Jharkhand University of Technology, Ranchi
NEP-2020 based Syllabus w.e.f – 2025-26 batch
B.Tech in Civil Engineering

Semester- VIIth

S.No.	Course Code	Course Title	L	T	P	J	Cr	FM	Overall Pass Marks	Internal	External	Categorization
			Contact Hours per week									
		PROGRAMME CORE COURSES (PCC)										
01	CIVC701	PCC-I (Foundation Engineering)	3	1	0		4	100	35	30	70	
		PROGRAMME ELECTIVES V, VI & VII										
02	CIVPEV701, CIVPEV702, CIVPEV703, CIVPEV704, CIVPEV705, CIVPEV706, CIVPEV707, CIVPEV708, CIVPEV709, CIVPEV710	PE-V (Any One From The Given Basket of PE-V)	3	0	0		3	100	35	30	70	
03	CIVPEVI701, CIVPEVI702, CIVPEVI703, CIVPEVI704, CIVPEVI705, CIVPEVI706, CIVPEVI707, CIVPEVI708, CIVPEVI709, CIVPEVI710	PE-VI (Any One From The Given Basket of PE-VI)	3	0	0	6	3	100	35	30	70	
04	CIVPEVII701, CIVPEVII702, CIVPEVII703, CIVPEVII704, CIVPEVII705, CIVPEVII706,	PE-VII (Any One From The Given Basket of PE- VII)	3	0	0		3	100	35	30	70	

	CIVPEVII707, CIVPEVII708, CIVPEVII709, CIVPEVII710											
		OPEN ELECTIVE-II& III										
05	CIVOEII701, CIVOEII702, CIVOEII703, CIVOEII704, CIVOEII705, CIVOEII706, CIVOEII707, CIVOEII708, CIVOEII709, CIVOEII710	OE-II (Any one From The Given Basket of OE-II& III)	3	0	0		3	100	35	30	70	
06	CIVOEIII701, CIVOEIII702, CIVOEIII703, CIVOEIII704, CIVOEIII705, CIVOEIII706, CIVOEIII707, CIVOEIII708, CIVOEIII709, CIVOEIII710	OE-III (Any one From The Given Basket of OE-II& III)	3	0	0		3	100	35	30	70	
Total			**18**	**1**	**0**		**19**	**600**	**--**	**--**	**--**	
Practical			**L**	**T**	**P**		**Cr**	**FM**	**Overall Pass Marks**	**Internal**	**External**	**Categorization**
06	CHEP701	**Lab-I** (Quantity Surveying & Public works Laboratory)	**0**	**0**	**3**		1	50	25	30	20	
07	CHEP702	**Lab-II** (RS & GIS Lab)	**0**	**0**	**3**		1	50	25	30	20	
Total			**0**	**0**	**6**		**2**	**100**	**--**	**--**	**--**	
Audit Course			**L**	**T**	**P**		**Cr**	**FM**	**Overall Pass Marks**	**Internal**	**External**	**Categorization**
10	AUC701	**(THROUGH NPTEL/SWAYAM)** Exploring Human Values: Visions of Happiness and Perfect Society					--	100	35	30	70	Student will complete this Audit Paper of 12 weeks duration from NPTEL/SWAYAM. It is mandatory to pass this paper in order to pass this semester. Students may register on NPTEL/SWAYAM at any time from 1st to 7th semester also but the passing marks and credits will be reflected only in the 7th semester. The passing marks and certificate shall be forwarded by the institute to Controller of Examination (CoE), JUT, Ranchi timely

11	AUC702	Sports/NCC/NSS/YOGA/Painting/Music/ Classical Dance	6				--	50	25	30	20	
							Students shall participate actively in one of the activities and for Passing of the semester "Participation Certificate" in activity will be mandatory student participation shall be monitored and participation record shall be maintained at institute level. The marks obtained shall be forwarded to controller of Examination (CoE), JUT, Ranchi timely.					
Project			**L**	**T**	**P**		**Cr**	**FM**	**Overall Pass Marks**	**Internal**	**External**	**Categorization**
12	CIVP703	Minor Research Project	0	0	6		**3**	**100**	**35**	**30**	**70**	
Total			**0**	**0**	**6**		**3**	**250**	**--**	**--**	**--**	
Grand Total			**18**	**1**	**6**		**24**	**950**	**--**	**--**	**--**	

Professional Elective-V

S. No.	Course Code	Subject
01	CIVPEV701	Air Pollution Management
02	CIVPEV702	Industrial Wastewater Treatment
03	CIVPEV703	Environmental Management and Impact Assessment
04	CIVPEV704	Models for Air and Water Quality
05	CIVPEV705	Solid Waste Management Techniques
06	CIVPEV706	Indoor Air Quality
07	CIVPEV707	Models for Air and Water Quality
08	CIVPEV708	Hazardous Waste Management
09	CIVPEV709	Health Safety and Environment
10	CIVPEV710	Air and Noise Pollution Control

Professional Elective-VI

S. No.	Course Code	Subject
01	CIVPEVI701	Traffic Engineering and Safety
02	CIVPEVI702	Pavement Analysis and Design
03	CIVPEVI703	Transportation Planning
04	CIVPEVI704	Urban Transportation Systems
05	CIVPEVI705	Intelligent Transportation Systems
06	CIVPEVI706	Pavement Management System
07	CIVPEVI707	Pavement Material Characterization
08	CIVPEVI708	Sustainable Transportation
09	CIVPEVI709	Elementary Structural Dynamics
10	CIVPEVI710	Maintenance and Rehabilitation of Structures

Professional Elective-VII

S. No.	Course Code	Subject		S. No.	Course Code	Subject
01	CIVPEVII701	Conceptual Design of Structures		06	CIVPEVII706	Applied Hydraulics Engineering
02	CIVPEVII702	Prestressed Concrete Structures		07	CIVPEVII707	Simulation Modelling for Water Resources Engineering
03	CIVPEVII703	Advanced Reinforced Concrete Design		08	CIVPEVII708	Coastal Engineering
04	CIVPEVII704	Advanced Steel Structural Elements		09	CIVPEVII709	Basic Bridge Engineering
05	CIVPEVII705	Advanced Structural Analysis		10	CIVPEVII710	Advanced Mechanics of Solids

