Seventh Semester

S.No.	Course Code	Course Title	Hrs./ Week			Credits
			L	T	P	
1	PCC – CE701	Foundation Engineering	2	1	2	4
2	PCC – CE702	Design of Advanced RCC Structures	2	1	2	4
3	PEC – CE701	Departmental Elective-I	3	-	-	3
4	PEC – CE702	Departmental Elective-II	3	-	-	3
5	OEC – CE701	Open Elective-III	3	-	-	3
6	PROJ – I	Project Phase -I	-	-	8	4
Evaluation of Internship completed in VI Sem						
Total Credits						**21**

S.No.	**Departmental Elective-I** (PEC – CE701)	**Departmental Elective-II** (PEC – CE702)	**Open Elective-III** (OEC – CE701)
1	Advanced Water resources Engineering	Pavement Design	Entrepreneurship
2	Traffic Engineering	Air and Noise Pollution Control	Principles of Mgt & Managerial Economics
3	Advanced Fluid Mechanics	Integrated Waste management	Industrial Pollution Abatement
4	Urban and Town Planning	Geo-Informatics Engineering	-
5	Building Services	Marine Construction	-

PCC – CE701	Foundation Engineering	2L:1T:2P (5hrs)	4 Credits

Objectives:

The course on Foundation Engineering provides the students necessary geotechnical engineering skills to analyze and design shallow and deep foundation systems under different loading and soil conditions.

Module 1 **(10 Hrs)**

Shallow Foundations: Type of foundations shallow and deep. Bearing capacity of foundation on cohesion less and cohesive soils. General and local shear failures. Factors effecting B.C. Theories of bearing capacity - Prandle, Terzaghi, Balla, Skempton, Meyerh of and Hansan. I.S. code on B.c. Determination of bearing capacity. Limits of total and differential settlements. Plate load test.

Module 2 **(10 Hrs)**

Deep Foundation: Pile foundation, Types of piles, estimation of individual and group capacity of piles in cohesion less and cohesive soils. Static and dynamic formulae.. Pile load test, Settlement of pile group, Negative skin friction, under- reamed piles and their design. Piles under tension, inclined and lateral load Caissons. Well foundation. Equilibrium of wells. Analysis for stability tilts and shifts,

Module 3 **(07 Hrs)**

Compaction: Soil compaction phenomenon, Factors affecting compaction. Dry density and moisture content relationship. Zero air voids line, Effect of compaction on soil structure. Standard Proctor test and Modified Proctor test as per IS – 2720. Field . Various equipment for field compaction and their suitability. Field compaction control.

Module 4 **(07 Hrs)**

Consolidation of Soil: Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, interpretation of consolidation test results, Terzaghi's theory of consolidation, final settlement of soil deposits, computation of consolidation settlement and secondary consolidation.

Module 5 **(10 Hrs)**

Soil Exploration and General Principles of Machine foundation design : Purpose, importance, methods

of soil exploration, subsurface exploration, trial pits, boring: method of borings. Sampling: Disturbed And Undisturbed Samples, Area ratio, Field tests: SPT, DCPT,SCPT, pressure-meter test, plate load test, field vane shear test, General principles of Machine foundation design

Types of Machines and Machine Foundations, General Requirements of Machine Foundations, Permissible amplitude, Modes of vibration of rigid block foundations

Course Outcomes:

CO1. Study the geotechnical aspects of shallow foundations and the theories involved in it.

CO2. Understand the detailed design related to deep foundations and its practical applications.

CO3. Learn the different practical approaches available for the improvement of soil properties, their porosity and compaction.

CO4. Understand the settlement behavior of different type of soil under different foundation

CO5. Understand the need of soil exploration and to visualize the design considerations involved in foundations subjected to vibration.

Text/Reference Books:

1. Dr. K.R. Arora, "Soil Mech. & Found. Engg." Std. Publishers Delhi.

2. Dr. B.C.Punmia, "Soil Mech. & Found" Laxmi Publications, Delhi.

3. Dr.l Aram Singh, "Modern Geotech Engg" IBT Publishers, Delhi.

4.. C. Venkatramaiah, "Geotech Engg" New Age International Publishers, Delhi

5. S.K. Garg, "Soil Mech. & Found. Engg." Khanna Publishers, Delhi.

6. Relevant I.S. Codes

Suggested List of Experiment:

1. Indian Standard Light Compaction Test/Std. Proctor Test
2. Indian Standard Heavy Compaction Test/Modified Proctor Test
3. Determination of field density by Core Cutter Method
4. Determination of field density by Sand Replacement Method
5. Determination of field density by Water Displacement Method
6. CBR Test
7. Consolidation test
8. 10. Demonstration of Plate Load Test SPT & DCPT

PCC – CE702	Design of Advanced RCC Structures	2L:1T:2P (5hrs)	4 Credits

Objective :

To analyze and design the special RCC structures using standard codal provisions and procedures.

Module 1

Design of Multistory Buildings : Sway and nonsway buildings, Shear walls and other bracing elements.

Module 2

Erth Retaining Structures : Cantilever and counter fort types retaining walls.

Module 3

Water Tanks : Tanks on ground and underground tanks: Square, rectangular, circular tanks, Overhead tanks: square, rectangular, circular & intze tanks**.**

Module 4

Silos and Bunkers:

Module 5

T-beam & Slab bridges: for highway loading (IRC Loads).

Prestressing concepts materials, systems of prestressing & losses Introduction to working & limit State Design.

