

Course code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	Credits C
			L	T	P				
2065701	HSMC	Industrial Management and Entrepreneurship	2	1	-	30	70	100	3
Professional Elective – III									
2065702A	PEC	Hydraulic Structures							
2065702B		Air pollution and control							
2065702C		Construction Methods and Equipments	3	-	-	30	70	100	3
2065702D		Project Planning and Management							
Professional Elective – IV									
2065703A	PEC	Building Services and Maintenance							
2065703B		Airport Planning and Design	3	-	-	30	70	100	3
2065703C		Earth Retaining Structures							
2065703D		Irrigation Engineering							
Professional Elective – V									
2065704A	PEC	Industrial waste treatment							
2065704B		Pavement management Systems	3	-	-	30	70	100	3
2065704C		Design of formwork and construction safety							
2065704D		Rock Mechanics							
2065707	PROJ	Industrial Internship evaluation (done after 6th sem)	-	-	-	50	50	100	3
2065708	OEC	Open Elective-III Disaster Management	2	0	-	30	70	100	3
2065709	SC	Skill Course 5: BIM	0	0	4	50	50	100	2
20657010	OEC	Open Elective-IV Interior Design	2	0	-	30	70	100	3
Total Credits									23

INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

Course Objectives:

The objective of this course is to:

Collect and analyse data to assess the attractiveness of new business opportunities in regards to the market, the industry, and the team.

Course Outcomes:

At the end of the Course, the Student will be able to:

1. Evaluation of economic condition and relating them to financial decision in the organization
2. understand the characterizes an attractive business opportunity and common pitfalls during the entrepreneurial process
3. Demonstrate the ability to carry out a market research projects
4. understand the nature of entrepreneurship
5. explore entrepreneurial leadership and management style

SYLLABUS

Unit-I

Basic Concepts of Management: Definition, Nature and Importance; Functions of the Management; Levels of Management; F.W Taylor's Scientific Management; Henry Fayol's Principles of Management;

Unit-II

Forms of Business Organizations-Sole Partnership, Joint Stock Company-private Limited and Public Limited company, Public enterprises and their types.

Unit-III

Operations Management: Plant Location– Factors to be considered in the Selection of Plant Location; Break-even Analysis– Significance and Managerial Applications; Importance of Production Planning and Control and its Functions; Human Resource Management and Functions of Human Resource Manager (in brief); Functions of Marketing; Methods of Raising Finance.

Unit-IV

Entrepreneurship: Definition, Characteristics and Skills, Types of Entrepreneurs, Entrepreneur vs. Professional Managers, Growth of Entrepreneurs, Nature and Importance of Entrepreneurs, Women Entrepreneurs, Problems of Entrepreneurship.

Unit-V

Entrepreneurial Development, Institutions in aid of Entrepreneurship Development, DIC, IDBI, ICICI, SIDB, SISI for starting a Small Enterprise – Incentives for Small Scale Industries by Government.

Text Books

1. Industrial Organization and Engineering Economics by T.R.Banga and S.C.Sharma , Khanna Publishers.

2. *The Dynamics of Entrepreneurial Development and Management (Planning for future Sustainable growth)* by Vasant Desai, Himalayan Publishing House.

Reference Books

1. *Management Science* by A.R.Aryasri, McGraw-Hill Education (India Private Limited).
2. *Entrepreneurship*, P.Sheela and K.Jagadeswara Rao, Shree Publishing House

HYDRAULIC STRUCTURES

Subject code: 1965603	Credits : 3
Instruction : : 2 Lecture & 1 Tutorial /week	Sessional Marks : 30
End Exam : 3 Hours	End Exam Marks : 70

Course Objectives:

The objective of this course is to:

1. Introduce students to the structure of the dams, earth dam, canals, and spillways and cross drainage works.
2. Develop design the principle of Sarda type, trapezoidal notch, straight glacis fall.
3. Necessity and importance of diversion, storage head works, weir and barrages.
4. Understand the different river training works and Water power engineering.

Course Outcomes:

At the end of this course student will be able to:

1. Create a new technology for construction of dams, it can also deal the causes of failure of the dams.
2. Demonstrate the Essential requirements of Spillway and design of Spillways.
3. Demonstrate Diversion Head Works and its application, which have designed in the all cases.
4. Explain the types of canal, distributaries, canal head works, cross-drainage and canal regulator works.
5. Explain different river training works and Water power engineering

UNIT-I

Storage Works: Classification of dams, Factors governing selection of types of dam, Selection of site, Preliminary investigation.

