	08 Hrs
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Micro-Finance: Definitions, Scope & Assumptions, Types of Microfinance, Customers of Micro-finance, Credit Delivery Methodologies, SHG concept, origin, Formation & Operation of Self Help Groups (SHGs). Models in Microfinance - Joint Liability Groups (JLG), SHG Bank Linkage Model and GRAMEEN Model: Achievements & Challenges, Institutional Mechanism. Current Challenges for Microfinance, Microfinance Institutions (MFIs): Constraints & Governance Issues, Institutional Structure of Microfinance in India :NGO-MFIs, NBFC-MFIs, Co-operatives, Banks, Microfinance Networks and Associations; Demand & Supply of Microfinance Services in India, Impact assessment and social assessments of MFIs,

References / Text Books / List of experiments / Assignment

Reference Books:

- Banking and Financial Sector Reforms in India , by Asha Singh, M.S. Gupta, Serials Publication.
- Indian Banking Sector: Essays and Issues (1st) , by M.S. Gupta & J.B. Singh, Serials Publication.
- Basics Of Banking & Finance , by K.M. Bhattacharya O.P. Agarwal , Himalaya Publishing House
- Agricultural Finance And Management, by S. Subba Reddy , P. Raghu Ram .
- The Indian Financial System And Development , by Dr.Vasant Desai, Himalaya Publishing House; Fourth Edition
- Income Tax Management , Simple Way of Tax Management, Tax Planning and Tax Saving , By Sanjay Kumar Satapathy
- Direct Tax System Income Tax by Dr. R. K. Jain, SBPD Publications.
- Simplified Approach to GST Goods and Services Tax, By S K Mishra , Educreation Publishing.
- Introduction To Microfinance , By Todd A Watkins , World Scientific Publishing

Program : Civil Engineering	BTECH	Semester: VII
Open Elective Course - I Energy Audit and Management (22OECE7056T)		

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 the present state of energy security and its importance.	L2	Understand
CO2	Identify and describe the basic principles and methodologies adopted in the energy audit of a utility	L2	Understand
CO3	Describe the energy performance evaluation of some common electrical installations and identify energy-saving opportunities.	L2	Understand
CO4	Describe the energy performance evaluation of some common thermal installations and identify energy-saving opportunities.	L2	Understand
CO5	Analyze the data collected during performance evaluation and recommend energy-saving measures.	L4	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.

References / Text Books / List of experiments / Assignment

Reference Books:

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

Program : Civil Engineering	BTECH	Semester: VII
Open Elective Course - I Science of Well-being (22OECE7057T)		

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.
2. To introduce the learners to the means of mental and physical well-being, ill effects of mal- practices like alcoholism, smoking etc.
3. 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.	L2	Understand
CO2	Describe the meaning of happiness, practice gratitude and self-compassion, and analyze incidents from one's own life	L2	Understand
CO3	Explain the causes and effects of stress, identify reasons for stress in one's own surroundings and self.	L2	Understand
CO4	Describe the importance of physical health and fitness, assess one's lifestyle, and justify its limitations or effectiveness.	L2	Understand
CO5	Analyze one's own coping mechanisms, assess their effectiveness, develop and strategize for betterment, and execute them.	L4	Understand

Course Content

Unit-I

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

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

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

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

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.

References / Text Books / List of experiments / Assignment

Reference Books:

- 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.
- Man Adapting by Dubos, R; New Haven: Yale University Press.
- Happiness a history by McMahon D. M., Atlantic Monthly Press.
- Well-being: The foundations of hedonic psychology by D. Kahneman & E. Diener & N. Schwarz, New York: Russell Sage
- Selye H. The Stress of Life. New York; McGraw-Hill; 1984.

Textbooks:

- The Science of well-being by Felicia Huppert, Nick Baylis, Barry Keverne; Oxford University Press
- Health and Well-Being: Emerging Trends by S. Ojha, U. Rani Srivastava, Shobhna Joshi, Global Vision Publishing House
- Positive psychology: The scientific and practical explorations of human strengths by Shane
- J. Lopez, Jennifer Teramoto Pedrotti, Charles Richard Snyder; Sage Publications.

Program : Civil Engineering	BTECH	Semester: VII
Open Elective Course - I Research Methodology (22OECE7058T)		

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	Apply preliminary research design concepts for projects in their subject matter areas.	3	Apply
CO2	Analyse and report research data using appropriate statistical and analytical techniques.	1	Analyse
CO3	Explain complex data or situations clearly.	2	Understand
CO4	Analyse the research findings.	1	Analyse
CO5	Summarize a structured research report based on research findings.	2	Understand

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		

References / Text Books / List of experiments / Assignment

Reference Books:

- Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers Distributors.
- Kothari, C.R.,1985, Research Methodology-Methods and Techniques, New Delhi, Wiley Eastern Limited.
- 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 (22OECE7059T)		

Course Objectives

1. To analyse 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 analyse 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	Reference Books:	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.		