Course Outcomes:

CO1. Analyze the behavior of multi-storied and retaining structures and undertake design and detailing for gravity and lateral loads applying relevant codes of practice (IS: 875, IS: 1893, IS: 13920).

CO2. Understanding the behavior of Cantilever and Counter fort Retaining Wall and IS code terminologies involved in design.

CO3. Understand the behavior and undertake the design of liquid storage structures (Water Tanks) in simple configurations applying relevant codes of practice IS: 3370.

CO4. Understand the behavior and undertake the design of storage structures (bunker & silo) in simple configurations applying relevant codes of practice IS: 4995.

CO5. Understand the behavior and undertake the design of storage structures (bunker & silo) in Simple configurations applying relevant codes of practice IS: 4995.

Suggested Books: -

1. R.C.C. by O.P. Jain Vol. II
2. R.C.C. by B.C. Punmia
3. Essentials of Bridge engineering – D.J. Victor
4. Bridge Engineering - Ponnuswamy
5. Advanced R.C.C. Design by N.K. RAJU
6. N.Krishna Raju, Prestressed Concrete, Tata Mc Graw Hill, New Delhi.
7. Pre stresses concrete – T.Y. Lin

PEC – CE701	**Advanced Water resources Engineering**	**3L:0T:0P (3hrs)**	**3 Credits**

Objectives:

To provide advance knowledge of water resource engineering, water management, flood management and various concepts of optimization techniques.

Module 1 **(10 Hrs)**

Optimal Raingauge Network Design, Adjustment of Precipitation Data, Depth Area-Duration Analysis, Design Storm, Probable Maximum Precipitation, Probable Maximum Flood, Flood Frequency Analysis, Probable Maximum Precipitation, Probable Maximum storm

Module 2 **(12 Hrs)**

Flood Management, Flood Routing through Reservoirs, Modified Puls Method, Modified Muskingham Method, Channels Routing Muskingum Method, Introduction to Stochastic Models in Hydrology like AR, ARMA, ARIMA model.

Module 3 **(10 Hrs)**

System Analysis: Water Resources Systems, Optimization Techniques, Linear Programming (LP), Graphical Method, Simplex Method, Use of Linear Programming (LP) in Water Resources, Introduction to Reservoir Operation

Module 4 **(08 Hrs)**

Dynamic Programming, its utility in Water Resource Allocation and other Decision Making Problems, Optimal Operating Policies, Use of DP in Reservoir operation.

Module 5 **(08 Hrs)**

Watershed Hydrology: Geomorphology of Drainage Basins, Landuse and Capabilities, Watershed Management Techniques.

Course Outcomes:

CO1. Ability to understand network, storm design, measurement and presentation of rainfall.

CO 2. Enable the students to understand the flood management, flood routing and introduction of stochastic models in hydrology.

CO 3. The students are exposed to the application of water resources systems, optimization techniques and introduction to reservoir operation.

CO 4. The students obtain the complete knowledge on dynamic programming including its utility, decision making problem and its use in reservoir operation.

CO 5. To understand the concept of hydrology of watershed & it's techniques.

Text/Reference Books:

1. Stochastic Water Resources Technology by N.T. Kottegoda
2. Engineering Hydrology by Subramanian
3. Irrigation & Water Power Engineering By Punmia Lal
4. Irrigation & Hydraulic Structure by S.K. Garg
5. Operation Research by Phillips & Ravindran
6. Operation Research by TAHA
7. Stochastic Hydrology by Jaya Rani Raddy
8. Frequency Analysis, NIH Publication.

PEC-CE701	Traffic Engineering	3L:0T:0P (3 Hours)	3 Credits

Objectives: To provide fundamental knowledge of various conventional and modern planning & design techniques used for traffic control, traffic management and planning of masstransportation systems.

Module 1

Traffic Characteristics : Road user's characteristics- general human characteristics, physical, mental and emotional factors, factors affecting reaction time, PIEV theory. Vehicular characteristics- Characteristics affecting road design-width, height, length and otherdimensions. weight, power, speed and braking capacity of a vehicle.

Module 2

Traffic Studies : Spot Speed Studies and Volume Studies, Speed and Delay Studies purpose, causes of delay, methods of conducting speed and delay studies, Origin and destination Studies (O & D) : Various methods, collection and interpretation of data, planning and sampling, Traffic Capacity Studies: Volume, density, basic practical and possible capacities, level of service, Parking Studies: Methods of parking studies cordon counts, space inventories, parking practices.

Module 3

Traffic Operations and Control : Traffic regulations and various means of control, One way streets- advantages and limitations, Traffic signals- isolated signals, coordinated signals, simultaneous, alternate, flexible and progressive signal systems. Types of traffic signals, fixed time signals, traffic actuated signals, speed control signals, pedestrian signals, flashing signals, clearance interval and problems on single isolated traffic signal.

Module 4

Street Lighting : Methods of light distribution, Design of street lighting system, Definitions- Luminaire, foot candle, Lumen, utilization and maintenance factors, Different types of light sources used for street lighting, Fundamental factors of night vision.

Module 5

Accident Studies & Mass Transportation : Causes of accidents, accident studies and records, condition

and collision diagram, preventive measures, Expressways and freeways, problems on mass transportation and remedial measures, brief study of mass transportation available in the country.

Course Outcomes:

CO1: To understand different traffic characteristics and how these affect the system designs.

CO2: To comprehend the procedures to conduct traffic studies.

CO3: To visualize different traffic operations and grasp knowledge of various traffic controlfacilities and regulations.

CO4: To develop an understanding for types of traffic lighting systems, terminologies associated and design criteria for lighting systems.