Gravity Dams: Forces acting on a gravity dam, Stability criteria, Modes of failure – Elementary and Practical Profiles, Stability analysis, Principal and shear stress – Construction joints, Openings in dams-Galleries, Foundation treatment of gravity dam.

UNIT-II

Earth Dams: Types, Foundation for earth dams, design of earth dams, Causes for failure of earth dams, Criteria For safe design, phreatic line, Seepage analysis – Seepage control through body and foundation.

Spillways: Essential requirements, Spillway capacity, Components, Types of spillways and their working. Spillway crest gates – Different types.

UNIT-III

Diversion Head Works: Types, Location and components, effects of construction of weirs on permeable Foundation, Bligh's, Lanes and Khosla's theories, Design of vertical drop weir, Silt control devices.

River Training Works: River Training and its objectives, Classification of river training works, Marginal embankment, Guide banks, Groynes, cutoffs, Bank pitching, Launching aprons, Miscellaneous types of river training works.

UNIT-IV

Regulation Works: Canal falls – Definition, Necessity and location, Classification of falls, Design principles of syphon well drop, Notch fall, Sarada fall, Straight glacis fall; Cross regulator and Distributary head regulator

Cross Drainage Works: Types, Factors affecting the suitability of each types, Classification of aqueducts, Design principles of different types of aqueducts.

UNIT-V

Water Power engineering: Development of hydro power in India, Assessment of available power, Utilization factor, Load factor, Diversity factor, Storage and Pondage; Types of hydro power schemes; Components of hydel schemes – Fore bay, Intake structure, Trash racks, Surge tanks; Water hammer pressure, Substructure and Superstructure of power house.

TEXT BOOKS

1. Punmia, B.C. and Lal Pande B.B. (1992), "Irrigation and Water Power Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 12th edition.
2. Garg, S.K. (1999), Irrigation Engineering and Hydrology Structures, Khanna Publishers, Delhi, 14th Edition.

REFERENCES

1. K.R.Arora, "Irrigation, Water Power and Water Resources Engineering", Standard

- Publishers Distributors, 2010, 3rd Edition.
2. Varshney R.S., S. C. Gupta & R.L. Gupta, "Theory and Design of Hydraulic structures", Nemchand and Brothers, 1992, 2nd Edition.
 3. Satyanarayana Murthy C, "Water Resources Engineering", New Age International Pvt. Ltd. Publishers, 1997, 1st Edition.

AIR POLLUTION AND CONTROL

Subject code: 1965604 C	Credits : 3
Instruction : 3 Lecture /week	Sessional Marks : 30
End Exam : 3 Hours	End Exam Marks : 70

Course Objectives

1. The Course Objectives of this course are:
2. To create awareness about air pollution and its magnitude
3. To emphasize environmental implications of air pollution on all life forms
4. To enhance knowledge on air emission monitoring and control

Course Outcomes

At the end of the course the student should be able to:

1. Define Air Pollution, sources, effects and explain factors influencing air pollution
2. Explain wind effects and estimate pollutants and their behavior
3. Demonstrate knowledge on air pollution effects on life forms and implications of episodes.
4. Apply knowledge of air emissions on monitoring processes
5. Apply knowledge of monitoring equipment in control, reduce and remove air pollutants

UNIT I

Definition of Air Pollution

Air Pollution and its definition – Sources of pollution - Classification of pollutant particulates - Factors influencing air pollution – Location of Industries and Air pollution effects on all life forms.

UNIT II

Spread of Air Pollution

Meteorology – Wind roses – lapses rates – mixing depth atmospheric dispersion – plume behavior accumulation - estimation of pollutants – Effective stack height.

UNIT III

Effects of Air pollution on life forms

Air Pollution effects on human beings, animals, plants and materials – Air Pollution Episodes in India and abroad.

UNIT IV

Air Pollution Monitoring

Need for Air Monitoring - Air emissions and types, Air qualities standards, Ambient air quality monitoring and stack monitoring.

UNIT V

Control of air pollution

Removal of pollutants – particulate and gaseous – Air pollution control equipment such as settling chamber, cyclones, wet scrubbers/collectors, scrubbers, centrifugal scrubbers spray towers, packed beds, electrostatic precipitators, after burners- absorption – adsorption – Diffusion.