References / Text Books / List of experiments / Assignment

Reference Books:

- Introduction to Public Policy by Charles Wheelan, W.W. Norton & Company.
- Understanding Public Policy by Thomas R. Dye, Prentice Hall.
- Public Policy-Making: An Introduction by Anderson J.E., Boston, Houghton.
- Public Administration by Avasthi & Maheshwari, Lakshminarayan Agarwal, Agra.
- New Horizons of Public Administration by Bhattacharya, Mohit, Jawahar Publishers, New Delhi.
- Public Administration and Public Affairs by Henry, Nicholas, Prentice Hall of India, New Delhi.
- Public Finance 10th Edition by Harvey S Rosen and Ted Gayer, McGraw-Hill Education, 2013.
- Public Finance in Theory and Practice by Musgrave and Musgrave.

Program : Civil Engineering	BTECH	Semester: VII
Project Stage-II (22PJCE7060L)		

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	Analyse 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, filed/ 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 programming/ Experimental work	Result verification	Presentation	Total
			5	5	5	5	5	25

SEM

VIII

Program : Civil Engineering	BTECH	Semester: VIII
Professional Elective Course-IV Structural Audit (22PECE8011T)		

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-IV Introduction to Earthquake Engineering (22PECE8012T)		

Course Objectives:

1. To develop civil engineering graduates having clear understanding of concept of dynamic loads, dynamic analysis, basic section analysis & section analysis of structures.
2. To apply the knowledge of structural dynamic to evaluate the seismic response of structural subjects to different ground motion.
3. To apply provisions of IS 1893-2016 & IS 13920 to design seismic resistant

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand importance of designing the building to targeted seismic performance.	2	Understanding
CO2	Design earthquake resistant structures using the provision of IS -1893& IS 13920	3	Applying
CO3	Evaluate the seismic response of various structures subjected to different ground motions	5	Evaluating
CO4	Evaluate dynamic loads, carry out dynamic analysis & understand basic seismology	5	Evaluating

Course Content

Unit-I	Introduction to Seismology	06 Hrs
Elements of seismology: Terminology, structure of the earth, causes of an earthquake, seismic waves, magnitude and intensity, seismograph, strong motion earthquakes, earthquake frequency, local site effects, seism tectonics and Seismicity of India. Accelerogram, prominent earthquakes of India		
Unit-II	Fundamental of structural Dynamics	08 Hrs
Definitions of basic problems in dynamics, static v/s dynamic loads, different types of dynamic loads, undamped vibration of SDOF system, natural frequency and periods of vibration, damping in structure, response to periodic loads. Direct determination of frequencies and mode shapes, orthogonality principle, approximate methods for determination of frequencies and mode shapes. Introduction to MDOF system		
Unit-III	Earthquake Resistant Design	08 Hrs
Earthquake Resistant Design Philosophy, MCE and DBE planning aspects, symmetry, simplicity, regularity, Lateral load analysis, Provisions of IS 1893-2016 for building, Base shear, Load combinations		
Unit-IV	Ductile Detailing	08 Hrs
Concept of earthquake resistant design, objectives, Ductility, Ductility reduction factors, Ductile detailing, Provisions of IS 13920-2016		
Unit-V	New Techniques in Seismic Design	06 Hrs
Introduction to Geotechnical earthquake Engineering, Base Isolation technique, Seismic dampers, Retrofitting techniques etc.		

References / Text Books / List of experiments / Assignment

Reference Books:

1. Clough R.W. and Penzien J.(1993), “Dynamics of Structures”, McGraw Hill New York
2. Humar J. L., “Dynamics of Structures”, 2nd Edition (2002), Swets and Zeitlinger, Netherlands.
3. FarzadNaiem, “The Seismic Design Handbook”, Kluwer Academic Pub. (2001), Massachusetts, ISBN: 0-7923-7301-4.
4. Dowrick D. J., “Earthquake Resistant Design for Engineers & Architects”, John Wiley and Sons Ltd. ISBN: 0-471-91503-3.
5. Pauley T. and Priestley M.J.N., “Seismic Design of Reinforced Concrete and Masonry Buildings”, (1992) John Wiley & Sons Inc., USA, ISBN 0-471-54915-0.
6. Nayak N. V., “Foundation Design Manual”, Dhanpatrai and Sons, Delhi.
7. Housner G.W. & Hudson D. E., “Applied Mechanics- Dynamics”, East-West Edition, N. Delhi.
8. Kramer S. L., “Geotechnical Earthquake Engineering”, Pearson Education

Text Books:

1. IS 456, IS 1498, IS 1893, IS 1905, IS 2131, IS 13920, IS 4326 of recent editions, Bureau of Indian Standards, New Delhi.
2. Chopra A.K. (2001), “Dynamics of Structures”, 2nd Edi, Pearson Education Pvt. Ltd., India, ISBN 81-7808-472-4.
3. Mario Paz, “Structural Dynamics”, CBS Publication.
4. Arya A.S., “Elements of Earthquake Engineering”, South Asian Pub., New Delhi.