CO5: To learn about different accident studies and understand in brief the existing masstransportation systems.

Reference Books:

1. Traffic Engineering and Transport Planning by L.R. Kadiyali, Khanna Publishers, Delhi
2. Traffic Engineering by Matson, W.S.Smith & F.W. Hurd
3. G.J. Pingnataro, Principles of Traffic Engineering
4. D.R.Drew, Traffic Flaw Theory
5. W.R. Mchsne and R.P. Roess "Traffic Engg"
6. Wohl & Martin, Traffic System Analysis for Engineering & Planners

PEC – CE701	Advanced Fluid Mechanics	3L:0T:0P (3hrs)	3 Credits

Objectives:

To provide fundamental knowledge of fluid, its properties and behavior under various situation of internal and external flows.

Module 1 **(12 Hrs)**

Pipe Flow Problems: Losses in pipe flow, pipes in series, pipes in parallel, branching pipes, siphons, multi-reservoir problems, pipe net works. Major and minor losses in pipes. Loss due to bend, loss due to elbow bend, loss due to valve fitting, loss due to junction and fittings. The concept of unsteady flow. The concept of water hammer phenomenon. Water hammer (action for gradual and sudden closure). Two conditions for sudden closure for rigid and flexible pipes. Concept of Surge and design of surge tank.

Module 2 **(08 Hrs)**

Boundary Layer Theory: Introduction, Development of boundary layer over a flat plate, boundary layer thickness, displacement, Application of momentum equation to boundary layer flow, local and mean drag coefficients, boundary layer separation and its control.

Module 3 **(10 Hrs)**

Characteristics of Turbulent Flow, temporal velocity, semi empirical theories to estimate shear stress in turbulent flow using Boussinesq's theory, velocity distribution in Turbulent flow, Prandtl's velocity distribution equation, Karman Prandtl velocity distribution equations for smooth and rough boundaries, Equation for mean velocity for pipes, Friction factor for commercial pipes, Moody's diagram, explicit equations for friction factor.

Module 4 **(10 Hrs)**

Steady gradually varied flow, Characteristics of flow profile and methods of computation, Practical problems, gradually varied flow classification, analysis and computations. Steady rapid varied flow, Hydraulic jump analysis and location, introduction to surges in channel, Design of spillways, Energy dissipaters, Channel transitions.

Module 5 **(10 Hrs)**

Practical Problems involving fluid flow around submerged objects; Definitions and expression for drag, lift

drag coefficient, lift coefficients. Karmann's Vortex Street, Effects of free surface and compressibility on drag, Development of lift on cylinder and aerofoil, Polar Diagram.

Course Outcomes:

CO1. Demonstrate the concept of pipe flow and various conditions of pipe flow.

CO 2. Demonstrate the concept of Boundary Layer Theory and to have the concept of different thickness related to boundary layer.

CO 3. Details of Turbulent flow and concept of Moody's diagram.

CO 4. Demonstrate the Concept of unsteady flow and Water Hammer Phenomenon.

CO 5. Demonstrate the concept of Drag and Lift and related equations.

Text/Reference Books:

1. A.K. Jain "Mechanics of fluids", Khanna Publisher., Delhi.
2. Modi, P. N. and S. N. Seth "Hydraulics and Fluid Mechanics", Standard book house, New Delhi.
3. R. K. Bansal – A text book of Fluid Mechanics & Hydraulic

PEC-CE701	Urban and Town Planning	3L (3 hrs.)	3 credits

Objective:

- To achieve sustainable development
- To make the most out of municipal budgets by informing infrastructure and services investments, balancing demands for growth with the need to protect the environment
- To distribute the economic development within a given territory to reach social objectives and creates a framework for collaboration between local governments, the private sector and the public at large

Module 1 **(12 hrs.)**

Urban Planning: Definition; History: Pre-classical, China, Greco-Roman, Medieval Europe, Renassaince Europe, Enlightenment Europe and America; Technical Aspects:Aesthetics, Safety and security, Decay, Reconstruction and renewal, New Master-Planned Cities, Transport, Suburbanization, Environmental factors, Zoning, Light and Sound, Water and Sanitation and Infrastructure; Urban Planners: Responsibilities-Land use planning, Strategic urban planning, Regional Planning, Heritage and Conservation, Urban Revitalization, Master Planning, Transportation Planning, Economic Development, Environmental Planning, Urban Design, Infrastructure Planning; Education and Training, List of Different Urban Planners Nation Wide

Module 2 **(10 hrs.)**

Urban Development: Concept, Policies and Programmes in India, Impact on Metro and Mega Cities

Module 3 **(10 hrs.)**

Land and Real Estate Development: Land Pricing/Valuation, Factors affecting land supply and demand, Real Estate Markets, Method of Development, Environmental Considerations

Module 4 **(08 hrs.)**

Town Planning: History in India, Concepts of landmark, axis, orientation, Definition, Orthodoxies of planning, Sustainability and Rationality in planning

Module 5 **(10 hrs.)**

Planning Theories: Concentric Zone Theory, Sector Theory, Multiple Nuclei Theory, Land Use and Land Value Theory of William Alonso, Ebenezer Howard's Garden City Concept, Green Belt Concept

Course Outcome:

- To imbibe the basic notion about urban planning, its history, technical aspects and understand the role of urban planners in detail
- To get acquainted with the concept of urban development by reviewing its policies and programmes implemented in India and study its impact upon Metro and Mega Cities
- To comprehend the minutes of Land and Real Estate Development
- To gain knowledge of Town Planning together with its Sustainability and Rationality
- To cram the various Planning Theories in detail