Text Books:

1. M N Rao and HVN Rao, Air Pollution McGraw Hill Education, First Edition 2018.
2. Santosh Kumar Garg, Sewage Disposal and Air Pollution Engineering, Revised 33rd Edition Khanna Publishers, 2015

Reference:

1. K.V.S.G. Murali Krishna, Air Pollution Control, Lakshmi Publications, First Edition
2. B.S.N. Raju, Fundamentals of Air Pollution, First Edition, Oxford & I.B.H.
3. T. Shivaji Rao, Elements of Air Pollution and its control., Visalandhra Publishers, Hyderabad.

CONSTRUCTION EQUIPMENT AND METHODS

Construction Equipment:

Introduction, significance of equipment in construction industry - laboratory setting including plan reading, specification reading, construction scheduling and estimating, Job layout and its importance.

Construction Equipment Management:

Equipment Management- Introduction, Differences between men and manpower, Extent of Mechanisation, Equipment planning, Selection of equipment, Forward planning, Purchase of Equipment, Specifications for ordering equipment.

Maintenance Management – Introduction, Objectives, Functions, Maintenance planning, Maintenance control, Types of maintenance.

Equipment cost – Operating cost – Cost Control of Equipment - Depreciation Analysis –

1. Replacement of Equipment- Replacement Analysis - Safety Management.

Equipment for Earthwork:

Fundamentals of Earth Work Operations - Earth Moving Operations - Types of Earth Work Equipment –Excavation equipment- Power Shovels, Back Hoe, Drag line, Clamshell – Excavating and Earth Moving Equipment – Scrapers, Bull Dozers, Tractors, Hauling Equipment – Dump trucks, Dumpers Loaders, trucks, Earth Compaction Equipment-Tamping Rollers, Smooth Wheel Rollers, Sheepsfoot Roller, Pneumatic-tyred Roller, Vibrating Compactors, Vibrocompaction methods.

Other Construction Equipment:

Pile driving Equipment - Erection Equipment – Cranes, Derrick Cranes, Mobile cranes, Overhead cranes, Traveller cranes, Tower cranes - Types of pumps used in Construction -

1. Grouting - Material Handling Conveyors –Industrial Trucks, Forklifts and related equipment .

Equipment for Concrete and Road laying:

Aggregate production equipment- Different Crushers – Feeders - Screening Equipment - Handling Equipment - Batching and Aggregate Mixing Equipment - Asphalt Plant, Asphalt Pavers, Asphalt compacting Equipment – Ready mix concrete equipment, Concrete mixers, Concrete batching and mixing plant, Transportation of concrete mix, Concrete pouring and pumps, concrete compaction equipment.

Text Books

1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods", McGraw Hill, Singapore, 2006.

2. Sharma S.C. "Construction Equipment and Management", Khanna Publishers, New Delhi, 1988.

Reference Books

1. Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers, New Delhi, 1988.

2. Dr.MaheshVarma, "Construction Equipment and its planning and Application", Metropolitan

1. Book Company, New Delhi. 1983.

PROJECT PLANNING AND MANAGEMENT

Course Objectives:

1. Importance of project management in civil engineering projects
2. Role and responsibilities of a project manager in construction.
3. Management of resources in construction industry.
4. Understand labour problems in construction and legislation in India

Course Outcomes

1. Extend the planning, scheduling & controlling of a project.
2. Categorize and Compare direct & indirect cost, operation time, process of updating of project.
3. Illustrate the importance of contract types, process of bidding.
4. Identify to manage the work, scope in constructions & quality of project manager
5. Prioritize the different Acts, , Minimum Wages Act 2022.

UNIT 1: PERT and CPM : Introduction to PERT and CPM, Planning, Scheduling and controlling , Bar charts, Milestone charts, weaknesses in Bar charts, PERT and CPM networks – Comparison, Event, Activity, Rules for drawing networks, Numbering the events (Fulkerson's law : Dummy activities, Time estimate-Expected time, Earliest allowable occurrence time, Latest allowable occurrence time, slack, project duration, probability of completion, Start and Finish time estimates, Floats, Project scheduling, Critical and sub-critical path.

UNIT 2: Cost analysis / updating / resource scheduling: Cost Analysis, operation time, Normal and crash points, optimizing project cost, crash limit, free float limit, Optimization.

Updating – Process of updating; when to update, Resource scheduling – Resource smoothening. Resource levelling.

UNIT 3: Contracts: Element of contract, offer acceptance and consideration, valid contract, Department execution of works, Master Roll Form 21, work order; Contract system with tenders – Definitions – Contract, Contractor, Quotation, Earnest money, Security money, Tender, Tender notice, Tender form, Bidding procedure, Irregularities in Bidding, award, Types of contracts, Arbitration Disputes and claim settlement.

