



Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

(An Autonomous Institute)

Course Structure

Final Year B. Tech

(Department of Civil Engineering)

With effect from Year 2023-24



**Shahada Road, Near Nimzari Naka Shirpur Maharashtra 425405 Ph:
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Final Year B Tech

Semester-VII

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

(A)

Prepared by



Checked by


C.O.E.


Dean Academic/Dy. Director


BCS Chairman


Director



Semester-VIII

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

1. * Professional Elective Courses offered for the students doing Internship at institute level.

2. # Professional Elective Courses offered for the students doing Internship at Industry. These courses are to be studied in self

Study mode using NPTEL/Swayam platform.

3. Students doing internship at industry shall submit certificate of NPTEL examination OR they have to appear examinations conducted by institute like TT1, TT2 and ESE.

4. List of NPTEL courses will be declared by concerned BOS at the beginning of semester.



Prepared by



Dean Academic/Dy-Director



Checked by


BOS Chairman


BOS Chairman


Director



List of Elective Subjects

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

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

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

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

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

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



Geotechnical Engineering (PCCE7010T)

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 01 Hr/week
Credit : 04

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Pre-requisite – Engineering mechanics, strength of mechanics 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 and design
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.		



Course Contents

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.

07Hrs

Elastic settlement, contact pressure, elastic stresses and strains, pressure bulb, elastic settlement, empirical relation for settlement of basset, 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.



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

Reference Books:

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

Evaluation Scheme:**Continuous Assessment (A):**

Subject teacher will declare Teacher Assessment criteria at the start of Semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.



Geotechnical Engineering Laboratory (PCCE7010L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment: 25 Marks
End Sem Exam : 25 Marks
Total Marks : 50 Marks

Pre-requisite – 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 and design
CO3	Compute geostatic stresses in soils and Describe compaction and soil stabilization.	3	Understand



Course Contents

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

List of Experiments:

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)

Evaluation Scheme:

Continuous Assessment (A):

Laboratory work shall consist of minimum 7 Experiment, visit report and subject specified assignments/ case study/ other activities.

The distribution of marks shall be as follows:

1. Performance in practical: 05 Marks
2. Submission of bunch of sheets: 05 Marks
3. Viva-voce: 05 Marks
4. Assignments/ Case study: 10 Marks

The final certification and acceptance of laboratory journal/manual/report will be subject to satisfactory performance of practical work and upon fulfilling minimum passing criteria in the teacher assessment.

End Semester Examination (C):

Oral / Practical examination will be based on the entire syllabus including, the practical's performed during practical session



Public Health Engineering (PCCE7020T)

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 00 Hr/week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

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	Relate the relations between the environment and ecology, estimating water requirement for public water supply scheme.	1, 2	Remember, Understand
CO2	Ascertain the quality of water as per BIS and select the appropriate treatment method required for the water source.	3, 4	Apply, Analyze
CO3	Learn how to characterize source water, and the best available technologies (BAT) for physical and chemical treatment of drinking water.	3, 5	Analyze, Evaluate
CO4	Learn how to characterize wastewater, and the BAT for physical, chemical and microbiological treatment of wastewater.	4	Analyze
CO5	Understand selected contemporary global water and wastewater issues such as water shortage, wastewater reuse and emerging contaminants.	2, 4	Understand, Analyze



Course Contents

Unit-I Introduction to Water quality

06 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

General considerations for source of drinking water; Water demand, Population forecasting; arithmetical increase method geometrical increases method, incremental increase method

Unit-II Introduction to Principles of Water Treatment process

06 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

08 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

8 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.



Reference Books:

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

Text Books:

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

Evaluation Scheme:**Continuous Assessment (A):**

Subject teacher will declare Teacher Assessment criteria at the start of Semester.

Continuous Assessment (B):

1. Two term tests of 15marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.



Public Health Engineering Laboratory (PCCE7020L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment: 25 Marks
End Sem Exam : 25 Marks
Total Marks : 50 Marks

Course Objectives

After successful completion of this course students shall be able to

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. Demand for water supply to households, industry and public services.
3. To understand the sources, effects, prevention and control measures of water pollution and its legislative aspects.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Relate the relations between the environment and ecology, estimating water requirement for public water supply scheme.	1, 2	Remember, Understand
CO2	Ascertain the quality of water as per BIS and select the appropriate treatment method required for the water source.	3, 4	Apply, Analyze
CO3	Learn how to characterize source water, and the best available technologies (BAT) for physical and chemical treatment of drinking water.	3, 5	Analyze, Evaluate



Course Contents

Lab course work shall consist of Following experiment complete any 05 from list

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

1. Determination of pH in given water & waste water samples.
2. Determination of turbidity and optimum dose of coagulant.
3. Determination of alkalinity and acidity of given sample (water & waste water samples)
4. Determination of carbonate and non-carbonate hardness of water waste water samples.
5. Determination of chlorine demand and residual chlorine of water
6. Determination of dissolved oxygen present in the given water samples
7. **A complete report on site visit to a Municipal Water & waste water Treatment Plant.**

RECOMMENDED BOOKS: -

1. Physico-chemical processes for water quality control by Walter J Weber, Wiley Inter-science Publications.
2. Garg S.K., "Water Supply Engineering", Khanna Publisher, New Delhi
3. Manual on Water Supply & Treatment, Central Public Health &
4. Environmental Engineering, Organization, Ministry of Urban Affairs, Government of India Therous, Eldridge & Mallmann, "Laboratory Manual for Chemical & Bacteriological Analysis of Water & Sewage", Agro Botanic Publisher, India
5. 5. Laboratory Manual for Environmental Quality Testing, Environmental Protection Research Foundation, Sangli.

Evaluation Scheme:

Continuous Assessment (A):

Laboratory work shall consist of minimum 7 Experiment, visit report and subject specified assignments/ case study/ other activities.