List of Text / Reference Books:

1. Hall, P., "Cities of Tomorrow: an intellectual history of urban planning and design in the twentieth century", 2001, Blackwell London
2. Sandercock, L., "Making the Invisible Visible:A Multicultural Planning History", 1998, University of California Press, London
3. Rakodi, C. and Lloyd-Jones, T., "Urban Livelihoods: A People-Centered Approach to Reducing Poverty", 2002, Earthscan, London
4. Datta, A., "The Illegal City: Space, Law and Gender in a Delhi Squatter Settlement", 2012, Ashgate, Burlington
5. Bawa, V.K., "Indian Metropolis: Urbanization, Planning and Management", 1987, Inter-India Publications, New Delhi

PEC-CE701	Building Services	3L (3 hrs.)	3 credits

Objective:

- To make the building comfortable, functional, efficient and safe
- To contribute to the design of building in terms of façade engineering
- To influence the building's architecture, its sustainability and energy demand

Module 1 **(08 hrs.)**

Building Management System: Home Automation and Building Automation; Management Level, Automation Level, Field Level

Module 2 **(12 hrs.)**

Energy Generation, Distribution and Supply: Hydroelectricity, LPG, Marine Energy, Natural Gas, Nuclear Energy, Biomass, Renewable energy, Solar Energy, Tidal lagoon power, Wind Energy

Module 3 **(10 hrs.)**

Escalators and lifts: History, Speed, Configurations, Design Considerations, Components; Security and Alarm System: Access Control, Perimeter Security CCTV, Sensors and Detectors, Intrusion Alarms, Fire Detection System, Fire Extinguisher System

Module 4 **(08 hrs.)**

Façade Engineering; Water, Drainage and Plumbing: Types of Pumps, Types of Drainage Systems in Buildings

Module 5 **(10 hrs.)**

Fire: Fire Safety Strategies, Prevention, Communication, Escape, Containment, Passive Fire Resistance, Active Measures, Extinguishment; HVAC: Heating, Ventilation, Air Conditioning, Energy Efficiency, Air Filtration and Cleaning, Industry and Standards, Lighting: Natural, Artificial-General, Ambient, Accent, Task, Emergency, Security, Construction Site, Circadian Rhythms

Course Outcome:

- To imbibe the basic notion about building management system
- To get acquainted with the concept of energy generation, its distribution and supply
- To comprehend the minutes of escalators and lifts, and security and alarm systems
- To gain knowledge of Façade Engineering and about Water, Drainage and Plumbing
- To cram about Fire, HVAC and Lighting

List of Text / Reference Books:

- Hall, F. and Greeno, R., "Building Services Handbook", 2017, 9th Edition, Routledge
- "Maintenance of Buildings" by A C Panchdhari
- "Building Repair and Maintenance Management" by P S Gahlot
- Maintenance and Repairs of Buildings" by Pijush Kanti Guha

PEC – CE702	Pavement Design	3L:0T:0P	3 credit

Objective: To provide knowledge of planning & design of flexible and rigid pavement.

Module 1 **(10 Hrs)**

Wheel Load: Equivalent Single Wheels Load concepts and applications, Relationship between wheel arrangements and loading effects, tyre contact area, Effect of load repetition, Effect of transient loads, Impact of moving loading, Factors to be considered in Design of pavements, Design wheel load, soil, climatic factors, pavement component materials, Environmental factors, Special factors such as frost, Freezing and thawing.

Module 2 **(12 Hrs)**

Flexible Pavements: Component parts of the pavement structures and their functions, stresses in flexible pavements, Stress distribution through various layers, Boussinesque's theory, Burmister's two layered theory, methods of design, group index method, CBR method, Burmister's method and North Dakota cone method.

Module 3 **(12 Hrs)**

Rigid Pavements: Evaluation of subgrade, Modulus-K by plate bearing test and the test details, Westergaard's stress theory stresses in rigid pavements, Temperature stresses, warping stresses, frictional stresses, critical combination of stresses, critical loading positions.

Module 4 **(08 Hrs)**

Rigid pavement design: IRC method, Fatigue analysis, PCA chart method. AASHTO Method, Reliability analysis. Pavement Joints: Types of joints, contraction and warping joints, dowel bars and tie bars, Temperature reinforcements, filling and sealing of joints.

Module 5 **(08 Hrs)**

Evaluation and Strengthening of Existing Pavements: Benkleman beam method, Serviceability Index Method. Rigid and flexible overlays and their design procedures. Bituminous materials: tar, cutback, bitumen, emulsion, tests on different bituminous materials.

Course Outcomes:

Students will be able to

CO1. To provide a systematic approach towards pavement design by introduction to fundamental terminologies and factors affecting design consideration.

CO2. To visualize the different layers existing in a flexible pavement and design criteria involved.

CO3. To visualize the different layers existing in a rigid pavement, design criteria involved and the stress generated.

CO4. To provide a systematic approach towards rigid pavement design and design of joints via different methods.

CO5. To provide an insight to strength evaluation and enhancement methods.

Text/Reference Books:

1. S.K. Khanna & C. J. Justo, "Highway Engineering", Nemchand & Bros., 7th Edition 2000.
2. Dr.L.R.Kadiyali & Dr. N. B. Lal, "Principles and Practices of Highway Engineering", Khanna publishers 2003.
3. Yoder & wit zorac, "Principles of pavement design", Jhonwilley & Sons.