UNIT 4: Management – Scope of the Construction Management, Significance of Construction Management, Concept of Scientific Management, Qualities of Manager. Organization – Authority, Policy, Recruitment process and Training Development of Personnel Department.

UNIT 5: Labour problems, Labour legislation in India, Subsequent amendments, Minimum Wages Act 2022.

TEXT BOOKS:

1. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.

2. PERT and CPM – L. S. Srinath.

References:

1. Estimating and Costing – B.N. Dutta. CBS Publishers and Distribution private limited. 2016

2. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006

3. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015

BUILDING SERVICES AND MAINTANANCE

Course Objectives

The Course Objectives of this course are:

1. Create awareness to students about building services
2. Relate towards comfort, convenience and safety in buildings
3. Orient knowledge towards environmental concerns due to building services

Course Outcomes

At the end of the course the student should be able to

CO1 Describe various building services

CO2 Identify plumbing services

CO3 Recognize the basics of electrical systems and safety concerns

CO4 Explain concepts of HVAC

CO5 Classify the environmental impacts of buildings

UNIT I

INTRODUCTION

Buildings and types, different services for safety and comfort - Electric power, lighting, plumbing, security systems, fire safety, and heating, ventilation and AC. Mechanical, Electrical and Plumbing Resources and machinery used in distribution and disposal.

UNIT II

PLUMBING SERVICES

Introduction to Water supply systems, sewerage, drainage, plumbing related to roofs, piped Gas supply, mechanical systems- types of hot water boilers, water storage tanks and pipeline materials, garbage collection and disposal.

UNIT III

ELECTRICAL SERVICES

Basics of Electricity-, Lighting, protective devices in lighting installations, Earthing and types of Earthing, types of wires, principles for planning electrical lines in buildings, transformers and fire safety.

UNIT IV

HEATING, VENTILATION AND AC (HVAC)

Heat transfer between outside and inside buildings, Comfort conditions, Air Handling Units, Air conditioning systems for different types of buildings, ventilation systems and fire safety.

UNIT V

GREEN BUILDINGS AND SUSTAINABILITY

Effects of building services on the environment- greenhouse emissions, resource depletion, energy usage, waste management. Services emphasis on Green Buildings, renewable energy, low carbon technologies, reducing building footprint, Net Zero concepts and various Fire safety systems design.

TEXTBOOKS

1. A text book on Building Services R. Udaykumar Eswar Press, Chennai
2. Building Services S. M. Patil Seema Publication, Mumbai Revised edition
3. Water Supply and Sanitary Engineering by Rangwala
4. Basic Refrigeration and Air Conditioning by Ananthanarayanan
5. Green buildings- www.igbc.in rating system

CODES FOR REFERENCE

National Building Code, 2016

Energy Conservation and Building Code 2017

Airport planning and Design

Course Learning Objectives:

The objective of this course is to:

1. To know about characteristics of airport and aircraft
2. Can be able to design runway based site conditions
3. Can design all component parts of airport
4. To know about air traffic control

Course Outcomes:

At the end of the Course, the Student will be able to:

1. The requirements and characteristics of aircraft
2. Classify airport obstructions.
3. Fix the orientation of the runways
4. Carryout the geometrical design of the airport infrastructure
5. Summarize air traffic control.

Air transport: History of Air transport, structure and organization of air transport, National Airports Authority, Airports Authority of India, International Civil Aviation Organization.

UNIT-I

Airport characteristics: Requirements of aircraft types, weight components, Aeroplane component parts, classification of flying activity, Aircraft characteristics.

UNIT-II

Airport planning: Airport master plan, Regional planning, Airport site selection, Estimation of future air traffic needs. Airport obstructions: Zoning laws, classification of obstructions.

UNIT-III

Runway design: Runway orientation, Basic runway length, Corrections, Airport classification, Runway Geometry Design. Airport Capacity & Configuration, Runway intersection design,

UNIT-IV

Taxiway design: Geometric design standards, exit taxiways, Holding aprons.

Terminal area & airport layout: Building area, Terminal area, Apron, Hangar, Typical Airport Layouts. Visual aids: Airport marking, Airport lighting

UNIT-V

Air traffic control: Need of air traffic control Air traffic control network, Air traffic control Aids– Enroute Aids & Landing Aids, Instrumental Landing System

Text books:

[1. Airport planning and design by S.K. Khanna, M.G. Arora, S.S. Jain](#)

[2. Airport engineering by Rangwala](#)

Reference:

[1. Planning and Design of Airport by Asheesh Kumar](#)

Earth Retaining Structures

Pre-requisites: Engineering Mechanics, Geotechnical Engineering.