The distribution of marks shall be as follows:

1. Performance in practical: 05 Marks
2. Submission of bunch of sheets: 05 Marks
3. Viva-voce: 05 Marks
4. Assignments/ Case study: 10 Marks

The final certification and acceptance of laboratory journal/manual/report will be subject to satisfactory performance of practical work and upon fulfilling minimum passing criteria in the teacher assessment.

End Semester Examination (C):

Oral / Practical examination will be based on the entire syllabus including, the practical's performed during practical sessions.



Water Resource Engineering (PCCE7030T)

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 01 Hr/week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Course Objectives

1. Know the hydrologic cycle and analyze different components of the cycle such as precipitation, evaporation, transpiration and infiltration.
2. Analyze the hydrological parameters required for water resources engineering.
3. Identify suitable method of irrigation and drainage of waterlogged area.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain hydrology cycle and water distribution on earth.	1	Remembering
CO2	Describe evaporation and calculate runoff water.	2,3	Understand, Applying
CO3	Draw Hydrograph and find volume of runoff	4	Analyzing
CO4	Describe the basic aquifer parameters and groundwater resources.	4	Applying
CO5	Assess water requirements of crops. Explain hydrology cycle and water distribution on earth.	5 1	Evaluating Remembering



Course Contents

Unit- I Hydrology

07 Hrs.

Hydrology and Water resources development, Hydrologic cycle, applications of hydrology and hydrological cycle. Precipitation: Forms of precipitation, different types of rain and measurement of precipitation (recording and non-recording type gauge), rain gauge network and presentation of precipitation data: mass curve and hyetograph, presentation of rainfall data, mean precipitation over an area, depth area distribution curves and frequency of rainfall.

Unit-II Evapotranspiration, Infiltration and Runoff

06 Hrs.

Evaporation and evapotranspiration: Evaporation process, Evaporimeters, reduction in evaporation measurement of evapotranspiration, Infiltration, Introduction to stream gauging and introduction to methods of discharge and stage measurement in streams.

Runoff: Different routes of runoff, rainfall runoff correlation, Strange's tables, factors effecting runoff, flow distribution curve, flow mass curve and uses.

Unit-III Hydrograph

07 Hrs.

Introduction, Factors affecting Flood Hydrograph, Components of a hydrograph, Base flow separation, Effective rainfall, Unit Hydrograph, Use and Limitations of unit hydrograph, Derivation of unit hydrograph, Synthetic Unit Hydrograph, Instantaneous Unit Hydrograph, Flood Studies: Design Flood and method of its estimation, empirical formula, frequency analysis, Gumbels and Log Pearson distribution, Muskingum methods.

Unit-IV Ground water hydrology

09 Hrs.

Ground water hydrology: Occurrences and distribution of ground water, specific yield of aquifers, movement of ground water, Darcy's law, permeability, safe yield of basins, hydraulics of wells under steady flow in confined and unconfined aquifers, well loss, specific capacity of well, well irrigation: introduction to tube wells and open wells. Water logging and drainage: Causes, preventive and curative measures of water logging, design and spacing of the tile – drains.

Unit-V Irrigation methods

10 Hrs.

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



Reference Books:

1. Varshney R.S., Gupta S.C., Gupta R.L. "Theory and Design of Irrigation Structures, Volume I and II", 1979 Fourth edition. New Chand & Bros., Roorkee.
2. Mutreja, "Applied Hydrology", Tata McGraw Hill Company, New Delhi.
3. Sharma R.K., "A Text Book of Hydrology & Water Resources", Dhanpat Rai and Sons.
4. Raghunath H.M., "Hydrology", New Age Publications, New Delhi.
5. Raghunath H.M., "Ground Water", New Age Publications, New Delhi.
6. P.Jayaram Reddi, "A Text Book of Hydrology", Laxmi Publications, New Delhi.

Text Books:

1. Subramanya K, "Engineering Hydrology", Third Edition, 2008, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Modi P.N. 2012. "Irrigation, Water Resources and Water Power Engineering, Eight edition. Standard Book House, Delhi.
3. Garg S.K. 1998. "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, Delhi.
4. Punmia B.C., Pande B.B., Lal, "Dams II: Irrigation and Water Power Engineering". 1999. Laxmi Publications Pvt. Ltd., New Delhi.

Evaluation Scheme:**Continuous Assessment (A):**

Subject teacher will declare Teacher Assessment criteria at the start of Semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.
3. Tutorial Min five tutorials shall be conducted.



Professional Elective Course-III (Integrated Watershed Management) (PECE7040T)

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 00 Hr/week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Course Objectives

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

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Students will able to learn the different soil and water conservation approaches	3	Learn
CO2	Students will able to analyze degradation of soil and water resources	4	Analyze
CO3	Students will able to understand watershed Area	3	Understand
CO4	Students will have a thorough knowledge on watershed planning, development	2	Design
CO5	Students will able to Suggest drought control measures, water conservation structures	2	Prepare



Course Contents

Unit-I Introduction

06 Hrs.

Watershed – Definition - concept - Objectives – watershed behavior, effects of land use and its change 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

06 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

8 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

8 Hrs

Drought and its management-causes and impacts, definition, management objectives and strategy-short term and long term measures. National Watershed Development Programme. Watershed based rural development – infrastructure development - Use of Aerial photography and remote sensing in watershed management - Role of NGOs in watershed development.



Reference Books:

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

Text Books:

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

Evaluation Scheme:**Continuous Assessment (A):**

Submit Visit Report based on Water conservation and watershed management.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.



Professional Elective Course-III (Construction Economics & Finance) (PECE7041T)

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 00 Hr/week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Course Objectives

1. Adopt as per principles of economics and financing
2. Analyze available alternatives and propose best suitable among them
3. Apply various models of financial management and accounting

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Students will able to learn the principles of economics and financing	3	Learn
CO2	Students will able to analyse available alternatives	4	Analyze
CO3	Students will able to Apply various models of financial management	3	Apply



Text Books

1. Blank, L.T., and Tarquin, A. J., (1988). Engineering Economy, Mc-Graw Hill Book Co.
2. Collier C. and Gla Gola C. (1998). Engineering Economics & Cost Analysis, Addison Wesley Education Publishers.
3. Patel, B. M., (2000). Project management- strategic Financial Planning, Evaluation and Control, Vikas Publishing House Pvt. Ltd. New Delhi,
4. Shrivastava, U. K., (2000). Construction Planning and Management, Galgotia Publications Pvt. Ltd. New Delhi.