(PEC – CE702)	Air and Noise Pollution Control	L:T:P (Hrs) 3:0:0	Credits: 3

Objective: To provide a deep insight to the global problem of Air and Noise pollution and its control technologies.

Module 1 **(10 Hrs)**

Introduction and Impacts of Air pollution: Air pollution: Introduction, Structure of Atmosphere, Lapse rate and Inversion, Definition and Causes of Air pollution, Sources and Classification of air pollutants, Mobile and stationary sources of air pollutants, Automobile pollution sources, Impacts of Air Pollution on human beings, plants, animals and properties. Global Impacts - Green house effect, Ozone depletion, Acid rain, Heat island, Dust storms, Photochemical smog, Climate Change. History of Air pollution with case studies.

Module 2 **(10 Hrs)**

Transport of Pollution in Atmosphere: Introduction to meteorology and transport of air pollution: Global winds, Headley cells, wind rose terrestrial wind profile, Effects of terrain and topography on winds, maximum mixing depths, plume rise, effective stack height concept, Plume behavior under different atmospheric conditions, Plume behavior in valley and terrains. Plume behavior under different meteorological conditions, Mathematical models of dispersion of air pollutants: Gaussian Plume Model, Concept of isoplates.

Module 3 **(10 Hrs)**

Air Pollution control: CO, CO_2, H_2S, SO_x, NO_x emissions, and its control. Air Pollution control at source, equipments for control of air pollution. For particulate matter control: Settling chambers, Cyclonic Settling chambers, Fabric filters, Scrubbers, Electrostatic precipitators. For Gaseous pollutants control: absorption, adsorption, combustion and incineration, catalytic converter for automobile pollution control. Working principles advantages and disadvantages, design criteria and examples. Future engines and fuels.

Module 4 **(10 Hrs)**

Air Quality Sampling and Monitoring: Stack sampling, Instrumentation and methods of analysis of SO_2, NOx, CO etc, High Volume air sampler and digital aerosol samplers, legislation for control of air pollution and automobile Pollution, Air Quality Index, Indian Ambient Air Quality Standards, Air (Prevention and

Control of Pollution) Act.

Module 5 **(08 Hrs)**

Noise Pollution and Control: Definition, Source, Causes and Impacts of Noise Pollution. Measurement of Noise: Decibel scale. Monitoring Instrument for Noise pollution: Noise Meters, principle and working. Noise level standards and bearable limits of noise. Noise pollution control at source, pathway and user end.

Course Outcome:

CO1: Introduction to basic concepts causes and impacts of air pollution.

CO2: To provide knowledge regarding transport of air pollution in atmosphere.

CO3: To develop skills relevant for control of air pollution.

CO4: Knowledge of how to estimate the quantity of air pollutant, it's sampling and monitoring.

CO5: To understand the different types of noises, their acceptable levels and how to control noise pollution.

Text/Reference Books:

1. H.C Parkins, Air Pollution Mc Graw Hill Publication
2. Environmental Engineering - H.S. Peavy & D.R. Rowe-Mc Graw Hill Book Company, New Delhi
3. De A.K., Environmental Chemistry, Wiley Eastern Ltd
4. De Nevers, N., Air Pollution Control Engineering, McGraw-Hill (2000).

(PEC – CE702)	Integrated Waste management	L:T:P (Hrs) 3:0:0	Credits: 3

Objective:

This course will also cover many other aspects including recovery of biological conversion products from solid waste to compost and biogas, incineration and energy recovery, hazardous waste management and treatment, and integrated waste management.

Module 1 **(08 Hrs)**

Solid Waste Management- Definition, Concept of 4Rs (reduce, reuse, recycle and recover) of waste management, Elements of a waste management system, Current Issues in Solid Waste Management, Integrated Waste Management Hierarchy: Source reduction, Recycling, Waste-to-Energy and Landfilling. Review of waste management under Swachh Bharat Mission and Smart Cities Program.

Module 2 **(08 Hrs)**

Municipal Solid Waste: Waste Composition and Quantities, Collection, Transportation, Segregation, and Processing.

Module 3 **(08 Hrs)**

Disposal of Municipal Solid Waste: Landfill, Biochemical Processes and Composting, Energy Recovery from Municipal Solid Waste. Municipal Solid Waste (MSW) Rules 2016.

Module 4 **(08 Hrs)**

Construction and Demolition (C&D) Waste Management: Overview, Components; C&D Waste Management Rules 2016, Beneficial Reuse of C & D Waste Materials.

Module 5 **(08 Hrs)**

Electronic Waste (E-Waste) Management – Issues & Status in India and Globally, E-Waste Management Rules 2016 and Management Challenges. Hazardous Wastes: Definition, Classification, Risk assessment, Transportation of hazardous waste, Current Management Practices: Environmental audit, Containment, Remedial alternatives.

Books:

1. George Tchobanoglous, Hilary Theisen and Samuel A Vigil, Integrated Solid Waste management, Tata McGraw Hill
2. Ramachandra T.V., Management of Municipal Solid Waste, 2009; by The Energy and Resource Institute, TERI
3. Sasikumar, K, Gopi Krishna, Sanoop, Solid Waste Management; 2009, PHI.

References:

1. Manual on Solid Waste Management, prepared by The Central Public Health and Environmental Engineering Organization(CPHEEO), India
2. MSW Management Rules 2016, Govt. of India, available online at CPCB website
3. Construction and Demolition Waste Management Rules, 2016, MoEF&CC
4. Electronic Waste Management Rules 2016, Govt. of India, available online at CPCB website.
5. Freeman, M. H.1988. Standard Handbook of Hazardous Waste Treatment and Disposal, McGraw-Hill Book Company, New York
6. O P Gupta, " Element of hazardous waste management, Khanna Publishing House.