Course Learning Objectives:

The objective of this course is to:

1. Provide civil engineering students with a basic knowledge of earth pressure theories.
2. Ability to understand different design principles of retaining structures.
3. Ability to understand design of sheet pile walls.
4. Ability to know the importance cellular coffer dams and braced cuts.

Course Outcomes: At the end of the Course, the Student will be able to:

1. Able to recognize different earth pressures and solve the problems accordingly.
2. Able to analyze design principles of retaining structures.
3. Able to understand design of sheet pile walls.
4. Able to understand the importance braced cuts.
5. Able to understand the importance cellular coffer

SYLLABUS:

UNIT I: Earth Pressure: Basic concepts, Rankine and Coulomb earth pressure theories, Determination of active and passive pressures: Culmann's Graphical method, logarithmic spiral methods, friction circle method. Consideration of surcharge, seepage, earth quack, wave effect, stratification, type of backfill, wall friction and adhesion.

UNIT II: Retaining structures: Uses, types, stability and design principles of retaining walls, backfill drainage, settlement and tilting.

UNIT III: Sheet Pile Walls: Types, Design of cantilever sheet pile walls in granular and Cohesive soils; Design of anchored sheet pile walls by free and fixed earth support methods, Rowe's theory of moment Reduction, Design of anchors.

UNIT IV: Braced excavations: Types of sheeting and Bracing systems, lateral earth pressure on sheeting in sand and clay, Design components of braced cuts.

UNIT V: Cellular cofferdams: Types – Diaphragm and Circular type, Design by TVA method. Stability of cellular cofferdams, cellular cofferdams in rocks and soils.

TEXT BOOKS:

1. Foundation design by W. C. Teng, Prentice Hall
2. Basic & Applied Soil Mechanics by Gopal Rajan & A.S.R.Rao, New Age International Publishers.

Reference books:

1. Soil Mechanics in Engineering Practice by K.Terzaghi and R.B. Peck, John Wiley & Sons.

2. Foundation Analysis & Design by J.E. Bowles, Mc Graw-Hill Publishing Co.
3. Terzaghi. K. and Peck R. B. Soil mechanics in engineering and practice 2nd edition, John Wiley 1968.

IRRIGATION ENGINEERING

COURSE OBJECTIVE:

1. Familiarize on the concept of Irrigation in Agriculture.
2. Explain the principles Soil Water Potential relationship
3. Infer on water harvesting and explain Watershed management
4. Describe Surface Irrigation Methods
5. Discuss Irrigation Water Quality

COURSE OUTCOMES:

1. Understand the concept of Water Resources of India
2. Explain Soil Water Plant Relationship
3. Demonstrate Irrigation Requirement and Irrigation Scheduling
4. Describe Combined irrigation and drainage systems
5. Summarize Water quality for irrigation

UNIT-I

Development Of Irrigation : Water Resources of India - Importance of Irrigation in Agriculture - Historical evolution of irrigation in India – Irrigation development during pre-colonisation – Colonisation and post-colonization - National Water Policy- Inadequacy of Irrigation Management- Criteria for good Irrigation management.

UNIT-II

Soil Water Plant Relationship : Soil physical properties influencing Soil-water relationship- Forms and occurrence of Soil Water- Classification of Soil Water- Soil Water Constants- Energy concept of Soil Water-Forces acting on Soil Water- Soil Water Potential concept- Soil Water retention- Soil Moisture Measurement.

UNIT-III

Crop Water Requirement: Water requirement of crops- Evapotranspiration and Consumptive use- Methods of estimating Evapotranspiration- Effective Rainfall- Irrigation Requirement-Duty of Water- Irrigation Efficiencies- Irrigation Scheduling- Irrigation measurement.

UNIT-IV

Surface Irrigation Methods: Canal network and canal design- Surface irrigation methods- Types- Border irrigation, Furrow irrigation and Strip irrigation- Specifications, Hydraulics and Design.

Drip And Sprinkler Irrigation Method: Sprinkler and Drip- History and development, Types, Components, Design and Layout, Operation and Maintenance.

Drainage Principles And Criteria : Factors to be considered in land drainage – Combined irrigation and drainage systems - Water balance – Equations for water balance – Drainage surveys – Agricultural drainage criteria .