Program : Civil Engineering	BTECH	Semester: VIII
Professional Elective Course-IV Environmental Impact Assessment and Audit (22PECE8013T)		

Course Objectives

1. Identify environmental attributes to be considered for the EIA study
2. To Understand the different steps within environmental impact assessment
3. To understand strengths & limitations of environmental management.
4. Know procedures Understand screening & scoping processes Interpret options for evaluating environmental and social impacts.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Students will able to learn the Overview of assessing risks posing threats to the environment	3	Learn
CO2	Students will be able to access different case studies/examples of EIA in practice	4	Analyze and design
CO3	Understand the different steps within environmental impact	3	Understand
CO4	Students will Understand how to liaise with and the importance of stakeholders in the EIA process	2	Understand
CO5	Students will able to prepare the implications of current jurisdictional and institutional arrangements in relation to environmental impact assessment	2	Prepare

Course Content

Unit-I	Basic aspects of EIA	06 Hrs
Environment and its components, Concept of Ecological imbalances, carrying capacity and sustainable development. Evolution of environmental impact assessment (EIA) The Need for EIA, Indian Policies Requiring EIA, The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Public Hearing, Decision Making, Monitoring the Clearance Conditions, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000), List of projects requiring Environmental, Ecological sensitive places.		
Unit-II	Identifying the Key Issues	08 Hrs
Key Elements of an Initial Project Description and Scoping, Project Location(s), Land Use Impacts, Consideration of Alternatives, Process selection: Construction Phase, Input Requirements, Wastes and Emissions, Air Emissions, Liquid Effluents, Solid Wastes, Risks to Environment and Human, Health, Socio-Economic Impacts, Ecological Impacts, Global Environmental Issues		
Unit-III	Environmental laws and protection acts	06 Hrs
Environmental Legislation and Life cycle Assessment: Environmental laws and protection acts, Constitutional provisions-powers and functions of Central and State government, The Environment (Protection) Act 1986, The Water Act 1974, The Air act 1981, Wild Life act 1972, Guidelines for control of noise, loss of biodiversity, solid and Hazardous waste management rules. Life cycle assessment: Life cycle analysis, Methodology, Management, Flow of materials-cost criteria-case studies.		
Unit-IV	EIA Methodologies	8 Hrs
Environmental attributes -Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation and Evaluation, impact communication, Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods. EIA review- Baseline Conditions -Construction Stage Impacts, post project impacts, Rapid assessment of Pollution sources method, predictive models for impact assessment, Applications for RS and GIS.		
Unit-V	Case Studies	8 Hrs
Case Studies: Preparation of EIA for developmental projects- Factors to be considered in making assessment decisions, Water Resources Project, Pharmaceutical industry, thermal plant, Nuclear fuel complex, Highway project, Sewage treatment plant, Municipal Solid waste processing plant, Air ports		

References / Text Books / List of experiments / Assignment

Reference Books:

1. A Chadwick, Introduction to Environmental Impact Assessment, Taylor & Francis , 2007
2. Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., New York, 1996.
3. Environmental Impact Assessment, Barthwal, R. R., New Age International Publishers, 2002
4. Environmental Impact Assessment, Rau, J.G. and Wooten, D.C., McGraw Hill Pub. Co., New York, 1996.
5. Environmental Impact Assessment-Theory and Practice, Wathern.P., Routledge Publishers, London, 2004.