Open Elective-II

S. No.	Course Code	Subject
01	CIVOEII701	Building Technology
02	CIVOEII702	Environmental Management
03	CIVOEII703	Global Warming and Climate Change
04	CIVOEII704	Indoor and Ambient Air Quality Management
05	CIVOEII705	Intelligent Transportation Systems
06	CIVOEII706	Traffic Management Systems
07	CIVOEII707	Traffic flow Modeling and Simulation Techniques
08	CIVOEII708	Viscoelasticity
09	CIVOEII709	Soil Sciences
10	CIVOEII710	Rural Development and Technology

Open Elective-III

S. No.	Course Code	Subject
01	CIVOEIII701	Floods and Flood Management
02	CIVOEIII702	Climate Change and Water Resources Management
03	CIVOEIII703	Principles of Satellite Remote Sensing
04	CIVOEIII704	Spatial Information System
05	CIVOEIII705	Remote sensing and GIS applications in Engineering
06	CIVOEIII706	Spatial technology in Engineering
07	CIVOEIII707	GIS and Spatial Analysis
08	CIVOEIII708	Web GIS
09	CIVOEIII709	Building Materials
10	CIVOEIII710	Introduction to Environmental Studies

Abbreviations: - AU-Audit Course; L: Lecture, T: Tutorial, P: Practice.
J-Self learning hours shall not be reflected in the Time table. Self-learning includes micro projects/assignments/other activities as mentioned in earlier semesters.
***Passing in the Audit Course shall be mandatory.**
Note:- Students may choose their two Professional Electives (PE-V,VI & PE-VII) & Open Elective-II & III from NPTEL/SWAYAM also on the approval of departmental academic council if that subject is not mentioned in the above basket.
Students will complete the Elective Papers (Professional or Open) of 12 weeks duration from NPTEL/SWAYAM. Student may register on NPTEL/SWAYAM at any time between 1st to 7th semester but the passing marks and credits will be reflected only in the 7th semester.
The secured percentage of marks and passing certificate of the subject shall be forwarded by the institute to Controller of Examination (CoE), JUT, Ranchi timely.
The institute will inform University Examination Session about selection of PE and OE subjects by the students also before 1" mid-semester examination of that semester.

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B.Tech, Branch-Civil Engineering

VIIIth –Semester

S.No.	Course Code	Course Title	L	T	P	J	Cr	FM	Overall Pass Marks	Internal	External	Categorization
			Contact Hours per week									
01	CIVP801	Major Project/ Research Project/ Industrial Internship	36 Hours per week / week Total 12-16 Weeks			6	12	400	**200**	**240**	**160**	
Total			--	--	--		**12**	**400**	--	--	--	
Grand Total			--	--	--		**12**	**400**	--	--	--	

L: Lecture, T: Tutorial, P: Practical.
J- Self learning hours shall not be reflected in the Time table. Self-learning includes micro project/ assignment/ other activities as mentioned in earlier semester.

Semester- VIIth

PCC-1 (Foundation Engineering)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO-1 Determine the earth pressures on foundations and retaining structures

CO-2 Analyze shallow and deep foundations

CO-3 Calculate the bearing capacity of soils and foundation settlements

CO-4 Conduct soil exploration for engineering works

Course Content

Unit: 1

Lateral Earth Pressures: Lateral earth pressure theory, Different types of earth pressures, Rankine's active and passive earth pressures, Pressure distribution diagram for lateral earth pressures against retaining walls for different conditions in cohesionless and cohesive soils, Coulomb's active and passive earth pressure theory, Culmann's graphical construction, Stability check, Problems.

Unit: 2

Bearing Capacity of Foundation: Bearing capacity – Basic Definitions, Factors affecting bearing capacity, Estimation of Bearing capacity by different methods, Analytical measures – Terzaghi's and Meyerhof methods and calculations, Field measures – SPT, CPT and Plate load tests.

Unit: 3

Settlement of Foundation: Settlement analysis – Types of foundation settlement, Components of settlements - their estimation, Allowable settlement values, Effects, Causes and remedial measures of total and differential settlements. Shallow Foundations: Types of shallow foundations and choice, Basic requirements, Significance of these foundations.

Unit: 4

Pile Foundations: Classification and uses, Load carrying capacity calculations by different methods - static methods, dynamic methods, in-situ penetration tests, piles load test, Negative

skin friction, Under reamed, pile foundations, Pile groups - necessity, efficiency, Group capacity and settlements.

Unit: 5

Well Foundations: Types of caissons and their construction, Different shapes of wells, component parts and forces, Estimation of bearing capacity, Sinking of wells and remedial measures for tilts and shifts. Soil Exploration: Introduction, Different methods - direct methods, semi-direct and indirect methods, Sampling in soils and rocks, Subsurface exploration program - Preparation of bore logs and preparation of exploration report.

References

- Murthy, V.N.S, A text book of Soil Mechanics and Foundation Engineering, UBS Publishers & Distributors Pvt. Ltd., New Delhi 1999.
- Punmia, B.C. Soil Mechanics and Foundation Engineering, Laxmi Publications Pvt. Ltd., New Delhi, (16th edition)
- Gopal Ranjan and Rao, Basic and Applied Soil Mechanics, New Age International (P) Limited, New Delhi, 2002 (Second edition).
- 4.Braja M. Das, Principles of Foundation Engineering, Thomson Asia Pvt. Ltd., Singapore, 2023
- Donald P. Coduto, Man-Chu Ronald Yeung and William A. Kitch, Geotechnical Engineering, Principles and Practices, PHI Learning Private limited, 2011.

Lab-I (Quantity Surveying & Public works Laboratory)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO1 Prepare quantity estimates for Civil Engineering works

CO2 Calculate the quantity of materials required for civil works as per specifications

CO3 Evaluate contracts and tenders in construction practices

CO4 Prepare cost estimates

Course Content

Unit: 1

Introduction to Estimates: Purpose of estimating, Different types of estimates - their function and preparation. Building Estimates: Methods, Estimation of different building components, Schedule of rates, Units of measurements, Units of works.

Unit: 2

Earthwork: Different methods, Earthwork for roads, rails and canals, Earthwork for hill roads. Analysis of Rates: Preparation for analysis of rates, Quantity of materials per unit rate of work, Labour estimate.