PEC – CE702	Geo-informatics Engineering	3L:0T:P (3hrs)	3 Credits

Objectives:

To Introduces fundamental concept of Remote sensing & GIS,GPS techniques for modeling and analysis in civil engineering problem.

Module 1 **(09 Hrs)**

Remote sensing: Basic concept of Remote sensing, Types of Remote Sensing ,Data and Information, Remote sensing data collection, Remote sensing advantages & Limitations, Remote Sensing process. Atmospheric windows, Electromagnetic Spectrum, Energy interactions with atmosphere and with earth surface features (soil, water, and vegetation), Resolution, image registration and Image and False color composite, elements of visual interpretation techniques.

Module 2 **(10 Hrs)**

Remote sensing Platforms and Sensors: Indian Satellites and Sensors characteristics, Remote Sensing Platforms, Sensors and Properties of Digital Data, Data Formats: Introduction, platforms- Types of Platforms ,Types and characteristics of sensors, sensor resolutions (spatial, spectral, radiometric and temporal). Basics of digital image processing- introduction to digital data, systematic errors(Scan Skew, Mirror-Scan Velocity, Panoramic Distortion, Platform Velocity , Earth Rotation) and non-systematic [random] errors(Altitude, Attitude), Image enhancements(Gray Level Thresholding, level slicing, contrast stretching),image filtering.

.**Module 3** **(12 Hrs)**

Geographical Information System: Introduction to GIS; components of a GIS; Geographically Referenced Data, Spatial Data- Attribute data , attribute data and Geospatial data Data input-existing GIS data, creating new data; attribute data query, spatial data query, raster data query, Attribute data Management, - Projected Coordinate System, Geographic coordinate System, Datum; Map Projections: Types of Map Projections, Projected coordinate Systems. UTM Zones ; -

Module 4 **(12 Hrs)**

Data Models: Vector an d Raster data model:Non Spatial data model, Representation of simple features – Topology and its importance; coverage and its data structure, Shape file, DBMS, Relational Database, , Grid model, TIN model, Network model, applications; Data collection, capture and Geo processing: Sources,

input methods, editing, re-projection, geometric transformation, map scale, precision and accuracy. Raster Data Model: Elements of the Raster data model, Types of Raster Data, Raster Data Structure, Data conversion. Vector and Raster data models,

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Module 5 **(16 Hrs)**

GPS & Integrated approach of Remote sensing & GIS: Definition, history, components; , GPS Position Location Principles, types and application of GPS; system segmentation – control segment, user segment, space segment, types of receivers, types of signals.

Applications of Remote sensing and GIS: Applications in land use land cover analysis, change detection, Road Planning ,water resources, urban planning, environmental planning, Natural resource management and Traffic management. Location Based Services And Its Applications.

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Course Outcomes:

Students will be able to

CO 1. To understand the fundamental Principal and component of remote sensing

CO 2. Describe the process of data acquisition of satellite images and their characteristics

CO 3. Explain the concepts and fundamentals of GIS

CO 4. Describe the fundamental elements of relational database management systems and access techniques

CO 5. Analysis of GPS equipment GIS & Remote Sensing and their application for solving problems of surveying, mapping in Civil engineering.

Text/Reference Books:

1. Remote Sensing and GIS Lillesand and Kiefer, John Willey 2008.
2. Remote Sensing and GIS B. Bhatta by Oxford Publishers 2015
3. Introduction to Geographic Information System – Kang-Tsung Chang, McGraw-Hill 2015
4. Concepts & Techniques of GIS by C. P. Lo Albert, K.W. Yonng, Prentice Hall (India) publication
5. Principals of Geo physical Information Systems – Peter A Burragh and Rachael A. Mc Donnell, Oxford Publishers 2004.
6. Basics of Remote sensing & GIS by S. Kumar, Laxmi Publications.
7. M. Anji reddy, “Remote Sensing and Geographical Information Systems”, 3rd Edition, B.S. Publications, 2006.
8. Bradford W. Parkinson & James Spilker., Global Positioning System: Theory and Applications, Vol I,1996

PEC – CE702	Marine Engineering	3L:0T:P (3hrs)	3 Credits

Objectives:

The objective of this course is to educate students about marine engineering, ship terms, movement of ships and the various materials used in ship building.

Module 1 **(10 Hrs)**

Introduction to ships & offshore structures: Characteristics of shipbuilding industry; Structural Requirement - Longitudinal strength, Transverse strength, Torsional strength, Local strength; Framing system / stiffening arrangement - Longitudinal framing, Transverse framing; Basic structural components – Stiffeners, Longitudinal, Transverse, Girders & Transverses, Hatch side girder, Hatch end beam, Stringers, Brackets.

Module 2 **(10 Hrs)**

Structural sub assemblies: Flat stiffened panel, Curved stiffened panel, Floors - Longitudinally framed, Transversely framed; Bulkheads - Transverse water tight bulkhead, Non water tight bulkheads, Flat stiffened bulkhead, Corrugated bulkhead, Decks & shells.

Module 3 **(10 Hrs)**

Bottom shell, Side shell, Inner bottom plating: Structural assemblies -Double bottom construction, Wing tanks & duct keels, Fore & Aft end construction, Mid ship sections of various ship types - General cargo carrier, Bulk carrier/OBO, Container ship, Oil tanker, RO-RO ship.