Text Books:

1. Environmental Impact Assessment Methodologies, Anjaneyulu.Y., and Manickam. V., B.S. Publications, Hyderabad, 2007.
2. Fundamentals of Reinforced Concrete –Sinha and Roy, S. Chand and company Ltd. Ram Nagar, New Delhi
3. Limit State Design of reinforced concrete P.C.Varghese, Prentice Hall, New Delhi PHI, 2nd Edition, 2006
4. Reinforced Concrete Design-M. L. Gambhir-Mc millan India Ltd. New Delhi

Program : Civil Engineering	BTECH	Semester: VIII
Professional Elective Course-IV Dams & Hydraulic Structures (22PECE8014T)		

Course Objectives

1. Introduce dams including gravity, arch and earth dam, modes of failures and stability analysis of these dams.
2. Introduce spillway, diversion head-works and explain stability analysis of weirs on permeable foundations.
3. To know unlined irrigation canals and their design principles

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Discuss planning and investigations for locating reservoirs with cost benefit ratio.	1	Remembering
CO2	Explain gravity dam, compute forces acting on gravity dam and analyze for stability.		Understand, Applying
CO3	Describe various types of spillway, diversion headwork and energy dissipaters	4	Analyzing
CO4	Discuss earth dams and basic design considerations and analyze for stability.	4	Applying
CO5	Design of irrigation canal on various condition.	5	Evaluating

Course Content

Unit-I	Reservoirs planning	07 Hrs
Planning of Reservoirs: Classification of Reservoir, Selection of site for Reservoir, Investigation works for Reservoir, Yield and Capacity of Reservoir, Mass Curve and Demand Curve, Storage Calculations, Control Levels, Useful Life of Reservoir, Silting of Reservoirs, Losses in Reservoirs.		
Unit-II	Gravity Dam	10 Hrs
Gravity dams: - Introduction, cross section, forces acting on dam, load combinations as specified by IS 6512-1984, stresses in dam (normal, principal and shear stresses), modes of failures, stability analysis and design of gravity dam, elementary and practical profile, low and high dam, materials of construction, control of cracking, galleries, Joints and keys. Introduction to arch dams, types and their suitability, optimum central angle for constant angle arch dam.		
Unit-III	Spillway, Gates and Diversion head work	09 Hrs
Spillways: - Introduction, spillway capacity, different types of spillways and their suitability, design principles of Ogee spillway, working of siphon spillway. Energy dissipation below spillway, types of hydraulic jump, jump height curves and tail water rating curves, various types of energy dissipaters: Indian Standard stilling basins and buckets. Gates: - Uses, types of spillway crest gates. Diversion head works: Selection of site- layout of work -types of weirs and barrages design for subsurface flow-safety against piping and uplift. Uplift theories such as Bligh, Lane and Khosla's theories- design of weirs on permeable foundations.		
Unit-IV	Earth Dams	07 Hrs
Earth dams :- Introduction, types, elements of earth dam, basic design considerations, causes of failures, piping and its prevention, control of seepage, drainage in earth dams, phreatic line—its uses and characteristics, equation, procedure of construction phreatic line for various cases, stability of upstream and downstream slopes of earth dam under various situations, introduction to rock-fill dam.		
Unit-V	Canal Irrigation Design	6 Hrs
Canal irrigation: - Types of irrigation canals, canal alignment. Design of cross section of stable unlined channels in alluvial soil by Kennedy's and Lacey's theories according to IS 7112 – 1973, merits and demerits of Kennedy's and Lacey's theories, Garret's diagram. Design procedure for L – section of an irrigation canal, balancing depth, losses in canals, schedule of area statistics and channel dimensions.		

References / Text Books / List of experiments / Assignment

Reference Books:

1. Sharma R.K., “A Text Book of Hydrology & Water Resources”, Dhanpat Rai and Sons.
2. Irrigation and Water Resources Engineering- Asawa G.L- New Age International (P) Ltd. Publishers, first ed, 2005.
3. K. B. Khushlani “Irrigation Engineering”.
4. Justin, Hinds “Irrigation Engineering and Practice”.

Text Books:

1. Modi P.N. 2012. “Irrigation, Water Resources and Water Power Engineering, Eight edition. Standard Book House, Delhi.
2. Garg S.K. 1998. Irrigation Engineering and Hydraulic Structures”, Khanna Publishers, Delhi.
3. Punmia B.C., Pande B.B., .Lal, “Dams II: Irrigation and Water Power Engineering”. 1999. Laxmi Publications Pvt. Ltd., New Delhi.

Program : Civil Engineering	BTECH	Semester: VIII
Professional Elective Course-IV Solid Waste Management (22PECE8015T)		

Course Objectives

1. To learn the various analysis of hazardous waste constituents.
2. To understand health and environmental issues related to solid waste management
3. To apply steps in solid waste management.
4. To become aware of Environment and health impacts solid waste mismanagement.
5. Evaluate the techniques and methods used in recovery of materials and energy from solid wastes.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Students will able to Understanding of problems of municipal waste, biomedical waste, hazardous waste, e-waste, industrial waste	3	Learn
CO2	Students will able to analyze and design engineering, financial and technical options for waste management	4	Analyze
CO3	Students will able to understand sampling and characterization of solid waste	3	Understand
CO4	Students will be able assessment of disposal techniques	2	Design
CO5	Students will Knowledge of legal, institutional and financial aspects of management of solid wastes	2	Understand