Unit: 3

Specifications**:** Necessity, Types of specifications, Specifications for different civil engineering materials. Contracts: Essentials of contracts Types of engineering contracts Advantages and disadvantages.

Unit: 4

Tenders: Tender forms, Tender documents & notices time limits, Necessity. Valuation: Purpose, Difference between value and cost, Qualifications and functions of a valuer, Scrap & salvage value, Sinking fund, Capitalised value.

Learning Resources:

Text Books:

1. M Chakraborti, Estimating Costing Specification & Valuation in Civil Engineering, National Halftone Co. Calcutta, 2006.

2. B. N. Dutta, Estimating and Costing in Civil Engineering, CBS Publishers & Distributors Private Limited, 2020.

Reference Books:

1. G.S. Birdie, A Text Book of Estimating and Costing for Civil Engineering, Dhanpat Rai Publishing, Company Private Limited, 2014.

2. D. D. Kohli, R. C. Kohli, A Textbook of Estimating and Costing (Civil), S Chand Publishing, 2013.

3. https://www.udemy.com/course/estimating-and-costing/

Lab-II (RS & GIS Laboratory)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO-1 Interpret the remotely sensed data

CO-2 Map the earth surface features

CO-3 Prepare the different geospatial layers

CO-4 Compute geometric measurements and perform spatial analysis

CO-5 Create high-quality maps and associated graphics and Integrate different geospatial layers

Course Content

Remote Sensing:

1. Satellite Data downloading from different sources (Bhuvan, USGS, Earth data etc.,)
2. Spectral signature curves of various Land Use and Land Cover (LU/LC) features
3. Image Processing
4. Spectral Indices
5. Land use and land cover classification.

GIS:

1. Importing maps and layers from various sources
2. Georeferencing and projection
3. Digitization of Points and Lines
4. Editing Map Elements/Attribute Data Entry and Manipulation
5. Cleaning, Building and Transformation
6. Data Analysis – Overlay, Buffer
7. Map Generation with Patterns and Legends
8. Buffer Analysis and Network Analysis
9. Digital Elevation Model (DEM) applications
10. GIS Process and Model application

11. Google Earth Engine Applications
12. Field collection of geospatial features

Learning Resources:

Text Books:

1. Lillie and T.M and Kiefer R.W., Remote Sensing and Image Interpretation, John Wiley and Sons, 2015.

2. ERDAS Software user manuals.

PE-V (Air Pollution Management)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO1: Identify the types and sources of air pollutants

CO2: Predict the effects of air pollutants on human health and the environment

CO3: Choose appropriate technologies for removal of air pollutants

CO4: Measure the pollutant concentration in indoor environment

CO5: Suggest the control techniques for indoor air pollution layers

Course Content

Unit: 1

Air pollutants – Sources – Classification of air pollutants – Particulates and gaseous pollutants – Effects of air pollutants on human health, vegetation and property – Global issues and air pollution – Global warming – Ozone layer depletion – Ambient air quality and emission standards – Air pollution indices – Air act;

Unit: 2

Fundamentals of meteorology – Wind roses – Atmospheric stability – Atmospheric diffusion of pollutants – Transport, transformation and deposition of air contaminants – Plume behaviour – Atmospheric diffusion theories – Plume rise – Gaussian dispersion models;

Unit: 3

Control principles – Principles and equipment description of control technologies – Particulates control by Gravitation, centrifugal, filtration, scrubbing, electrostatic precipitation – Absorption, adsorption, condensation, incineration and biofiltration for control of gaseous air pollutants – Biological air pollution control technologies – Bioscrubbers, biofilters;

Unit:4

Air pollutants in indoor environments – Levels of pollutants in indoor and outdoor air – Indoor air pollution from outdoor sources – Measurement methods – Control Technologies.

References

- Anjaneyulu, D., Air Pollution and Control Technologies, Allied Publishers, Mumbai, 2002.
- Rao, C. S., Environmental Pollution Control Engineering, New Age International, New Delhi, 2006.
- Rao, M. N. and Rao H. V. N., Air Pollution, Tata McGraw-Hill, New Delhi, 2007.
- W. L. Heumannn, Industrial Air Pollution Control Systems, McGraw-Hill, New York,1997.
- Davis M. L. and Cornwell D. A., Introduction to Environmental Engineering, Tata
- McGraw Hill Education Pvt. Ltd,. New Delhi, 2010.
- Davis M. L. and Cornwell D. A., Introduction to Environmental Engineering, Tata
- McGraw Hill Education Pvt. Ltd,. New Delhi, 2010.
- Peavy H. S., Rowe D. R. and Tchobanoglous G., Environmental Engineering, McGraw Hill, New York, 1985.

PE-V (Industrial Wastewater Treatment)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO1: Recognize various environmental impacts due to improper management of industrial Waste-water.

CO2: Propose strategies for the prevention and control of industrial pollution.

CO3: Determine appropriate technologies for the treatment of industrial wastewater.

CO4 : Suggest safe sludge disposal techniques to minimize environmental risks.

CO5: Recommend the implementation of zero effluent discharge systems in industries**.**

Course Content

Unit: 1

Industrial wastewater: Characteristics – Environmental impacts – Effects- Effluent standards — Regulatory requirements; Prevention Vs control of industrial pollution: Source reduction-Volume reduction – Process Modification – Strength reduction – Waste minimization strategies;

Unit: 2

Treatment of industrial wastewater: Equalization and neutralization – Separation of solids – Removal of organic and inorganic solids – Oil separation – Precipitation — Biological treatment methods –

Unit: 3

Aerobic and anaerobic methods - Chemical oxidation – Advanced oxidation processes - Photocatalysis –Adsorption– Ion exchange - Membrane methods – Reverse Osmosis - Electrochemical methods – Nutrient removal – Land treatment;

Unit: 4

Sludge production and its management – Quantification and characteristics of sludge – Treatment of sludge and its disposal; Reuse of industrial wastewater– Zero effluent discharge systems; Case studies of wastewater treatment units in industries.