Module 4 **(10 Hrs)**

Structural alignment & continuity: Steel material preparation - Shot blasting, Acid pickling, Plate & Section forming - Mechanical methods, 3-point hydraulic press, Universal press, Line heating, Plate cutting – Mechanical, Thermal - Oxy-fuel, Plasma, Fusion Welding & Power Source, Welding parameters and their effects.

Module 5 **(10 Hrs)**

Fusion Welding Methods – MMAW, GMAW, GTAW, SAW, Electro slag Welding, Electro gas welding, Single side welding, Solid state welding - Friction stir welding, Welding distortions,

Distortion prevention, Distortion mitigation, Welding defects, Non destructive testing.

Course Outcomes:

CO1. To establish a basic understanding of various means of marine and study about different terminologies related to marine engineering and structures.

CO2. To understand structural sub assemblies used in marine engineering.

CO3. To know about the various construction & cargo carrier.

CO4. To understand the various structural alignment & wildings used in marine ship.

CO5. To understand various methods of welding & distortion prevention.

Text/Reference Books:

1. Ship Construction 6th Edition,by D.J. Eyres.
2. Aluminum Welding 2nd Edition Narosa Publishing House, New Delhi ,by N. R. Mandal.
3. Welding Techniques, Distortion Control and Line Heating. Narosa Publishing House, New Delhi, by N R Mandal.
4. Ship Design and Construction, Edited by: Robert Taggart, SNAME publication.
5. Ship construction- Edrich Fernands Publishers: Pro-Navigator books.
6. Notes on ship construction – Capt. Dara E. Driver By Rumar Publications.

OEC – CE701	Entrepreneurship	3L:0T:0P	3 credit

Objective:

To give an overview of who the entrepreneurs are and what competences are needed to become an Entrepreneur. The course aims to acquaint the students with challenges of starting new ventures and enable then to investigate, understand and internalize the process of setting up a business.

Module 1 **(10 Hrs)**

The Entrepreneurial Development Perspective: Entrepreneur–meaning, evolution, importance, Qualities, nature, types, traits. Entrepreneurship development - its importance, role of Entrepreneurship. Entrepreneurial environment, culture and stages in entrepreneurial process, changing dimensions in entrepreneurship– Digital entrepreneurship. EntrepreneurVs.Intrapreneur, EntrepreneurVs.Entrepreneurship, EntrepreneurVs.Manager

Module 2 **(10 Hrs)**

E-Cell: Meaning and concept of E-cells, advantages to join E-cell, significance of E-cell, various activities conducted by E-cell

Module 3 **(10 Hrs)**

Family Business Development: Family Business–meaning, characteristics, importance, types and models. Growing and evolving family business–Complexity of family enterprise. Diversity of successions: Different Dreams and challenges.

Module 4 **(10 Hrs)**

Micro, Small and Medium Enterprises: Concept, role and importance, MSME Policies governing SMEs-Steps in setting up a small Modules. SME funding-Requirements of capital (fixed and working), Factors determining capital requirements, Importance of fixed and working capital, Sources of finance for SMEs.

Module 5 **(10 Hrs)**

Business Organization: Introduction to various forms of business organization (sole proprietorship, partnership, corporations, Limited Liability Company), mission, vision and strategy formulation.

Course Outcomes:

Students will be able to

CO1. To understand basic knowledge of Entrepreneurship culture and stages in entrepreneurial process.

CO 2. To understand the concept of E –cell and there working system.

CO3. To understand the working models of family business development.

CO 4.To gain knowledge of MSME different policies for development of projects

CO 5. To get knowledge of various business origination

Text/Reference Books:

1. David H holt, "Entrepreneurship: New Venture Creation", Prentice Hall India Learning Private Limited., 1998.
2. Dr. Sucheta Gauba, "Entrepreneurship", Galgotia Publishing Company 2020.
3. Dr. Pradeep Kumar Mehta , Dr. (Mrs.) Meena Singh, "introductory microeconomics", Taxmann; 2nd Edition June 2017 .

OEC – CE701	Principles of Mgt& Managerial Economics	3L:0T:0P	3 credit

Objective:

Understand the variety of tools and techniques associated with productivity, economy, decision-making and project management.

Module 1

Management Concept: Management, Administration and Organization Difference and Relationship between Organization Management and Administration. Importance of Management, Characteristics of Management.

Module 2

Management: Scientific Management, Principles of Management, Process of Management, Functions of Management, Levels of Management, Project Management.

Module 3

Decision Making: Introduction and Definition, Types of Decisions, Techniques of Decision Making, Decision making under certainty Decision making under uncertainty, Decision Making under risk.

Module 4

Managerial Economics: Introduction, Factors Influencing Manager, Micro and Macro-economics, Theory of the Cost, Theory of the Firm, Theory of Production Function.

Module 5

Productivity: Input-Output Analysis, Micro-economics Applied to Plants and Industrial Undertakings, Production and Production system, Productivity, Factors affecting Productivity, Increasing Productivity of Resources.

Course Outcomes:

Students will be able to

CO1. Get information on a variety of concept, including management, administration and

organization.

CO2. Knowledge of science management.

CO3. learn how to make decisions in different circumstances.

CO4. Learn about the economic parameters.

CO5. Understanding resource productivity.