Course Content

Unit-I	Introduction to Solid Waste Sources	06 Hrs
Waste sources, Evolution, generation, nature and characteristics, Quantities and Qualities, generation rates, Potential of disease - nuisance and other problems.		
Unit-II	Functional elements of solid waste management	08 Hrs
Solid waste management, on-site storage, collection and separation. Containers and its location, collection systems, vehicle routing- route balance- transfer station. Disposal methods – sanitary land filling, planning, site selection, design. Processing techniques; materials-recovery systems; recovery of biological conversion products; recovery of thermal conversion products; recovery of energy from conversion products; materials and energy recovery systems.		
Unit-III	Solid waste Transport means, methods, separation and processing	06 Hrs
Collection and Storage, Transports means and methods, unit operation for component separation, recycling of dry waste components		
Unit-IV	Municipal Solid Wastes	8 Hrs
Characteristics of MSW, Elements of solid waste management, engineered systems for solid waste management, Disposal of MSW, Hazardous waste, Biomedical and e-waste disposal.		
Unit-V	Special waste and integrated solid waste management	8 Hrs
Construction and demolition waste, Hazardous Waste Management, management of bio medical, inert waste, ISWM, MSW Rules.		

References / Text Books / List of experiments / Assignment

Reference Books:

1. Integrated Solid Waste Management, Engineering Principles and Management Issues, Techno obanoglous G, Theisen H and Vigil SA, McGraw Hill Education, 2014,
2. Indian Edition, Environmental Engineering, Peavy, H.S., Rowe, D.R., and Techno obanoglous G., McGraw Hill Education, 2017 First Indian Edition.
3. Handbook of Solid Waste Management, Tchobanoglous G and Kreith F, McGraw-Hill Education, 2002, 2nd Edition

Text Books:

1. Waste Management Practices: Municipal, Hazardous and Industrial, John Pichtel, CRC Press, 2014, 2nd Edition
2. Solid Waste Engineering, Vesilind PA, Worrell W and Reinhart D, Brooks/Cole Thomson Learning Inc., 2010, 2nd Edition

Program : Civil Engineering	BTECH	Semester: VIII
Maintenance and Repair of Concrete Structures NPTEL / SWAYAM Course# (22PECE8016T)		

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.
4. To analyze condition assessment data and select appropriate repair and rehabilitation strategies.
5. To understand surface repair methods, materials, and design considerations for concrete structures.
6. 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	08 Hrs
cover the introduction, significance, and mechanisms of corrosion, specifically focusing on embedded metal corrosion.	
Unit-II	08 Hrs
detail the deterioration of cementitious systems due to sulphate attacks, acid attacks, alkali-silica reactions (ASR), and shrinkage.	
Unit-III	08 Hrs
focus on concrete assessment using non-destructive tests (NDT), load effects, and surface repair strategies, including analysis and material requirements.	
Unit-IV	10 Hrs
discuss strengthening and stabilization techniques, including beam shear, column, and flexural strengthening.	
Unit-V	08 Hrs
Strengthening and stabilization: Beam shear, column, and flexural strengthening.	

References / Text Books / List of experiments / Assignment

Reference Books

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

Text Books

- R. T. L. Allen & S. C. Edwards Repair of Concrete Structures, Condition assessment, surface repair strategies, materials, and methods.
- BRE Digest / Concrete Society Technical Reports (TR 22, TR 54), Practical guidance on inspection, repair, and strengthening.
- Malhotra & Carino, Handbook on Non-destructive Testing of Concrete, Standard reference for NDT methods and interpretation.
- 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 (22PECE8020T)		

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.
4. Understand the concept of underground construction methods.
5. 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, workers 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		

References / Text Books / List of experiments / Assignment

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
Professional Elective Course - V Air Pollution Control (22PECE8022T)		

Course Objectives

1. To provide general understanding of quality of air and impact on local and global effects of air pollution on human, materials, properties and vegetation.
2. To study the fate and transport of air pollutants and its measurement techniques.
3. To discuss the various types of air pollution control equipment and their design principles and limitation

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Classify and identify the sources of air pollutants and predict the effects of air pollutant on human health and environment	3	Learn
CO2	Apply and relate the significance of various air pollution dispersion models.	4	Analyze and design
CO3	Analyze the air quality and relate with air pollution regulation	3	Understand
CO4	Design various air pollution control equipment and evaluate its use.	2	Design

Course Content

Unit-I

07 Hrs

History, Sources and Effects of Air Pollution: Air Pollution- Definition, Sources, Types and classification, Its effect on human health, vegetation, materials and properties, Air pollution Episodes and lesson learnt, Global effects: Global Warming and Cooling, Acid Rain, Dust dome effects and Heat Island effect, Ozone Layer Depletion.