References

1. Van Horne, J.C. (1990). Financial Management and Policy, Prentice-Hall of India Ltd.
2. Taylor, G.A. (1968). Managerial and Engineering Economy, East-West Edition,
3. Thuesen, H.G. (1959). Engineering Economy, Prentice-Hall, Inc.
4. Brigham, E.F. (1978). Fundamentals of Financial Management, the Dryden Press, Hinsdale, Illinois,
5. Kolb, R.W. and Rodriguez, R.J. (1992). Financial Management, D.C. Heath & Co.
6. Walker, E.W. (1974). Essentials of Financial Management, Prentice Hall of India Private Limited, New Delhi.

Evaluation Scheme:

Continuous Assessment (A):

Assignment based on each unit

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.



Professional Elective Course-III (Planning for Sustainable Development) (PECE7042T)

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 00 Hr/week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Course Objectives

1. Understand the basic concept of Sustainable Development (SD), the environmental, social and economic dimensions
2. In depth learning and analysis of factors that support to achieve sustainability and resilience in an individual level and in a community
3. Develop an encompassing understanding of sustainability issues.
4. Understand the embedment of sustainability issues in environmental, societal, and economic systems, and the relevance of the conditions, interrelations, and dynamics of these systems.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Students will able to learn the principles of Sustainable development	3	Learn
CO2	Students will able to analyse the available alternatives for SD	4	Analyse
CO3	Students will able to Understand the case study of village	3	Apply



Course Contents

Unit- I

06 Hrs.

Sustainable Development-explains and critically evaluates the concept of sustainable development, Environmental degradation and poverty Sustainable development: its main principles, the evolution of ideas about sustainability,

Unit- II

06 Hrs.

Dimensions to Sustainable Development - society, environment, culture and economy; current challenges - natural, political, socio-economic imbalance; sustainable development initiatives and policies of various countries: global, regional, national, local; needs of present and future generation - political, economic, environmental. Examine some important current issues and areas of debate in relation to sustainable development.

Unit-III

06 Hrs

Innovation for sustainable development- Environmental management and innovation strategies. Frameworks of Sustainability - Analytical frameworks in sustainability studies, sustainability Metrics: criteria and indicators; the significance of quantitative and qualitative assessments of sustainability; current metrics and limitations; metrics for mapping and measuring Sustainable development; application of the metrics in real scenarios Innovation for sustainable development- Environmental management and innovation strategies.

Unit – IV

06 Hrs

Critical Perspectives on Sustainable Development: Resource management and implications on sustainable development - implications for valuation, risk assessment; integrated decision-making processes: requirements of information, information flow, data analytics, learning from historical data, multicriteria decisions, multi-level decisions, participatory decisions ; translating impact chains to information flows - impact of governance and policies

Unit –V

06 Hrs

Case Studies & Projects on Rural Sustainable Development (Indian village perspectives) - Village resources (broad perspectives); current challenges and thematic areas; village social hierarchy; village economy; needs of present and future generation; conflicts - sustainability and rural culture & tradition; road to achieving sustainable development goals. Governance for sustainable development. Policy responses to environmental degradation.



Text Book

1. Franco, I.B. and Tracey, J. (2019), "Community capacity-building for sustainable development: Effectively striving towards achieving local community sustainability targets", *International Journal of Sustainability in Higher Education*, Vol. 20 No. 4, pp. 691-725
2. *Our Common Journey: A Transition Toward Sustainability*. National Academy Press, Washington D.C. Soubbotina, T. P. 2004.
3. Elliott, Jennifer. 2012. *An Introduction to Sustainable Development*. 4th Ed. Routledge, London.
4. Rogers, Peter P., Kazi F. Jalal, and John A. Boyd. "An introduction to sustainable development." (2012).
5. Sachs, J. D. 2015. *The Age of Sustainable Development*. Columbia University Press, New York.
6. Soubbotina, Tatyana P. 2004. *Beyond Economic Growth: An Introduction to Sustainable Development*. WBI learning resources series, Washington DC ; World Bank.
7. Kerr, Julie. *Introduction to energy and climate: Developing a sustainable environment*. CRC Press, 2017.
8. Saito, Osamu. *Sharing Ecosystem Services*. Springer Singapore, 2020.
9. Nhamo, Godwell, and Vuyo Mjimba. *Sustainable Development Goals and institutions of higher education*. Springer, 2020
10. Hjorth, P. & A. Bagheri (2006), "Navigating towards Sustainable Development: A System Dynamics Approach", *Futures* 24 38: 74-92.
11. Mog, J.M. (2004) „Struggling with Sustainability – A Comparative Framework for Evaluating Sustainable Development Programs, *World Development* 32(12): 2139–2160. IISD Commentary on the OECD's Draft Principles for International Investor Participation in Infrastructure (PDF – 68 kb)
12. Arundel, A., R. Kemp, and S. Parto (2004) *Indicators for Environmental Innovation: What and How to Measure*, forthcoming in *International Handbook on Environment and Technology Management (ETM)*, edited by D. Annandale, J. Phillimore and D. Marinova, Cheltenham, Edward Elgar.
13. Douthwaite, B. (2002) *Enabling Innovation, A practical guide to understanding & fostering innovation*, London, Zed Books

Evaluation Scheme:

Continuous Assessment (A):

Assignment based on each unit

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.