References

1. Eckenfelder, W. W., Industrial Water Pollution Control, McGraw Hill, 2014.
2. Nemerow N. L., Industrial Water Pollution, Addison-Wesley Publishing Company Inc.,USA, 1978.
3. Narayana Rao M. and Amal K. Dutta, Wastewater Treatment, Oxford & IBH Publishing Co., Pvt., Ltd., New Delhi, 2001.
4. Bhatia S. C., Handbook of Industrial Pollution and Control, Volume I & II, CBS Publishers, New Delhi, 2003
5. Mahajan, S. P., Pollution Control in Process Industries, Tata McGraw Hill Publishing, company, New Delhi, 1991.

PE-V (Environmental Management And Impact Assessment)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO1 Analyse the environmental impacts of proposed projects.

CO2 Categorize the type of EIA required as per the EIA notification.

CO3 Predict and assess the impact on the environment.

CO4 Propose mitigation measures to avoid environmental impacts.

CO5 Prepare the EIA report with environmental management plan.

Course Content

Unit: 1

Impacts of development projects on environment and Environmental Impact Assessment (EIA) and Environmental Impact Statement (EIS) – Objectives – EIA Types – EIA in project cycle – Capacity and limitations – Legal provisions on EIA – Environmental Impact.

Unit: 2

Assessment notification – Environmental Impact Assessment consultants. Methods of categorization of industries for EIA – Elements of EIA – Process screening - baseline studies – mitigation – matrices – checklist;

Unit: 3

Methods of EIA– Strength, weakness and applicability – Appropriate methodology solution; Prediction and Assessment of Impact on land – water – air - noise and energy - flora and fauna - Socio economic impact – Mathematical models for impact prediction - rapid EIA - public participation – Post environmental audit;

Unit: 4

Plan for mitigation of adverse impact on environment – Options for impact mitigation; Addressing the issues related to the project affected people – Environment Management Plan – ISO 14000

References

1. Canter, R. L., Environmental Impact Assessment, McGraw Hill Inc., New Delhi 1996.
2. Anjaneyulu, Y., Environmental Impact Assessment Methodologies, B. S. Publications, Hyderabad, 2002.
3. S. K. Shukla and P. R. Srivastava, Concepts in Environmental Impact Analysis, Common Wealth Publishers, New Delhi, 1992.
4. G. Rao and David C. Hooten (Ed.), Environmental Impact Analysis Handbook, raw Hill Book Company, 1990.

PE-V (Solid Waste Management Techniques)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO1 Quantify and categorize solid wastes for any region

CO2 Understand the various functional elements in solid waste management

CO3 Analyse the collection route and collection system

CO4 Select suitable waste processing technologies

CO5 Design a suitable sanitary landfill for disposal of solid waste

Course Content

Unit: 1

Municipal Solid Waste (MSW): Sources - Types – Generation rates - Composition - Characteristics - Sampling – Effects of improper disposal – Public health and environmental effects;

Unit: 2

Functional Elements of MSW management: Source reduction – Reuse and Recycling – Source Segregation – Onsite storage – Collection - Transfer and transport – Transfer stations.

Unit: 3

Waste Processing technologies - Biological and chemical conversion technologies – Resource recovery – Composting - Biomethanation – Thermal processing options;

Unit: 4

Sanitary landfill: Site selection - Design - Operation – Landfill liners – Management of leachate and landfill gas – Landfill post closure and environmental monitoring; Landfill bioreactor; Dumpsite rehabilitation.

References

- George Tchobanolglous and Frank Kreith Handbook of Solid Waste Management, McGraw Hill, New York, 2002.

Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban, Development, Government of India, New Delhi, 2000.

- Peavy H. S., Rowe D. R. and Tchobanoglous G., Environmental Engineering, McGraw Hill, New York, 1985.
- Davis M. L. and Cornwell D. A., Introduction to Environmental Engineering, Tata McGraw Hill Education Pvt. Ltd, New Delhi, 2010.
- Bhide A. D. and Sundaresan, B. B. Solid Waste Management Collection, Processing and Disposal, 2001.
- Manser A. G. R and Keeling A. A, Practical Handbook of Processing Recycling of Municipal Solid Wastes, Lewis Publishers, CRC Press, 1996.

PE-V (Indoor Air Quality)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO1: Identify and analyze the sources and types of indoor air pollutants and assess their impacts on indoor air quality

CO2: Measure the indoor air pollution using relevant instrumentation

CO3: Apply simple mass balance models to predict pollutant concentrations in indoor environments

CO4: Evaluate the human exposure to indoor air pollutants using mathematical models

CO5: Eevelop and recommend effective indoor air pollution control methods and Strategies**.**

Course Content

Unit: 1

Indoor air pollution: Sources – Effects – Sick building Syndrome - Sampling and analysis methods –

Unit: 2

Indoor air quality guidelines and standards - Simple mass balance models - Concepts of half-lives and residence times;

Unit: 3

Indoor aerosols: Chemical and physical properties – Aerosol formation – Coagulation – Deposition – Gas-particle partitioning – Chemical kinetics – Chemical reactions in indoor air.

Unit: 4

Reactions on surfaces – Bioaerosol/biological particles in indoor atmosphere – Human exposure – Models for human exposure- Time-activity information – Risk assessment; Indoor air pollution control methods- CONTAM software.

References

1 R.M. Harrison, and R.E. Hester, Indoor Air Pollution: Issues in Environmental Science & Technology. RSC Press, 2019.

2 John D. pengler, John F. McCarthy, and Jonathan M. Same, Indoor Air Quality Handbook. McGraw Hill, 2000.

3 P Pluschke, H Schleibinger, Indoor Air Pollution. Springer-Verlag GmbH Germany 2018.

4. Thad Godish, Indoor Air Pollution Control, CRC Press, 2017.

PE-V (Models For Air And Water Quality)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO1 Apply mass balance concept for air and water quality prediction

CO2 Develop mathematical models for water quality based on transport mechanisms

CO3 Predict the quality of water in river and estuaries using specific models

CO4 Evaluate eutrophication potential of lakes and bacterial growth kinetics

CO5 Estimate the air pollutant concentration using dispersion models

Course Content

Unit: 1

Introduction to mathematical models – Modeling approaches to water quality – Classification of models;

Unit: 2

Conservation of mass – Mass balance – Steady state system – Time variable response systems;

Mathematical models for water quality – Mass transport mechanisms – Model development-calibration and verification – Model limitations; DO and BOD models for streams:

Unit: 3

Source and sinks of dissolved oxygen – Streeter Phelps model – Oxygen sag curve – deoxygenation and reaeration coefficients – Benthal oxygen demand;

Unit: 4

Models for estuary -Water quality distribution in estuaries –BOD and DO models; Models for Lakes: Eutrophication- steady and unsteady state models- Thermal stratification; Models for microorganisms – Growth and Decay;

Unit:5

Air quality models – Micrometeorological processes – Wind rose and stability classes – Gaussian dispersion model – Line source models – Indoor air quality model.