Unit-II

10 Hrs

Meteorology and Air Pollution: Introduction to Meteorology- factors influencing air pollution, Lapse rates, Atmospheric stability conditions and temperature inversions, Plume behavior, Maximum Mixing Depths, Effective Stack height, Types of dispersion models: Gaussian model - Introduction, Dispersion Equation for Point Source at GL.

Unit-III

09 Hrs

Air Pollution Sampling, Air Act (Prevention and Control) Act'81 And Ambient Air Quality Standards: Ambient air and stack sampling – pollutant measurement methods– Principles and instruments, Ambient air quality standards, Introduction to Air Act'81 and ambient air quality standards, Vehicle Emission standards.

Unit-IV

07 Hrs

Air Pollution Control Equipment's and Methods: Particulate Control: Principles and techniques for Control of particulate emission: Settling chambers, Cyclone Separators, Wet collectors, Fabric Filters, Electrostatic Precipitators. Other removal methods like Absorption, Adsorption and Precipitation

Unit-V

6 Hrs

Principles and techniques for Control of particulate emission: Adsorption, Absorption and other methods Auto Exhaust: Catalytic Converters, Add on devices, Engine modification, Alternative fuels for emission control.

References / Text Books / List of experiments / Assignment

1. Wark Kenneth and Warner C.F, “Air pollution its origin and control”. Harper and Row Publishers, New York, 1997.
1. Rao C.S., “Environmental pollution control engineering”, New age international Ltd, New Delhi, 2007.
1. Peavy, H.S., Rowe, D.R., Tchobanoglous, G. “Environmental Engineering”, McGraw Hills, New York 1985.
2. De Nevers, N., “Air Pollution Control Engineering”, McGraw Hill, New Delhi, 1995
3. Rao M. N., “Air Pollution”, Tata Mc-Graw Hill Publication

Program : Civil Engineering	BTECH	Semester: VIII
Professional Elective Course-V Software Application in Structural Engineering (22PECE8023T)		

Course Objectives

1. To familiarize with graphic primitives, transformations and two dimensional and three dimensional drafting of computer graphics.
2. To get practiced with computer methods of structural analysis.
3. To understand the basic commands, principles and features behind commercially available software's.
4. To utilize structural software for detailed analysis of complex structures

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To study the various software used in structural design	3	Learn
CO2	To understand various methods of design by using software's.	4	Analyze
CO3	To understand the basic commands, principles and features behind commercially available software's.	1	Remember
CO4	To utilize structural software for detailed analysis of complex structures	3	Apply

Course Content

Unit-I	Introduction	06 Hrs
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Introduction: Software and software engineering, software metrics Estimation and planning. System and Software Requirements Analysis: Computer based systems, computer systems engineering, system analysis, requirements analysis fundamentals, structured analysis and its extensions, object oriented analysis and data modelling.

Unit-II	Implementation of Software	06 Hrs
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Design and Implementation of Software: Software design fundamentals, data-flow oriented design, object oriented design, data oriented design methods, programming languages and coding.

Unit-III	Software Quality Assurance	06 Hrs
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Software Quality Assurance: Software quality and software quality assurance, software testing techniques, software Testing strategies, software maintenance, reverse engineering techniques.

Unit-IV	Software Application	06 Hrs
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Application Software in Civil Engineering: Introduction and application of software like MS Excel, Staad. Pro, E Tab, Primavera P6 etc and application to practical problems.

References / Text Books / List of experiments / Assignment

1. Pressman R S, “Software Engineering A Practitioner’s Approach” McGraw Hill International, New York, 2001.
2. Broeton P, “Software Engineering Environments” Wiley, New York, 2002.
3. Blum I B, “Software Engineering A Holistic View” Oxford University Press, 2001.
4. Blanchard B S and Fabrycky W J, “Systems Engineering and Analysis” Prentice-Hall International, New York 1998.
5. Roy S K and Chakrabarty S, “Fundamentals of Structural Analysis with Computer Analysis & applications” S. Chand & Company, New Delhi, 2002

Program : Civil Engineering	BTECH	Semester: VIII
Professional Elective Course-V Coastal Engineering (22PECE8024T)		

Course Objectives

1. Understand coastal engineering aspects of harbours methods to improve navigation.
2. Understand the wave properties and analysis of wave.
3. Gain knowledge in modelling in coastal engineering

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To study the coastal engineering aspects of harbours methods	3	Learn
CO2	To understand the wave properties and analysis of wave.	4	Analyze
CO3	Student will able to design coastal structure.	1	Remember
CO4	Understanding the Environmental aspects of Dredging & Disposal	3	Apply