Professional Elective Course-III (Numerical Methods for Civil Engineering) (PECE7043T)

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 00 Hr/week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Course Objectives

1. To develop a sound understanding of the various numerical techniques, principles and their application to Civil engineering problems.
2. To apply Numerical analysis which has enormous application in the field of Civil Engineering.
3. To calculate and interpret errors in numerical method.
4. To provide exposure to various numerical methods for performing task such as interpolation, differentiation, integration, solution of linear and nonlinear equations, solution of differential and integral equations
5. To facilitate numerical computing.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To develop a sound understanding of the various numerical techniques, principles and their application to Civil engineering problems.	Level 2	Understanding
CO2	To apply Numerical analysis which has enormous application in the field of Civil Engineering.	Level 3	Applying
CO3	To calculate and interpret errors in numerical method	Level 5	Evaluating
CO4	To provide exposure to various numerical methods for performing task such as interpolation, differentiation, integration, solution of linear and nonlinear equations, solution of differential and integral equations	Level 4	Analyzing
CO5	To facilitate numerical computing.	Level 4	Analyzing



Course Contents

Unit- I

08 Hrs.

Basis of Computations, Errors in Numerical Computation, Matrix Operations on Computer, Multiplication and Inversion, Solution of Simultaneous Equations, Gauss Elimination Method, Jordan and Gauss Seidal Methods.

UNIT-II

06 Hrs.

Roots of Equation by Bisection, False Position Method, Newton Rapson Method, Linear Programming Problem (L.P.P.) - Introduction, Assumptions, Applications, Limitations, General mathematical model, formulation, Simplex method.

Unit-III

06 Hrs.

Interpolation with Lagrange's Polynomial, Newton's Divided Differences, Forward and Backward Differences, Least Square Method, Regression Analysis: Linear, Parabolic, Curve Fitting

Unit-IV

06 Hrs.

Numerical Integration: Trapezoidal Rule, Simpon's Rules, Gauss Quadrature Rules. Introduction to initial value and boundary value problem, Finite Difference Method for solution of one dimensional wave equation, two dimensional equation. (Parabolic and Elliptic)

Unit -V

06 Hrs.

Solution of Ordinary Differential Equation, Euler's Method, Modified Euler's Method and Runga Kutta Methods, Predictor Corrector Method.



Reference Books:

1. Balaguruswami E., "Numerical Methods", Tata Mc-Graw Hill
2. Scheid F., "Numerical Analysis (Schaum's series)", Tata Mc-Graw Hill
3. Chapra. S. C. and Canale R. P., "Numerical Methods for Engineers", by, Tata Mc-Graw Hill
4. Shantha Kumar M., "Computer Based Numerical Analysis", Khanna Publication
5. Grewal B.S. and Grewal J.S., "Numerical Methods in Engineering and Science", Khanna Publication, N. Delhi
6. Sastry, S.S., "Introductory Methods of Numerical Analysis", Printice Hall of India, New Delhi
7. Jain, Aryengon, "Numerical Methods for Scientific and Engineering Applications", Wiley Eastern Publication
8. Numerical Recipe , Oxford Publishing
9. Manuals for the Commercial Computer Programmes

Evaluation Scheme:**Continuous Assessment (A):**

Assignment based on each unit

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.



Professional Elective Course-III (Ground water Engineering) (PECE7044T)

Teaching Scheme

Lectures : 03 Hrs./week

Tutorial : 00 Hr/week

Credit : 03

Examination Scheme

Term Test : 15 Marks

Teacher Assessment: 20 Marks

End Sem Exam : 65 Marks

Total Marks : 100 Marks

Course Objectives

1. To understanding the concept of ground water management.
2. To introduce the student to the principles of Groundwater governing Equations and Characteristics of different aquifers.
3. To understand the techniques of development and management of groundwater.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand aquifer properties and its dynamics	Level 2	Understanding
CO2	Get an exposure towards well design and practical problems	Level 3	Applying
CO3	Develop a model for groundwater management.	Level 5	Evaluating
CO4	Students will be able to understand the importance of artificial recharge and groundwater quality concepts	Level 4	Analyzing
CO5	Gain knowledge on conservation of groundwater.	Level 4	Analyzing



Course Contents

Unit-1 Hydrogeological Parameters

08 Hrs.

Introduction – Water bearing Properties of Rock – Type of aquifers - Aquifer properties – permeability, specific yield, transmissivity and storage coefficient – Methods of Estimation - Steady state flow - Darcy's Law - Groundwater Velocity – Dupuit Forchheimer assumption – Steady Radial Flow into a Well

UNIT II Well Hydraulic

08 Hrs

Unsteady state flow - Theis method - Jacob method – Chow's method – Law of Times – Theis Recovery – Bailer method – Image well theory – Partial penetrations of wells – Well losses – Specific Capacity and Safe yield - Collector well and Infiltration gallery

UNIT III Groundwater Management

08 Hrs

Need for Management Model – Database for Groundwater Management – Groundwater balance study – Introduction to Mathematical model – Model Conceptualization – Initial and Boundary Condition – Calibration – Validation – Future Prediction – Sensitivity Analysis – Uncertainty – Development of a model

UNIT IV Groundwater Quality

06 Hrs

Ground water chemistry - Origin, movement and quality - Water quality standards – Drinking water – Industrial water – Irrigation water - Ground water Pollution and legislation - Environmental Regulatory requirements.

UNIT V Groundwater Conservation

06 Hrs

Artificial recharge techniques – Reclaimed wastewater recharge – Soil aquifer treatment (SAT) – Aquifer Storage and Recovery (ASR) Seawater Intrusion and Remediation – Ground water Basin management and Conjunctive use – Protection zone delineation, Contamination source inventory and remediation schemes

TEXT BOOKS:

1. Raghunath H.M., "Ground Water Hydrology", New Age International (P) Limited, New Delhi, 2010.
2. Todd D.K., "Ground Water Hydrology", John Wiley and Sons, New York, 2000.

REFERENCES

1. Fitts R Charles, "Groundwater Science". Elsevier, Academic Press, 2002.
2. Ramakrishnan, S, Ground Water, K.J. Graph arts, Chennai, 1998.