References

1. Chapra and Steven C., Surface Water Quality Modelling, Waveland press, Inc., 2008.
2. Gilbert M. Masters, Introduction to Environmental Engineering and Science, 3rd Edition, Pearson Education Limited, 2013.
3. Davis M. L. and Cornwell D. A., Introduction to Environmental Engineering, Tata McGraw Hill Education Pvt. Ltd,. New Delhi, 2010.

PE-V (Hazardous Waste Management)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO1: Identify and manage different types of hazardous wastes

CO2: Select suitable waste minimization and resource recovery techniques for hazardous waste management

CO3: Understand the environmental regulations and policies related to hazardous waste management

CO4: Provide awareness for promoting sustainable e- waste management practices in

local communities

CO5: Suggest suitable disposal method for biomedical waste

Course Content

Unit: 1

Hazardous Waste: Sources – Characteristics - Classification - Impacts on human health and Environment - Environmental Regulations - Waste Minimization - Resource recovery - Storage - Transportation – Treatment - Landfill disposal;

Unit: 2

E-waste: Composition – Characteristics – Environmental and Health implications – Storage - On-site Handling - Recycling - Extended producer responsibility (EPR) - Treatment and Disposal;

Unit: 3

Biomedical waste: Source – Classifications – Health Hazards – Waste collection - Segregation - Labelling – Handling – Onsite/off site transportation – Treatment - Disposal;

Unit: 4

Status of waste management - Rules and regulations governing waste management.

References

1 Michael D. LaGrega, Phillip L. Buckingham, Jeffrey C. Evans “Hazardous Waste Management” Waveland Press, 2010

2 ohn Pichtel, Waste Management Practices: Municipal, Hazardous, And Industrial, CRC press, 2014

3 Daniel A. Vallero, Deepak Kumar Yadav, Pardeep Singh, Pradeep Kumar (Eds) Hazardous Waste Management: An Overview of Advanced and Cost-Effective Solutions” Elsevier Science, 2021

4 CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2016.

PE-V (Health Safety And Environment)

Course Code **L: T: P-3:0:0**

Rationale-

CLO1: To study the basics of environmental health, occupational safety, and industrial hygiene

CLO2: To know the major environmental health hazards in work place

CLO3: To learn the regulatory framework and policies governing health and safety

CLO4: To familiarize the skills in risk assessment and management

CLO5: To learn the concepts of air and water quality management

Course Outcomes

CO1 Identify and describe various environmental and occupational hazards

CO2 Apply relevant health and safety regulations

CO3 Implement strategies for managing and mitigating risks

CO4 Suggest effective environmental, health, and safety audit programs

CO5 Develop effective environmental pollution mitigation plans

Course Content

Unit: 1

Regulations for Health, Safety and Environment – Introduction to occupational safety and health (OSH) – OSH regulations and law in India.

Unit: 2

Technical standards - Codes and guidelines on OHS – National and International standards of personal protective equipment and fire protection.

Unit: 3

Health and safety at work place – Hazards and risk assessments – Waste management – Fire protection and prevention.

Unit: 4

Principles of chemical safety – Radiation safety and bio safety – Emergency preparedness –

Environment management and pollution control.

References

1 IS codes: IS 5903, IS 807, IS 2760, IS 14469, IS 13367-1, IS 5324, IS 7167, IS 7155,IS1800, IS 3521.

2 Handbook of Occupational Health and Safety, NIC, Chicago, 1982.

3 Encyclopedia of Occupational Health and Safety, Vol. I and II. International Labour Organisation,Geneva, 1985.

4 McCornick, E.J. and Sanders, M.S., Human Factors in Engineering and Design, Tata McGraw Hill, 1982.

5 Accident Preventional Manual, NSC Chicago, 1982. Henrich, H.W., Industrial AccidentPrevention, McGraw Hill, 1980.

6 Less, F.P., Loss Prevention in Process Industries, Butterworth, New Delhi, 1986.

PE-V (Air and Noise Pollution Control)

Course Code **L: T: P-3:0:0**

Rationale-

CLR-1: Know the various sources of air and noise pollution

CLR-2: Understand the effect of air and noise pollution

CLR-3: Explore the air and noise pollution monitoring techniques

CLR-4: Study the concepts related to reduce air pollution

CLR-5: Realize the concepts related to reduce noise pollution

Course Outcomes

CO-1: Identify the various sources of air and noise pollution.

CO-2: Analyze air quality parameters and its impact.

CO-3: Recognize the pollution measurement methods.

CO-4: Identify the techniques to reduce air pollution.

CO-5: Apply the concept of reducing air and noise pollution.

Course Content

Unit-1

Air pollutants, sources, classification-Monitoring techniques for air and noise pollution-Combustion processes and pollutant-Greenhouse effect. - Urban heat island-Air Act, legislation and regulations emission-Air quality management in India

Unit-2

Sources, classification and effects-Ambient air quality and emission-Air pollution indices. - Natural Sources-Man Made Sources-Type of air pollutants standards-Effects on human health Effects on Vegetation-Ozone Layer Depletion

Unit-3

Smoke, smog and ozone-Sampling and meteorology-Ambient air sampling-pollution measurement methods-principles and instruments-Monitoring stations in India-temperature lapse

rate and stability-diabatic lapse rate-Wind Rose, Inversion -Wind velocity and turbulence-Plume behavior-Carbon Emission-Monitoring-case studies

Unit: 4

Noise pollution-Sources, classification-Noise act, legislation and regulations-Noise quality management in India. -Natural Sources and their classification-Manmade Sources-Remedial Measures to reduce noise pollution-Noise management in other countries

Unit: 5

Noise Pollution Monitoring Techniques: Noise sampling and noise level meter. -CUSTIC Software-Noise Pollution Modelling-Pollution measurement methods, - Principles and instruments-Occupational noise monitoring-Infrasound, ultrasound, impulsive sound and sonic boom-Noise Indices-Noise Standards-Case Studies on Noise Pollution