Course Content

Unit-I	Introduction	06 Hrs
Basic understanding of wave and tides including wave generation, propagation, form and assessment in the surf zone. Statistical and spectral analysis of recorded wave data and prediction in coastal zone, Sediment motion along the coast.		
Unit-II	Tides & Coastal Processes, Global tidal cycle, tidal analysis.	06 Hrs
Types of tides, effect of tides, significance in coastal engineering, Coastal process-erosion/accretion due to waves, estimation of littoral drift, Effect of construction of coastal structures on stability of shoreline / beaches, shoreline configuration.		
Unit-III	Coastal Structures.	06 Hrs
Introduction to Coastal structures: Design criteria and functional aspects of coastal structures: sea wall, revetment, bulk-head, quay- wall, jetties, breakwater types: rubble-mound, composite, floating and pneumatic types, design of RBW, Introduction to offshore structures: oil platform, design criteria for sub marine pipelines, cables, response of oil platform members, floating structure to wave load –vibration and spacing of piles, forces on piles.		
Unit-IV	Ports & Harbours.	06 Hrs
Planning and management of port and Harbours, Modern trends and techniques in port engineering. - Roll on-Roll off/ Lift on –Lift off etc. Special purpose ports: Concepts of twin /mother port, SBM, outer to outer port etc. Significance of port cost analysis economic.		
Unit-V	Dredging & Disposal	06 Hrs
Dredging technology: types of dredgers, radioactive tracer's studies for feasibility of dumping ground for dredged materials- environmental aspects of dredging etc. Pollution in Coastal zone, disposal of waste/dredged.		

References / Text Books / List of experiments / Assignment

Text Books:

1. Basic Coastal Engineering-R. M. Sorensen, 2006.
2. Coastal Hydrodynamics-J. S. Mani, I IT Madras

Reference Books:

1. Shore Protection Manual-U. S. Waterways Experiment Station Corps of Engineer, Coastal Protection Manual 2002. Narasimhan and S. Kathirola,
2. Harbour and Coastal Engineering”, Vol I&II, Ocean and Coastal Engineering Publication, NIOT, Chennai

Program : Civil Engineering	BTECH	Semester: VIII
Data Analytics in Civil Engineering (22PECE8025T)		

Course Objectives

1. To provide necessary knowledge regarding analysis of data used in Civil Engineering.
2. To understand the various modules like structural Engineering, transportation Engineering, geomatics etc.
3. To Gain the knowledge of Data Analytics in Civil engineering

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Use the various mathematical techniques to analyse data used in Civil Engineering.	3	Learn
CO2	Apply data analytic tools in analysis of data used in Environmental Engineering.	4	Analyze and design
CO3	Execute data analysis in Structural & Transportation Engineering.	3	Understand
CO4	Use data analysis tools in Water Resource Engineering.	3	Apply

Course Content

Unit-I	Introduction and Mathematical Foundation	06 Hrs
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An overview, Vector spaces and subspaces, Basis and dimensions of vectors spaces, Linear Transformation, Eigenvalues and Eigenvectors, Matrix factorization, Introduction to Regression analysis, Linear and Multi linear Regression Technique, Polynomial Regression Technique, Logistic Regression Technique.

Unit-II	Environmental Data Analysis and Modelling	06 Hrs
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Introduction to Environmental Engineering, Areas of Environmental Engineering, Data Analysis, Applications of Soft Computing Tools, Multiple Criteria Decision Making Model.

Unit-III	Structural Engineering	06 Hrs
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Trends, Applications and Advances of Structural Engineering, Need of Data Science in Structural Engineering, Current Trends & Applications of Data Science in Structural Engineering,

Unit-IV	Data Science Application in Intelligent Transportation Systems	06 Hrs
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Introduction to Transportation Engineering, Data in Transportation Industry, Data Analytics in Transportation Industry, Boom Bike Share Demand Case study

Unit-V	Data Driven Modelling in Water Resource Engineering	06 Hrs
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Introduction to Water Resource Engineering, Data Analytics in Water Resource Engineering, Computational Intelligence Techniques in Water Resources Management, Predictive Models, Applications of Data Analytics in water resource engineering

References / Text Books / List of experiments / Assignment

Text Books:

- 1 A Primer on Machine Learning Applications in Civil Engineering, by Paresh Chandra Deka
- 2 Data Sciences for Civil Engineering, CRC press, (under process)

Reference Books:

1. Big Data & Hadoop, V.K. Jain, Khanna Publishing House
2. Big Data Black Book, DT Editorial Services, Wiley India
3. Data Science & Analytics, V.K. Jain, Khanna Publishing House
4. Beginner's Guide for Data Analysis using R Programming, Jeeva Jose, ISBN: 978-93-86173454
5. Sivanandam & Deepa, Principles of Soft Computing, Wiley India
6. S. Rajasekaram & G.A. Vijyalakshmi Pai, Neural Networks, Fuzzy Logic, PHI
7. A Textbook of Matrices, Narayan & Mittal, (ISBN: 9788121925969), S.Chand

Program : Civil Engineering	BTECH	Semester: VIII
NPTEL / SWAYAM Course# Maintenance and Repair of Concrete Structures (22PECE8026T)		

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.		