UNIT-V

Irrigation Water Quality: Water quality for irrigation – Salinity and permeability problem – Root zone salinity - Irrigation practices for poor quality water – Saline water irrigation – Future strategies

TEXT BOOKS

1. Asawa, G.L., "Irrigation Engineering", New Age International Publishers, 2000
2. Punima B.C. & Pande B.B .Lal Irrigation and Water Power Engineering, Laxmi Publishing , New Delhi 2007

References

1. Michael, A.M, Irrigation Theory and Practical, Vikas Publishing Pvt Ltd, 2006
2. Gupta, B.L, & Amir Gupta, "Irrigation Engineering", Satya Praheshan, New Delhi

INDUSTRIAL WASTE TREATMENT

Course Learning Objectives:

The objective of this course is to:

1. Distinguish between the quality of domestic and industrial water requirements and Wastewater quantity generation.
2. Understand the industrial process, water utilization and wastewater generation.
3. Impart knowledge on selection of treatment methods for industrial wastewater.
4. Acquire the knowledge on operational problems of common effluent treatment plants.
5. Gain knowledge on different techniques and approaches for minimizing the generation and application of Physio chemical and biological treatment methods for recovery, reuse and disposal of industrial wastewater.

Course Outcomes:

At the end of this course student will be able to:

1. Summarize characteristics of wastewater.
2. Define Principles of biological waste treatment

3. Design and working principle of various treatment methods
4. Apply Environmental Management Systems to an industrial activity.
5. Propose treatment and disposal of the industrial wastewater.

SYLLABUS

UNIT-I

Characteristics of waste water of specific industries, characteristics of treatment plant effluents
Effect of waste water on self-purification capacity of streams, Primary treatment of waste water.

UNIT-II

Principles of biological waste treatment; Microbiological growth rate kinetic equations, sludge production, oxygen requirements, continuous flow treatment models. Aerobic treatment studies in continuous and semi-continuous reactors. Anaerobic treatment, studies, Nitrogen and Phosphorus removal.

UNIT-III

Biological treatment facilities : Process designs of the following units w.r.t. Industrial Wastes; Activated sludge process; trickling filter; sludge digestion units; Aerated lagoons; Stabilization ponds (oxidation ponds); oxidation ditches (Paver ditches); Rotating Biological contactor; Anaerobic filter.

UNIT-IV

Principles of Industrial waste Treatment: Waste reduction pretreatment of wastes, collection and segregation of wastes, reduction in volume and strength neutralization; equalization; proportioning.

UNIT-V

Manufacturing processes, flowsheets; Characteristics and treatment of wastes and disposal methods of the following industries – Sugar, Dairy, Distillery, Paper, Tannery, Textile, Sheet, and Oil refinery.

TEXT BOOKS

1. M.N. Rao and A. K. Datta (2020), “Waste Water Treatment”, Oxford & IBH publishing, 3rd edition.
2. A.D. Patwardhan (2017), “Industrial Waste Water Treatment”, PHI Learning, 2nd edition.

REFERENCES

1. G.L.Karia and R.A.Christian (2013), “Waste Water Treatment”, PHI Learning, 2nd edition.
2. Dr. Ahmed Ashfaq (2013), “Industrial Waste Water Treatment Technology”, S.K.Kataraja & Sons, 14th edition.

PAVEMENT MANAGEMENT SYSTEMS

Course Learning Objectives

1. To study about the types and components of pavements
2. To learn about the stresses in flexible pavements and equivalent single wheel load
3. To study the design of flexible pavements
4. To learn about the stresses in rigid pavements
5. To study the design of rigid pavements

Course content

UNIT-I

Pavements - Types and Components - Factors affecting Design and Performance of Pavements, Comparison between Highway and Airport pavements - Functions and Significance of Sub grade properties.

UNIT-II

Stresses in Flexible Pavements - Stresses and Deflections in Homogeneous Masses - Burmister's 2-layer, 3-layer Theories - Wheel Load Stresses, ESWL of Multiple Wheels, Repeated Loads and EWL factors.

UNIT-III

Flexible Pavement Design - Empirical - Semi-empirical and Theoretical Approaches; Principles and procedure, Design, Advantages and applications of different Pavement Design Methods – IRC Method of Design.

UNIT-IV

Stresses in Rigid Pavements - Types of Stresses and Causes - Factors influencing the Stresses, General conditions in Rigid Pavement Analysis, ESWL, Wheel Load Stresses, Warping Stresses, Friction Stresses, Combined Stresses.