Evaluation Scheme:

Continuous Assessment (A): Assignment based on each unit

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.



Open Elective

Product Lifecycle Management (OECE7050T)

Teaching Scheme
 Lectures : 03 Hrs./week
 Tutorial : 00 Hr/week
 Credit : 03

Examination Scheme
 Term Test : 15 Marks
 Teacher Assessment: 20 Marks
 End Sem Exam : 65 Marks
 Total Marks : 100 Marks

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	Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation	2	Learn
CO2	Illustrate various approaches and techniques for designing and developing products.	4	Analyze
CO3	Apply product engineering guidelines / thumb rules in designing products for molding, machining, sheet metal working etc.	2	Understand
CO4	Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant	3	Design



Course Contents

Unit- I Introduction to Product Lifecycle Management

10 Hrs.

Introduction to Product Lifecycle Management (PLM): Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications
PLM Strategies: Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy, Change management for PLM

Unit-II

08 Hrs.

Product Design: Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase, Methodological Evolution in Product Design, Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering and Life Cycle Approach, New Product Development (NPD) and Strategies, Product Configuration and Variant Management, The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process

Unit-III Theory of Meteorology

06 Hrs.

Product Data Management (PDM): Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation

Virtual Product Development Tools: For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modelling and simulations in Product Design, Examples/Case studies.

Unit-IV Air Pollution

8 Hrs.

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

Unit-V Analysis and Design of Columns and Column footings

8 Hrs.

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



Reference Books:

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

Text Books:

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

Evaluation Scheme:**Continuous Assessment (A):**

Subject teacher will declare Teacher Assessment criteria at the start of Semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.



Open Elective Management Information System (OECE7051T)

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 00 Hr/week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

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	2	Understand
CO2	Identify the impact information systems have on an organization	4	Learn
CO3	Describe IT infrastructure and its components and its current trends	2	Understand
CO4	Understand the principal tools and technologies for accessing information from databases to improve business performance and decision making	2	Understand
CO5	Identify the types of systems used for enterprise-wide knowledge management and how they provide value for businesses	4	Learn



Course Contents

Unit- I

06 Hrs.

Foundation Concepts: Information Systems in Business, Functional Area Information System, The Components of Information Systems, Impact of IT on organizations and society, Organizational Strategy, Information systems for strategic advantage

Unit- II

06 Hrs

Information Technologies: Hardware and Software Computer Systems: End User and Enterprise Computing Computer Peripherals: Input, Output, and Storage Technologies Application Software: End User Applications System Software: Computer System Management Data Resource Management: Technical Foundations of Database Management, Managing Data Resources, Big data, Data warehouse and Data Marts, Knowledge Management Networks: The Networked Enterprise (Wired and wireless), Pervasive computing, Cloud Computing models

Unit- III

06 Hrs.

MIS Tools and applications for Decision making: ERP and ERP support of Business Process Reengineering, Business intelligence (BI): Managers and Decision Making, BI for Data analysis and Visualization Artificial Intelligence Technologies in Business

Unit- IV

06 Hrs.

Security and Ethical Challenges: Security, Ethical, and Societal Challenges of IT Security Management of Information Technology

Unit- V

06 Hrs.

Social Computing (SC): Web 2.0 and 3.0, SC in business-shopping, Marketing, Operational and Analytic CRM, E-business and E-commerce – B2B B2C, Mobile Commerce.

Unit- VI

06 Hrs.

Information System within Organization: Acquiring Information Systems and Applications: Various System development life cycle models. Enterprise and Global Management of Information Technology: Managing Information Technology, Managing Global IT.



Reference Books

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

Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of Semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.



(Open Elective)
Operations Research (OECE7052T)

Teaching Scheme

Lectures : 03 Hrs./week

Tutorial : 00 Hr/week

Credit : 03

Examination Scheme

Term Test : 15 Marks

Teacher Assessment: 20 Marks

End Sem Exam : 65 Marks

Total Marks : 100 Marks

Course Objectives

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

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Convert a real-world problem in to a Linear Programming Problem and analyse the solution obtained using Simplex method or other algorithms.	3	Learn
CO2	Identify the decision situations which vary with time and analyse them using principle of dynamic programming to real life situations	4	Analyze
CO3	Describe concept of simulation and apply Monte Carlo Simulation technique to systems such as inventory, queuing and recommend solutions for them.	3	Understand
CO4	Understand need for right replacement policy and determine optimal replacement age.	2	Understand



Course Contents

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

10 Hrs.

Queuing Models: Characteristics of queuing models. Single Channel – Single and multi-phase servers, Poisson arrivals, and exponential service time - with infinite population and finite population models – with infinite and finite capacity. Multichannel – Single phase server - Poisson arrivals, exponential service time with infinite population. Game Theory: Introduction. Minimax & Maxim in Criterion and optimal strategy. Solution of games with saddle points, rectangular games without saddle points - 2 x 2 games, dominance principle. Approximate methods - Iterative method, m x 2 & 2 x n games -Graphical method and method of sub-games. Expressing game as LPP.

Unit-V

8 Hrs

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

Text books:

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

Reference Books:

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



Evaluation Scheme:**Continuous Assessment (A):**

Subject teacher will declare Teacher Assessment criteria at the start of Semester,

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.



(Open Elective) Cyber Security and Laws (OECE7053T)

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 01 Hr/week
Credit : 04

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

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	Understand the different types of cybercrime and security issues E Business.	3	Understand
CO2	Analyses different types of cyber threats and techniques for security management	4	Analyze
CO3	Explore the legal requirements and standards for cyber security in various countries to regulate cyberspace.	3	Understand
CO4	Impart the knowledge of Information Technology Act and legal frame work of right to privacy, data security and data protection	2	Learn



Course Contents

Unit- I

12 Hrs.

Introduction to Cybercrime:

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

08 Hrs.

Cyber Threats Analysis

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

06 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- VI

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 Law

The 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

08 Hrs.

Security Industries Standard Compliances

IT Security v/s IT Compliance, Cyber Security Standards, critical security controls for cyber security, GRC (Governance, Risk Management, and Compliance), SOX, GLBA, HIPAA, ISO/IEC 27001, NIST Cyber Security Framework (CSF), PCI-DSS.