Principles of Management & Managerial Economics References:

1. Peter Drucker, Harper and Row: The Practice of Management.
2. Koontz: Essentials of Management, PHI Learning.
3. Staner: Management, PHI Learning.
4. Daft: Principles of Management, Cengage Learning.
5. T. N. Chhabra: Principle and Practice of Management, Dhanpat Rai, New Delhi.
6. Hirschey: Managerial Economics, Cengage Learning.
7. T. R. Banga and S.C. Sharma: Industrial Organisation and Engineering Economics, Khanna Publishers.
8. O.P. Khanna: Industrial Engineering and Management, Dhanpat Rai.
9. Joel Dean: Managerial Economics, PHI learning.
10. V. L. Mote, Samuel Paul and G.S. Gupta: Managerial Economics Concepts & Cases, TMH, New Delhi.
11. V. L. Mote: Managerial Economics, TMH, New Delhi.

(OEC – CE701)	Industrial Pollution Abatement	L:T:P (Hrs) 3:0:0	Credits: 3

Objective:

To understand the important issues and the abatement principles of industrial pollution.

MODULE 1 **(10 Hrs)**

Introduction and Impacts of Industrial activities: Industrial pollution, Causes of industrial pollution, Major polluting Industrial sectors, Different types of pollution generated due to industries with examples, air pollution, water pollution, soil pollution, noise pollution etc. Different types of wastes generated in an industry. Major Concerns of Industrial pollution, Environmental Crisis due to Industrial development, Environmental Ethics, EIA, list of projects or activities requiring environmental clearance. Overview of environmental rules and regulations. Standards for ambient air, noise and effluents.

MODULE 2 **(10 Hrs)**

Environmental Quality Monitoring and Analysis: Chemicals of concern, Link between source/environment/receptor; Exposure; Health effects; Toxicology; Defining the need for fate and transport. Physical/ Chemical properties of interest, relevant properties for environmental fate and transport; Definition of Equilibrium – partition constants, solubility, vapor pressure, henry's constant, Koc, Kow etc. Equilibrium partitioning of chemicals between different phases of the environment. Parameters for environmental water/ air / soil / sediment – screening parameters, priority air pollutants. Monitoring of environmental parameters – screening parameters – BOD, COD, TOC, TDS; Environmental sampling – definition and synthesis of a monitoring/sampling/analysis method. Quality Assurance and quality control (QA/QC). Chemical Exchange between air-water, sediment-water, soil-air. Dilution and Dispersion of pollutants, Overall transport model and scenarios.

MODULE 3 **(10 Hrs)**

Industrial Water Pollution Abatement: Water Pollution: Identification, quantification and analysis of wastewater, Industrial waste water management processes including physical processes, chemical processes, and biological processes, Stages and Modules of wastewater treatment like equalization, neutralization, physical, chemical, physico-chemical and biochemical techniques, coagulation and flocculation, Disinfection, Different Module operations and Module processes involved in conversion of polluted water to

potable standards. Design of Effluent treatment plant (ETP), Specific industrial ETP designs examples like paper and pulp industry, diary industry, pharmaceuticals industry, textile industry, sugar mills etc. Water pollution controls by different membrane based technologies, Concept of water recycling and reuse, environmental benefits of water recycling, uses of recycled water, water quality criteria.

MODULE 4 (**10 Hrs)**

Industrial Air & Noise Pollution Abatement: Air Pollution: Industrial air pollution characterization and treatment techniques, Description of stack monitoring kit and high volume sampler, Atmospheric dispersion of air pollutants, Gaussian model for prediction of concentration of pollutant down wind direction, Plume and its behavior, Operating principles and simple design calculations of particulate control devices, Brief concepts of control of gaseous emissions by absorption, adsorption, chemical transformation and combustion. Noise pollution: Source, Health effect, Characterization and control measures.

MODULE 5 **(10 Hrs)**

Industrial Solid Waste Abatement: Solid Wastes: Types of wastes from industries, Analysis and quantification of hazardous and non-hazardous wastes, Standard processes for managing wastes: Treatment and disposal of solid wastes, Land filling, Leachate treatment, Incineration. Introduction to industrial ecology and energy production from wastes by incineration, gasification, pyrolysis, waste plastics, organic wastes and algal biomass. Integrated solid waste management including 4 R's: Reduce, Recycle, Rebuy and Reuse, Concept of Extended Producer Responsibility.

Course Outcome:

CO1: Introduction to basic types of industrial pollution and its environmental impacts.

CO2: To provide knowledge regarding quantification and analysis of pollution load; fate and transport of pollutants in environment.

CO3: To develop skills relevant for suitable treatment for industrial wastewaters.

CO4: Knowledge of how to control industrial air and noise pollution.

CO5: To analyze the characteristics of solid wastes generated by industries and its integrated management by utilizing them for energy generation.

Text/Reference Books:

1. Metcalf & Eddy, Wastewater Engineering, Tata McGraw-Hill Education Private Limited (2009).
2. Rao, C.S., Environmental Pollution Control Engineering, Wiley Eastern (2010).
3. Masters, G.M., Introduction to Environmental Engineering and Science, Prentice Hall off India, (2008)
4. De Nevers, N., Air Pollution Control Engineering, McGraw-Hill (2000).
5. Garg, S.K., "Sewage disposal and Air Pollution Engineering", Khanna publishers, Delhi
6. Bhatia, S.C., "Environmental Pollution and Control in Chemical Process Industries," Khanna Publishers, Delhi
7. Modi, P. N., "Sewage Treatment and Disposal and Waste Water Engineering," Vol. II, Standard Book House, Delhi
8. Peavy, H. S., Rowe, D. R., Tchobanoglous, G., "Environmental Engineering"; McGraw Hill.
9. De A.K., Environmental Chemistry, Wiley Eastern Ltd