Learning Resources

1. C. S. Rao, "Environmental Pollution Control Engineering", Wiley Eastern Limited, 2000.
2. M. N. Rao, H. V. N. Rao, Air pollution, Tata McGraw Hill Pvt Ltd, New Delhi, 1993
3. Dr. Y. Anjaneyulu, "Air Pollution and Control Technologies", Allied publishers Pvt. Ltd., 2002.
4. Mukherjee, "Environmental Pollution and Health Hazards", causes and effects, 1986
5. Antony Milne, "Noise Pollution: Impact and Counter Measures", David & Charles PLC 1979.
6. Kenneth wark, Cecil F.Warner, "Air Pollution its Origin and Control", Harper and Row Publishers

PE-VI (Traffic Engineering And Safety)

Course Code **L: T: P-3:0:0**

Rationale-

CLO1 To understand the fundamentals of traffic stream characteristics

CLO2 To learn the skills of traffic control and management

CLO3 To learn the methods of safe intersection design

CLO4 To learn the importance and methods of accident investigation and prevention

CLO5 To understand the concepts of road safety audit and safety improvement methods

Course Outcomes

CO1 Carry out traffic surveys

CO2 Implement traffic system management

CO3 Carry out intersection design for safety

CO4 Record and analyse accident data and suggest countermeasures

CO5 Carry out road safety audit

Course Content

Unit: 1

Traffic stream characteristics:, Fundamental parameters and relationship of traffic flow, speed and concentration. Traffic stream models. Speed data collection and analysis, Density and travel time measurement and analysis, Moving Observer Method, Automated Traffic Measurements –

Unit: 2

Traffic forecasting and growth studies. Capacity and level of service of roads. Pedestrian studies – flow characteristics - Design principles of pedestrian facilities.

Traffic Management: Parking studies – parking parameters, parking surveys, parking requirements - on street and off street parking. Lay-byes and bus stops. Principles of Traffic

Unit: 3

Control: Basics of traffic management. Traffic System Management - speed control, one way streets, reversible lanes, access control, bus priority measures, turning restrictions.

Design of Intersections for Safety: Uncontrolled intersections, Conflicts at intersections, Channelization, Traffic islands, Design of median islands, turning vehicle templates Design of traffic rotaries. Traffic signal design - Design Principles of Traffic Signal, Signal Coordination, Vehicle Actuated Signals and Area Traffic Control. Design of Grade Separated interchanges - trumpet, diamond, cloverleaf, rotary and directional.

Unit: 4

Accident Investigation and Prevention: Characteristics of road accidents, causes of accidents: road – driver – vehicle - environment, Significance of accident data, Accident recording and analysis - Crash reporting and collision diagrams - Statistical Interpretation and Analysis of Crash Data. Identification of potential sites for treatment - Safety countermeasures. Monitoring and evaluation.

Unit: 5

Road Safety Audit – Overview, stages of road safety audit, audit process, checklists and elements of good road safety audit. Highway safety improvement program - Safety Education, Traffic Law Enforcement. Road Safety Management System. Case studies.

References

1.Khanna, S. K., Justo, C. E. G. and Veeraragavan A., Highway Engineering, Nem Chand and Bros, Roorkee, 2014.

2.Kadiyali, L.R, Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi, 2011.

3.IRC SP: 88 – 2010

4.Rune Elvik, Alena hoye, Truls Vaa and Michael Sorensen, The handbook of Road Safety Measures, Emerald Group Publishing Limited, 2009

5.Highway Safety Manual, ITE, 2010Course Outcomes (CO) CO5 Carry out road safety audit.

PE-VI (Pavement Analysis And Design)

Course Code **L: T: P-3:0:0**

Rationale-

CLO1 To study about the types and components of pavements

CLO2 To learn about the stresses in flexible pavements and equivalent single wheel load

CLO3 To study the design of flexible pavements

CLO4 To learn about the stresses in rigid pavements

CLO5 To study the design of rigid pavements

Course Outcomes

CO1 Identify the pavement components and compare highway and airport pavements.

CO2 Calculate the stresses and ESWL in flexible pavements.

CO3 Design the flexible pavement using empirical, semi empirical and IRC methods.

CO4 Analyze the warping, friction, wheel load stress and calculate the combined stress.

CO5 Design rigid pavements by IRC method and evaluate the pavements.

Course Content

Unit: 1

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: 2

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: 3

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: 4

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: 5

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. Yoder and Witezak, Principles of Pavement Design¸ John Wiley and sons, 1975

2. Yang H. Huang, Pavement Analysis and Design, Pearson Prentice hall, 2004.

2.IRC: 37 - 2012, Guidelines for the Design of Flexible Pavements

3.IRC: 58 - 2011, Guidelines for the Design of Plain Jointed Rigid Pavements for Highways

PE-VI (Transportation Planning)

Course Code **L: T: P-3:0:0**

Rationale-

CLO1: To know about the processes and concepts of transportation planning

CLO2: To study about trip generation

CLO3: To study about trip distribution

CLO4 : To study about modal split analysis

CLO5: To study about trip assignment

Course Outcomes

CO1 Apply the principles of the transportation planning process and demand estimation.

CO2 Analyse the trip production and trip attraction models.

CO3 Analyse the growth factor, gravity and opportunity models.

CO4 Apply the mode choice behaviour and mode split models.

CO5 Apply the shortest path models for route assignment

Course Content

Unit:1

Transportation Planning Process and Concepts - Role of transportation -Transportation problems - Urban travel characteristics - Concept of travel demand - Demand function - demand estimation - Sequential, recursive and simultaneous processes

Unit:2

Trip Generation Analysis - Zoning - Types and sources of data – O-D studies -Expansion factors - Accuracy checks - Trip generation models - Zonal models - Household models - Category analysis - Trip attractions of work centers.

Unit:3

Trip Distribution Analysis - Trip distribution models - Growth factor models - Gravity models- Opportunity models.

Unit:4

Mode Split Analysis - Mode split Models - Mode choice behaviour, competing modes, Mode split curves, Probabilistic models.