OWASP Top Ten Project, GDPR (General Data Protection Regulation), NIST (National Institute of Standards and Technology), CIS Controls (Center for Internet Security Controls)



Reference Books and Material:

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

Evaluation Scheme:**Continuous Assessment (A):**

Subject teacher will declare Teacher Assessment criteria at the start of Semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.



(Open Elective) Personal Finance Management (OECE7054T)

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 00 Hr/week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

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.	2	Learn
CO2	Compute income from salaries, house property, business/profession, capital gains and income from other sources.	3	Understand
CO3	Compute the amount of CGST, SGST and IGST payable after considering the eligible input tax credit.	4	Apply
CO4	Understand how Microfinance can help in financial inclusion.	4	Analyze



Course Contents

Unit- I

07Hrs

Overview of Indian Financial System: 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

08Hrs

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

08Hrs

Income Tax

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- VI

06Hrs

Goods and Services Tax

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

06Hrs

Introduction to Micro – finance

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.



Reference Books:

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

Evaluation Scheme:**Continuous Assessment (A):**

Subject teacher will declare Teacher Assessment criteria at the start of Semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.



(Open Elective) Energy Audit and Management (OECE7055T)

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 00 Hr/week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

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



Course Contents

Unit- I

07Hrs

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

08Hrs

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

08Hrs

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- VI

06Hrs

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

06Hrs

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



Reference Books:

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

Evaluation Scheme:**Continuous Assessment (A):**

Subject teacher will declare Teacher Assessment criteria at the start of Semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.



(Open Elective)
Disaster Management and Mitigation Measures (OECE7056T)

Teaching Scheme

Lectures : 03 Hrs./week

Tutorial : 00 Hr/week

Credit : 03

Examination Scheme

Term Test : 15 Marks

Teacher Assessment: 20 Marks

End Sem Exam : 65 Marks

Total Marks : 100 Marks

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	Know natural as well as manmade disaster and their extent and possible effects on the economy.	2	Understand
CO2	Know the institutional framework and organization structure in India for disaster management and get acquainted with government policies, acts and various emergency laws.	3	Apply
CO3	Get to know the simple dos and don'ts in such extreme events and build skills to respond accordingly	3	Learn
CO4	Understand the importance of disaster prevention and various mitigation measure with the exposure to disasters hotspots across the globe.	2	Understand



Course Contents

Unit- I

07Hrs

General Information about Disaster:

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

08Hrs

Disaster Management:

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

08Hrs

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- VI

06Hrs

Disaster risk reduction and Mitigation Measures:

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

Unit- V

06Hrs

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



Reference Books and Reports:

1. Disaster Management, by Harsh K.Gupta, Universities Press Publications (2003).
2. Disaster Management: An Appraisal of Institutional Mechanisms in India, by O.S.Dagur, published by Centre for land warfare studies, New Delhi, 2011.
3. Introduction to International Disaster Management, by Damon Copolla, Butterworth Heinemann Elsevier Publications (2015).
4. Disaster Management Handbook, by Jack Pinkowski, CRC Press, Taylor and Francis group (2008).
5. Disaster management & rehabilitation, by Rajdeep Dasgupta, Mittal Publications, New Delhi (2007).
6. Natural Hazards and Disaster Management, Vulnerability and Mitigation, by R B Singh, Rawat Publications (2006).
7. Concepts and Techniques of GIS, by C.P.Lo Albert, K.W. Yongg, Prentice Hall (India) Publications (2006).
8. Risk management of natural disasters, by Claudia G. Flores Gonzales, KIT Scientific Publishing (2010).
9. Disaster Management – a disaster manager’s handbook, by W. Nick Carter, Asian Development Bank (2008).
10. Disaster Management in India, by R. K. Srivastava, Ministry of Home Affairs, GoI, New Delhi (2011)
11. The Chernobyl Disaster: Legacy and Impact on the Future of Nuclear Energy, by Wil Mara, Marshall Cavendish Corporation, New York, 2011.
12. The Fukushima 2011 Disaster, by Ronald Eisler, Taylor & Francis, Florida, 2013.

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

Evaluation Scheme:**Continuous Assessment (A):**

Subject teacher will declare Teacher Assessment criteria at the start of Semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.



(Open Elective) Science of Well-being (OECE7057T)

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 00 Hr/week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Course Objectives

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

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Describe concepts of holistic health and well-being, differentiate between its true meaning and misconceptions and understand the benefits of well-being.	2	Understand
CO2	Recognize meaning of happiness, practice gratitude and self-compassion and analyze incidents from one's own life.	3	Apply
CO3	Understand the causes and effects of stress, identify reasons for stress in one's own surrounding and self.	2	Learn
CO4	Recognize the importance of physical health and fitness, assess their life style and come up with limitations or effectiveness.	3	Understand
CO5	Inspect one's own coping mechanism, assess its effectiveness, develop and strategize for betterment and execute it.	4	Analyze



Course Contents

Unit- I

07Hrs

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

08Hrs

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

08Hrs

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- VI

06Hrs

Physical Well-being / Health management: concept of health behaviours, dimensions of health behaviours. Health enhancing behaviors: Exercise and Weight control, application and importance of these health enhancing behaviours. Health protective behaviors 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

06Hrs

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.



Textbooks:

1. The Science of well-being by Felicia Huppert, Nick Baylis, Barry Keverne; Oxford University Press
2. Health and Well-Being: Emerging Trends by S. Ojha, U. Rani Srivastava, Shobhna Joshi, Global Vision Publishing House
3. Positive psychology: The scientific and practical explorations of human strengths by Shane

J. Lopez, Jennifer Teramoto Pedrotti, Charles Richard Snyder; Sage Publications.

Reference Books:

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

Evaluation Scheme:**Continuous Assessment (A):**

Subject teacher will declare Teacher Assessment criteria at the start of Semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.