UNIT-V

Rigid Pavement Design - Types of Joints in Cement Concrete Pavements and their Functions, Joint Spacing, Design of Slab Thickness, Design of Joint Details for Longitudinal Joints, Contraction Joints and Expansion Joints, IRC Method of Design.

References

- 1) Highway Engineering by Khanna & Justo.
- 2) Highway Engineering by Sharma & Sharma.
3. *IRC: 37 - 2012, Guidelines for the Design of Flexible Pavements*
4. *IRC: 58 - 2011, Guidelines for the Design of Plain Jointed Rigid Pavements for Highways*

DESIGN OF FORMWORK AND CONSTRUCTION SAFETY

UNIT I PLANNING, SITE EQUIPMENT & PLANT FOR FORM WORK

Introduction - Forms for foundations, columns, beams walls etc., General objectives of formwork building - Planning for safety - Development of a Basic System - Key Areas of cost reduction - Planning examples. Overall Planning - Detailed planning - Standard units - Corner units - Pass units - Calculation of labour constants - Formwork hours - Labour Requirement - Overall programme - Detailed programme - Costing - Planning crane arrangements - Site layout plan - Transporting plant - Formwork beams - Scaffold frames - Framed panel formwork - Formwork accessories.

UNIT II MATERIALS ACCESSORIES PROPRIETARY PRODUCTS Lumber - Types - Finish - Sheathing boards working stresses - Repetitive member stress - Plywood - Types and grades - Jointing Boarding - Textured surfaces and strength - Reconstituted wood - Steel - Aluminum - Hardware and fasteners - Nails in Plywood - Allowable withdrawal load and lateral load. Pressures on formwork - Examples - Vertical loads for design of slab forms - Uplift on shores - Laterals loads on slabs and walls.

UNIT III DESIGN OF FORMS AND SHORES

Basic simplification - Beam formulae - Allowable stresses - Deflection, Bending - Lateral stability - Shear, Bearing - Design of Wall forms - Slab forms - Beam forms - Column forms - Examples in each. Simple wood stresses - Slenderness ratio - Allowable load vs length behaviour of wood shores - Form lining Design Tables for Wall formwork - Slab Formwork - Column Formwork - Slab props - Stacking Towers - Free standing and restrained - Rosett Shoring - Shoring Tower - Heavy Duty props.

UNIT IV BUILDING AND ERECTING THE FORM WORK

Carpentry Shop and job mill - Forms for Footings - Wall footings - Column footings - Sloped footing forms - Strap footing - Stepped footing - Slab form systems - Sky deck and Multiflex - Customized slab table - Standard Table module forms - Swivel head and uniportal head - Assembly sequence - Cycling with lifting fork - Moving with table trolley and table prop. Various causes of failures - ACI - Design deficiencies - Permitted and gradual irregularities.

UNIT V FORMS FOR DOMES AND TUNNELS, SLIP FORMS AND SCAFFOLDS

Hemispherical, Parabolic, Translational shells - Typical barrel vaults Folded plate roof details - Forms for Thin Shell roof slabs design considerations - Building the forms - Placing concrete - Form removed -Strength requirements -Tunnel forming components - Curb forms invert forms - Arch forms - Concrete placement methods - Cut and cover construction - Bulk head method - Pressures on tunnels - Continuous Advancing Slope method - Form construction - Shafts. Slip Forms - Principles -Types - advantages - Functions of various components - Planning -Desirable characteristics of concrete - Common problems faced - Safety in slip forms special structures built with slip form Technique - Types of scaffolds - Putlog and independent scaffold -Single pole scaffolds - Truss suspended - Gantry and system scaffolds.

REFERENCES:

1. Austin, C.K., Formwork for Concrete, Cleaver -Hume Press Ltd., London, 1996.
2. Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 1996
3. Michael P. Hurst, Construction Press, London and New York, 2003.
4. Robert L. Peurifoy and Garold D. Oberlender, Formwork For Concrete Structures, McGraw - Hill , 1996.

ROCK MECHANICS

Pre-requisites: Engineering Geology, Geotechnical engineering, Foundation engineering

Course Objectives:

1. Classify the different rocks based on their properties.

2. Understand the different geo physical methods of rocks.
3. Classify the laboratory methods for different properties of rocks.
4. Utilization of the insitu testing methods.
5. Understand the various rock improvement techniques.

Course Outcomes:

At the end of the Course, the Student will be able to:

1. Classify rocks according to their properties.
2. Discuss different Geophysical methods of rocks.
3. Analyze permeability, physical and mechanical properties of rock using rock testing procedures.
4. Demonstrate in situ testing of rocks.
5. Understand the various improvement techniques for rock.