References / Text Books / List of experiments / Assignment

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

Text Books

- R. T. L. Allen & S. C. Edwards Repair of Concrete Structures, Condition assessment, surface repair strategies, materials, and methods.
- BRE Digest / Concrete Society Technical Reports (TR 22, TR 54), Practical guidance on inspection, repair, and strengthening.
- Malhotra & Carino, Handbook on Non-destructive Testing of Concrete, Standard reference for NDT methods and interpretation.
- 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
Internship (22INTCE8030L)		

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	Analyse 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

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)	Literature Survey & Problem Definition (5 Marks)	Objectives & Implementation/Product Development (5 Marks)	Presentation (5 Marks)	Report, Publications/Patent/ IPR documents (5 Marks)

Program : Civil Engineering	BTECH	Semester: VIII
Internship / Project stage -III (22INTCE8030L)		

Course Objectives

1. To implement the Papers based on above study
2. To develop the model or Registered the Patent.
3. To encourage students to become independent personnel, critical thinkers and lifelong learners

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply engineering knowledge to produce solution of a problem considering cultural, social, environmental, and economic factors using appropriate tool and method.	1	Analyse
CO2	Demonstrate project based learning that allows students to transfer existing ideas into new applications.	2	Understand
CO3	Develop an ability to work in teams and manage the conduct of the research study.	3	Apply
CO4	Integrate different perspectives from relevant disciplines which help them to get internships, jobs and admission for higher studies.	3	Apply
CO5	Present the research in the form of technical writing, understand what constitutes to plagiarism and how to use proper referencing styles.	2	Understand

Guidelines:

The main purpose of this activity is to provide an opportunity to the students of research oriented mindset. It will be an extension of the entire project which student has already done in VIth & VIIth semester i. e Project Stage-I & II or they can work on new objectives offered by department/ research guide.

- 1) It can be a group or individual activity as it is one of the option that student or group of students can opt in this semester.
- 2) In case of extension of project stage II, it is mandatory that, at least one student should be in the group who has done this project in stage I & II.
- 3) In case of the objectives offered by department/research guide, a group of fresh students can be formed.
- 4) Maximum 3 students can form a group.
- 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 copy right / 01 research publication (UGC care listed journal/conference). Student can work jointly with any government funding agency or industry. In such case, a detailed project report shall be submitted with duly authenticated by internal research guide and industry/funding agency mentor / authority. In case of standalone i.e. without any funding agency/industry collaboration, the detailed project report shall be submitted with duly authenticated by the internal research guide and the student.
- 6) In case of research objectives offered by department/research guide, the outcome of project stage III must be in the form of journal paper publication preferably at least one SCI/ one Scopus / one UGC care listed / indexed conference paper. The detailed project report shall be submitted with duly authenticated by the internal research guide and the student.
- 7) All the research work shall be submitted to the department in the form of project report in hard bound and soft copy.
- 8) Evaluation Scheme:
 - I. Continuous Assessment (A):
 - a) Each project will be reviewed twice in the semester. In the first monitoring at least 40% work must be completed which includes; Introduction/scope to the topic, literature overview, problem definition and objectives. The second monitoring remaining 60% work must be completed which includes; implementations, key findings, publications, patenting, copy right, product development etc.
 - b) A logbook of the work done must be maintained by the student.
 - II. End Semester Examination(C) : Departmental committee (including project guide) will evaluate project as per Table

9) Assessment Formats:

Table 1. Log Book Format			
Week (Start Date: End Date)	Work Done	Sign of Guide	Sign of Coordinator

Table 2. First Monitoring			
Topic Identification & Validation (5 Marks)	Literature Overview (10 Marks)	Problem Definition (5 Marks)	Objectives (5 Marks)

Table 3. Second Monitoring (Objectives given by dept/research guide)			
Implementation (5 Marks)	Publications (10 Marks)	Presentation (5 Marks)	Report (5 Marks)

Table 4. Second Monitoring (Extension of Project Stage-II)		
Product Development/Technology Transfer (10 Marks)	Publication/Patent/Startup/company registration (10 Marks)	Presentation & report (5 Marks)