(Open Elective) Research Methodology (OECE7058T)

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 00 Hr/week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

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	Prepare a preliminary research design for projects in their subject matter areas	2	Understand
CO2	Accurately collect, analyze and report data	2	Understand
CO3	Present complex data or situations clearly	4	Analyze
CO4	Review and analyze research findings	3	Learn
CO5	Write report about findings of research carried out.	3	Apply



Unit- I **07Hrs**

Basic Research Concepts

Meaning of research, Objectives of research, Types of research, Significance of research process

Unit- II **08Hrs**

Research Methodology:

Identification of research problem, Literature review, Formulation of hypothesis, Formulation of Research design.

Unit- III **08Hrs**

Research and Sample Design:

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- VI **06Hrs**

Data Collection and Data Analysis:

Types of data, Methods for collecting data: Experiments and surveys, Collection of primary and secondary data, Hypothesis testing and interpretation of Data.

Unit- V **06Hrs**

Interpretation and Report Writing:

Interpretation and drawing conclusions on the research, Preparation of the report, Ethical Issues

Reference Books:

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

Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of Semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.



(Open Elective) Public Systems and Policies (OECE7059T)

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 00 Hr/week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Course Objectives

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

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand 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.	2	Analyze
CO3	Explain public policy and its operations with special focus on policy relating to Government finance.	3	Learn
CO4	Make policies and know about the happenings in the world, in the nation and those in their locality.	3	Learn
CO5	Analyze and evaluate the impact of the public policy on firms and economy at large and work under various fields as policymakers	2	Analyze



Course Contents

Unit- I

07Hrs

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

08Hrs

Public Sector in the Economics Accounts: Public Sector in the circular flow; Public Sector in the National Income Accounts.

Unit- III

08Hrs

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- VI

06Hrs

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

06Hrs

Case Studies in Expenditure Policy: Public Services

A) National Defense B) Highways C) Outdoor Recreation D) Education.

Reference Books:

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

Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of Semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr



Project Stage –II (PJCE7060L)

Teaching Scheme
Practical : 02 Hr/week
Credit : 04

Examination Scheme
Teacher Assessment: 25 Marks
End Sem Exam : 25 Marks
TOTAL :50

Course Objectives

- To implement the solution as per the problem statement.
- To develop the team building, writing, logical reasoning and management skills.
- To provide the connections between the designs and concepts across different disciplinary Boundaries.
- 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.	L4	Analyze
CO2	Demonstrate project based learning that allows students to transfer existing ideas into new applications.	L2	Understand
CO3	Develop an ability to work in teams and manage the conduct of the research study.	L3	Apply
CO4	Integrate different perspectives from relevant disciplines which help them to get internships, jobs and admission for higher studies.	L3	Apply
CO5	Present the research in the form of technical writing, understand what constitutes to plagiarism and how to use proper referencing styles.	L2	Understand



Syllabus:

- 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- I 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 Maintain	Literature Review	Depth of Understanding	Report	Total
			5	5	5	5	5	25

Table -3 Evaluation Sheet

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



SEM-VIII

Professional Elective Course-IV
Dams and Hydraulics Engineering (PECE8010T)

Teaching Scheme
 Lectures : 03 Hrs./week
 Tutorial : 00 Hr/week
 Credit : 03

Examination Scheme
 Term Test : 15 Marks
 Teacher Assessment: 20 Marks
 End Sem Exam : 65 Marks
 Total Marks : 100 Marks

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

After successful completion of course, students should able to:

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.	2,3	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 Contents

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.

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.

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".



Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of Semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.



Professional Elective Course-IV
Introduction to Earthquake Engineering (PCCE8011T)

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : ----- Hr/week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

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 structures.
4. To inculcate ethics to deal with social, environmental & economic issues.

Course Outcomes (COs): After completion of this course students will be able to:

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.

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.

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



Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of Semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3hrs.



Professional Elective Course-IV

Environmental Impact Assessment and Audit (PECE8012)T

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 01 Hr/week
Credit : 04

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

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 Contents

Unit-1 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



Reference Books:

7. A Chadwick, Introduction to Environmental Impact Assessment, Taylor & Francis , 2007
8. Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., New York, 1996.
9. Environmental Impact Assessment, Barthwal, R. R., New Age International Publishers, 2002
10. Environmental Impact Assessment, Rau, J.G. and Wooten, D.C., McGraw Hill Pub. Co., New York, 1996.
11. 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

Evaluation Scheme:**Continuous Assessment (A):**

Submit case study report / visit report of EIA.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.



Professional Elective Course-IV Structural Audit (PECE8013)T

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 00 Hr/week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

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 Contents

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.
- c. **Design and construction errors-** Causes of seepage and leakage in concrete structures, Formation of cracks including those due to corrosion.

Unit-II Condition Survey, Evaluation and Assessment

12 Hrs.

- a. **Diagnostic methods and analysis.** Destructive, Semi destructive and Non- Destructive methods
- b. **Concrete Strength Assessment:**
NDT Test: Rebound hammer, Ultrasonic Pulse velocity, Penetration resistance, Pull out, Core test
Chemical test: Carbonation test, Chloride test, Corrosion potential assessment,
Fire damage assessment: Differential thermal analysis, X ray diffraction,
Structural Integrity and soundness assessment: Radiography, Impact echo test, dynamic testing of structure, Interpretation and evaluation of test results.

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,



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.

Evaluation Scheme:**Continuous Assessment (A):**

Subject teacher will declare Teacher Assessment criteria at the start of Semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.



Professional Elective Course-IV Solid Waste Management (PECE8014)†

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 00 Hr/week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

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 and design
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	Prepare



Course Contents

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.

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



Evaluation Scheme:

Continuous Assessment (A):

Visit Report submission of solid waste management Unit.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.