UNIT I

Introduction to Rock Mechanics

Geological formation of rocks, Structural Geology, classification of rocks, Defects in rock.

UNIT II

Methods of Rock Exploration

Introduction, methods of rock exploration, methods of geophysical prospecting- seismic methods, Gravity method, Magnetic methods. Exploration techniques – RQD and RMR,

UNIT III

Physical, Mechanical Properties of Rocks

Introduction, permeability, swelling, durability, strength- classification of strength- compressive strength and tensile strength. Laboratory tests for shear strength, tensile strength, flexural strength, elastic constants, Field tests– test for deformability, shear tests and strength tests.

UNIT IV

In-Situ Tests

Necessity of In-situ tests, Field tests– test for deformability, shear tests and strength tests.

UNIT V

Improvement Techniques for Rock

Grouting, Rock bolting, Rock reinforcement - Mechanism, types of reinforcement, steps involved in installation, Foundations on rock, Rock blasting explosives, Selection criteria for explosives, steps involved in blasting

TEXT BOOKS:

1. T. Ramamurthy “Engineering in Rocks for Slopes, Foundations and Tunnels”, 3rd Edition, PHI Learning Pvt. Ltd 2014.
2. R K Goel, Bhawani Singh “Engineering Rock Mass Classification Tunnelling, Foundations and Landslides “[Elsevier Science](#),2011.

REFERENCES:

1. Richard E. Goodman ,”Introduction to Rock Mechanics “Wiley India Pvt Ltd,2010.
2. Verma B.P, Rock mechanics for engineers, Khanna Publishers, 2nd Edition 1989, New Delhi.
3. Singh, B. and Goel, R. K. “Rock Mass Classification Systems – A Practical Approach in Civil Engineering “Elsevier Publisher.

OPEN ELECTIVE III(DISASTER MANAGEMENT)

UNIT-I: Concept of disaster management. Types of disasters. Disaster mitigating agencies and their organization structure at different levels. Overview of Disaster situations in India: Vulnerability profile of India and vulnerability mapping including disaster prone areas, communities and places.

UNIT-II: Disaster preparedness-ways and means; skills and strategies; rescue, relief, reconstruction and rehabilitation.

UNIT-III: Seismic vulnerability of urban areas. Seismic response of R.C frames buildings with soft first storey. Preparedness for natural disasters in urban in urban areas. Preparedness and planning for an urban earthquake

disaster. Urban settlements and natural hazards. Tsunami and its impact.

UNIT-IV: Landslide hazards zonation mapping and geo-environmental problems associates with the occurrence of landslides. A statistical approach to study landslides. Land causal factors in urban areas organization of mockdrills.

UNIT-V: Role of remote sensing, science & technology, Rehabilitation programmes, Management of Relief Camp, information systems & decision making tools, voluntary Agencies & community participation at various stages of disaster Management, School Awareness & Safety programme

OPEN ELECTIVE IV INTERIOR DESIGN

UNIT I: Introduction

Introduction to Design, meaning and importance. Fundamental elements of design: Point, line, shape, form, space, texture, value, color and material, Application of elements to create unity, balance, symmetry proportion, scale, hierarchy, rhythm, contrast, harmony, focus, use of grids, creating repetitive patterns.

UNIT II: Anthropometry

Anthropometric data of human beings for various actions; Rooms and functional design; Principles of design in 2- D and 3-D; Basic sketching skills

UNIT III: Interior Elements

Basic standards of circulation; Furniture involving human activities in residential buildings,

Public and institutional buildings; Design of Flooring, Walls, Ceilings, Doors and windows, Furniture, Lighting; Various materials used for interior elements- Masonry, Timber, cane, bamboo, Wood, Paints, Varnishes

UNIT IV: Services

Importance of lighting in interiors, Methods and types of lighting, lighting fixtures; Plumbing services inside buildings- layout, fixtures; Climatic Design and Air Conditioning.

UNIT V: Aesthetics and communication

Modern and Contemporary Interior design; Changing user preferences; Communication and presentation to clients; Simple drawing exercise to design one interior layout.

References:

1. Interior design: an introduction to Architectural interiors – Friedmann, Arnold and others, Elsevier, New York
2. Basic Drafting for Interior designers – Miller. E. Willam, Van Nostrand Reinhold, New York
3. Interior Architecture – Kurtich, John and Eakin, Garret, Van Nostrand Reinhold, New York

SKILL COURSE (BIM)

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