Unit:5

Traffic Assignment - Route split analysis: Elements of transportation networks, Nodes and links - minimum path trees - all-or-nothing assignment - Multipath assignment - Capacity restraint.

References

1.Hutchinson B.G., Principles of Urban Transportation System Planning, McGraw Hill,2007.

2.Bruton M. J., Introduction to Transportation Planning, Hutchinson, London, 1992.

3.C. Jotin Khisty, B. Kent Lall, Transportation Engineering, Prentice Hall of India, 2002.

4.C.S. Papacostas and P.D. Prevedouros, Transportation Engineering and Planning,Prentice Hall of India Pvt. Ltd., 2001.

PE-VI (Urban Transportation Systems)

Course Code **L: T: P-3:0:0**

Rationale-

CLO1 To understand the characteristics of various urban modes and service types

CLO2 To discuss transportation demand and network planning

CLO3 To learn the concepts of transit scheduling

CLO4 To study the planning aspects of terminals

CLO5 To be acquainted with integrated public transport planning

Course Outcomes

CO1 compare the various urban modes and service types

CO2 quantify transportation demand and identify planning corridor

CO3 apply the concepts of transit scheduling

CO4 evaluate the planning aspects of terminals and depots

CO5 describe the concepts of integrated public transport planning

Course Content

Unit:1

Urban modes and service types - Technological and operational Characteristics – environmental considerations – relative cost economics – criteria for selection

Unit:2

Transportation Demand estimation- Data requirements, Network planning - Corridor identification - Route Systems and Capacity, Comprehensive mobility plan.

Unit:3

Scheduling procedure and patterns –Fleet Requirement – Bus scheduling – Frequency and Headway-Way capacity and station capacity.

Unit:4

Planning and design of terminals - Bus stop capacity – Depot location - Depot layout, Parking patterns.

Unit:5

Integrated public transport planning – Transit oriented development, Preferential treatment for high occupancy modes, promoting non-motorized modes of transport - case studies.

References

1. Black, Alan, Urban Mass Transportation Planning, McGraw- Hill,Inc., New York,1995.

2. Vukan, R. Vuchic, Urban Transit Systems and Technology, John –Wiley & Sons, NewJersey, 2007.

3. Sigurd Grava, Urban Transportation Systems – Choices for Communities, TheMcGraw-Hill Companies, 2004.

4. Ceder, Avishai. Public Transit Planning and Operation: Theory, modelling and practice, Butterworth-Heinemann publications, 2007.

5. Mehrdad, Ehsani, Fei-Yue, Wang and Gary, L. Brosch., Transportation technologies for sustainability, Springer, 2013.

6. Black, Alan, Urban Mass Transportation Planning, McGraw- Hill,Inc., New York,1995.

PE-VI (Intelligent Transportation Systems)

Course Code **L: T: P-3:0:0**

Rationale-

CLO1: To learn the fundamentals of ITS

CLO2: To understand the different types of sensors

CLO3: To study the ITS functional areas

CLO4:To have an overview of ITS implementation in developed countries

CLO5: To learn the implantation, and advantages of ITS in field, with case studies from developed countries

Course Outcomes

CO1: Understand the sensor technologies

CO2: Understand the communication techniques

CO3: Apply the various ITS methodologies

CO4: Understand the user needs

CO5: Define the significance of ITS from developed countries perspective and implications for Indian conditions

Course Content

Unit:1

Introduction to Intelligent Transportation Systems (ITS) – Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS - ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection.

Unit:2

Telecommunications in ITS – Importance of telecommunications in the ITS system, Information Management, Traffic Management Centres (TMC). Vehicle – Roadside communication – Vehicle Positioning System.

Unit:3

ITS functional areas – Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS).

Unit:4

ITS User Needs and Services – Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management.

Unit:5

Automated Traffic Infrastructures – V2X Communications– Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries, Case studies.

References

1. ITS Handbook 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.

2. Sussman, J. M., Perspective on ITS, Artech House Publishers, 2005.

3. National ITS Architecture Documentation, US Department of Transportation, 2007 (CD-ROM).

4. Chowdhary, M.A. and A Sadek, Fundamentals of Intelligent Transportation systems planning. Artech House Inc., US, 2003.

5. Williams, B., Intelligent transportation systems standards. Artech House, London,2008.

6. Ni, Daiheng. Traffic Flow Theory. Butterworth-Heinemann, Elsevier, 2016

7. P. K. Sarkar, A.K. Jain. Intelligent Transport Systems. PHI Learning, 2018.

PE-VI (Pavement Management System)

Course Code **L: T: P-3:0:0**

Rationale-

CLO1: To understand the pavement performance evaluation

CLO2: To know about the pavement structure evaluation and field tests

CLO3: To understand the basic concepts of Pavement Management System.

CLO4: To develop the performance prediction models

CLO5: To learn pavement life cycle cost analysis and optimization of pavement maintenance and rehabilitation

Course Outcomes

CO1: Comprehend principles for evaluating pavement performance and assessing pavement distresses.

CO2: Gain knowledge of pavement structure evaluation techniques and field tests

CO3: Learn to develop and utilize performance prediction models for pavement management

CO4: Utilize performance prediction models for pavement management

CO5: Conduct life cycle cost analysis and optimize maintenance and rehabilitation strategies

Course Content

Unit: 1

Pavement distresses Evaluation – General concepts – functional evaluation, condition surveys, serviceability-performance concept, characterization of pavement roughness, equipment for evaluating roughness and skid resistance

Unit: 2

Pavement Structure Evaluation and Field Tests - Factors affecting Structural Condition of Flexible and Rigid Pavements- Pavement Deterioration- Evaluation by Non-Destructive Tests such as Benkelman Beam Rebound Deflection, FWD, Plate Load Test - Evaluation by Destructive Test Methods, and Specimen Testing.

Unit: 3

Introduction to Pavement Management: Pavement Management Levels and Functions- network and project levels of pavement management, influence levels of PMS components,key consideration in the application of a total pavement management system concept, function of pavement evaluation.

Unit: 4

Pavement performance prediction - concepts, techniques for developing prediction models– structural conditional deterioration models, functional condition deterioration models.

Unit: 5

Pavement Maintenance Management - expert system for pavement evaluation and rehabilitation, Pavement Life Cycle Cost Analysis, Priority Programming, Budget Level Evaluation, optimization of pavement maintenance and rehabilitation.