**Professional Elective Course-IV
NPTEL/SWAYAM COURSE (PECE8015)T**

Note:-

List of NPTEL /Swayam course will be declare by concerned BOS at the beginning of semester



Professional Elective Course-V Metro Construction Technology (PCCE8020T)

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : ---- Hr/week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Course Objectives:

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

Course Outcomes (COs): After completion of this course students will be able to:

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.	2	Understanding
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



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

Evaluation Scheme:**Continuous Assessment (A):**

Subject teacher will declare Teacher Assessment criteria at the start of Semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3hrs.



Professional Elective Course-V Air Pollution Control PECE8021T

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 00 Hr/week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

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 Contents

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.

List of References:

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



Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of Semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.



Professional Elective Course-V

Software application in Structural Engineering (PECE8022)†

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 00 Hr/week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

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 and design
CO3	To understand the basic commands, principles and features behind commercially available software's.	3	Understand
CO4	To utilize structural software for detailed analysis of complex structures		Apply



Course Contents

Unit- I Introduction

06 Hrs.

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.

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.

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.

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.

Unit- V Case Study

06 Hrs.

1. Solve the Practice design Numerical by using software.
2. Assignment based on software

Text and Reference Books:

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.

Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of Semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.



Professional Elective Course-V

Coastal Engineering (PECE8023)†

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 00 Hr/week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

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 and design
CO3	Student will able to design coastal structure.	3	Understand
CO4	Understanding the Environmental aspects of Dredging & Disposal		Apply



Course Contents

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 tracers studies for feasibility of dumping ground for dredged materials- environmental aspects of dredging etc. Pollution in Coastal zone, disposal of waste/dredged.

Text Books:

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

Reference Books:

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

Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of Semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.



Professional Elective Course-V

Data Analytics in Civil Engineering (PECE8024)†

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 00 Hr/week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment: 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

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.	2	Apply



Course Contents

Unit- I Introduction and Mathematical Foundation

06 Hrs.

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.

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.

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.

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.

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

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



Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of Semester.

List of Assignments

- 1 Assignment on 'Eigenvalues and Eigenvectors'
- 2 Assignment on 'Soft Computing Tools'
- 4 Assignment on 'Data Analytics in Transportation Industry'
- 5 Assignment on 'Data Analytics in Water Resource Engineering'

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best of the marks scored in both the two tests will be considered for final grading.

End Semester Examination (C):

1. Question Paper will be based on entire syllabus summing up to 65 marks
2. Total duration allotted for writing the paper is 3 hr.

**Professional Elective Course-V
NPTEL/SWAYAM COURSE (PECE8025)†**

Note:-

List of NPTEL /Swayam course will be declare by concerned BOS at the beginning of semester



Project Stage –III (PJCE8030L)

Teaching Scheme
Practical : 20 Hr/week
Credit : 10

Examination Scheme
Teacher Assessment: 150 Marks
End Sem Exam : 150 Marks

Course Objectives

- To implement the Papers based on above study
- To develop the model or Registered the Patent.
- 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.	L4	Analyze
CO2	Demonstrate project based learning that allows students to transfer existing ideas into new applications.	L2	Understand
CO3	Develop an ability to work in teams and manage the conduct of the research study.	L3	Apply
CO4	Integrate different perspectives from relevant disciplines which help them to get internships, jobs and admission for higher studies.	L3	Apply
CO5	Present the research in the form of technical writing, understand what constitutes to plagiarism and how to use proper referencing styles.	L2	Understand



Project Stage-III

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)



Internship (INTCE8030L)

Internships offer valuable educational and career development opportunities by providing students with practical experience in their field of study. In Semester – VIII, students have two options for their internship: Industry Internship and In-house Internship.

1. Industry Internship

Objectives: The industry internship aims to achieve the following objectives:

1. Expose technical students to the industrial environment, allowing them to gain real-world experience and develop into competent professionals.
2. Provide opportunities to learn and enhance the practical technical skills required for professional roles.
3. Familiarize students with current technological developments relevant to their field of study.
4. Encourage the application of technical knowledge in real industrial situations.
5. Develop skills in writing technical reports and projects.
6. Introduce students to the responsibilities and ethics of the engineering profession.
7. Familiarize students with various materials, processes, products, and quality control practices.
8. Promote academic, professional, and personal growth.
9. Facilitate connections between students and potential future employers.
10. Foster an understanding of the social, economic, and administrative factors influencing industrial organizations and their working environments.
11. Develop an understanding of employee psychology, habits, attitudes, and problem-solving approaches.

Industry Internship Guidelines:

- The Training and Placement (T&P) cell of the institute will arrange internships for students in industries/organizations after the seventh semester.
- Students are expected to accept internship offers regardless of the company, job profile, location, or stipend offered.
- 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:



1. Only T&P department granted internship will be considered.
2. The internship duration should be of minimum 12 Weeks.
3. Each student needs to take prior permission from T&P department before proceeding for any internship opportunity on his/her own.
4. 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.
5. 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 7. 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:

- 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.
- The internship report will be evaluated based on the following criteria:
 - i. Adequacy and purposeful write-up.



- ii. Variety and relevance of learning experiences.
- iii. Practical applications and connections with the fundamental theories and concepts covered in the course (semester I to VII).

6. 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.
8. 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 8, 9, 10, 11 & 12.



10) Assessment Formats:

Table 8. Log Book Format			
Week (Start Date: End Date)	Work Done	Sign of in-house mentor	Sign of Coordinator

Table 9. First Review			
Topic Identification & Validation (5 Marks)	Literature Survey (10 Marks)	Problem Definition (5 Marks)	Objectives (5 Marks)

Table 10. Second Review (Objectives given by department/in-house mentor)			
Implementation (5 Marks)	Publications (10 Marks)	Presentation (5 Marks)	Report (5 Marks)

Table 11. Second Review (in-house internship)		
Product Development/Technology Transfer (10 Marks)	Publication/Patent/Startup/company registration (10 Marks)	Presentation & Report (5 Marks)

Table 12. 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)