References

1. R Srinivasa Kumar, Pavement Evaluation and Maintenance Management System, Universities Press (India) Pvt. Ltd, 2014.

2. Rajib B. Mallick,Tahar El-Korchi, Pavement Engineering: Principles and Practice, Second Edition, CRC Press

3. Haas, R., Hudson, W. and Zaniewski, J., Modern Pavement Management, Krieger Publishing Company. McGraw- Hill, 1994

4. Derek Pearson, Deterioration and Maintenance of Pavements, ICE Publishing, 2011

5. Relevant IRC codes, CRRI and HDM 4 Manuals

PE-VI (Pavement Material Characterisation)

Course Code **L: T: P-3:0:0**

Rationale-

CLO1: To study the properties and test on aggregate for road construction

CLO2: To understand the properties of conventional and modified binders

CLO3: To introduce to the principles of bituminous pavement construction

CLO4: To learn the procedure of PQC mix design

CLO5: To study the use of composites and recycled waste products in road construction

Course Outcomes

CO1 understand the properties and test procedures of aggregate

CO2 understand the properties of bituminous materials

CO3 perform bituminous mix design using various methods

CO4 do PQC mix design and can conduct various tests on cement and concrete

CO5 use recycled and other materials in road construction

Course Content

Unit:1

Aggregate: Nature and properties – aggregate requirements – types and processing – aggregates for pavement base – aggregate for bituminous mixture – tests on aggregate – specification.

Unit:2

Bituminous Materials: conventional binders – production – types and grade – physical and chemical properties and uses, specification of binders – Modified Bitumens - Type of Bitumen Modifiers- tests on bituminous materials.

Unit:3

Bituminous Mixes: Mechanical properties - Resilient modulus, dynamic modulus and fatigue characteristics of bituminous mixes. Marshall method of mix design, Performance based Bitumen and SUPERPAVE mix design method

Unit:4

Cement /concrete-based materials: Cement – properties – PQC – properties, mix design, behaviour, performance, Special types of cement concrete, Tests on Cement and Concrete mixes.

Unit:5

Reclaimed / Recycled Waste Products and other materials: Reclaimed Materials – waste products in road construction — self-healing and smart materials – locally available materials. Composites, Plastics and Geosynthetics.

References

1. Kandhal, Veeraragavan, Rajan, Bituminous Road Construction in India PHI Learning PVT, India, Second Edition, 2023.
2. M.Rashed Isla, Rafiqul A. Tarefder, Pavement Design, Materials, Analysis, and Highways, McGraw-Hill Education, 7 Jul 2020
3. Barth Edwin J., Asphalt: Science and Technology, Gordon and Breach Science, Publishers, 2018.
4. Shan Somayaji, Civil Engineering Materials, second edition, Prentice Hall Inc.,2016.
5. P. T. Sherwood, Alternative Materials in Road Construction, Thomas Telford, Publication, London, 1997.

PE-VI (Sustainable Transportation)

Course Code **L: T: P-3:0:0**

Rationale-

CLO1: To understand the concept of sustainable transportation planning

CLO2: To learn the various evaluation techniques of non-motorized transportation

CLO3: To be introduced to the fundamentals of planning for pedestrians

CLO4: To be introduced to the fundamentals of planning for bicyclists

CLO5: To understand the sustainable policies and technologies

Course Outcomes

CO1: Specify transport planning strategies for sustainable development

CO2: Evaluate strategies for development of non-motorised transport

CO3: Specify actions for planning for pedestrian facilities

CO4: Specify actions for planning for bicyclists' facilities

CO5: Elaborate on sustainable policies and technologies

Course Content

Unit:1

Planning for Sustainability- Urban form, Indicator based planning, landuse transportation integration, Compact City, Public Transit, TOD, NMT, First and Last Mile Connectivity.

Unit:2

Evaluation of non-motorized transportation-Surveys, Demand Estimation and Analysis; Evaluation Techniques; Pedestrian Condition Evaluation Techniques; Prioritizing Improvements and Selecting Preferred Options

Unit:3

Pedestrian facilities and planning - Types of pedestrians and Characteristics; Pedestrian standards and improvements; Pedestrian facility Design, LOS; Pedestrian safety programs.

Unit:4

Planning for bicyclists: Types of cyclists and Bikeways; Integrating cycling into roadway planning; Bicycle network planning; Design aspects of Bicycle paths; Bicycle Parking/storage Facilities.

Unit:5

Sustainable policies and technology: Speed and speed limit policies, national policies, sustainable travel demand management; public awareness; Alternative Cleaner Fuels, vehicle technologies, nationally appropriate mitigation actions.

References

- Black, W. R., Sustainable Transport: Definitions and Responses, In Transportation Research Board, Integrating Sustainability into the Transportation Planning Process, Conference Proceedings 37. Washington, D.C., National Research Council, 2005.
- Black, W.R., Sustainable transport: Problems and Solutions. Gulford Press, New York,2010.
- Cervero, R. Accessible Cities and Regions: A Framework for Sustainable Transport and Urbanism in the 21st Century. Center for Future Urban Transport, Institute of Transportation Studies, University of California, Berkeley, 2005.
- Tolley, R., Sustainable Transport: Planning for Walking and Cycling in Urban Environments, CRC Press, 2003.

PE-VI (Elementary Structural Dynamics)

Course Code **L: T: P-3:0:0**

Rationale-

CLO1: Understand the basic concepts of dynamic analysis and elements of vibratory systems

CLO2: To study the dynamic response of SDOF system

CLO3: To study the dynamic response of MDOF system

CLO4: Implement numerical methods for evaluating the dynamic response of structures

CLO5: Apply approximate solution methods for dynamic analysis

Course Outcomes

CO1: Demonstrate an understanding of the basic concepts of dynamic analysis and the elements of vibratory systems

CO2: Develop and use mathematical models for single degree of freedom (SDOF) systems using the lumped mass procedure

CO3: Formulate and solve equations of motion for MDOF systems, identifying natural frequencies, mode shapes, and orthogonality conditions

CO4: Conduct deterministic analyses of earthquake responses for multi-storeyed frames using response spectra

CO5: Apply approximate methods for dynamic analysis, including Rayleigh's method, Rayleigh-Ritz method

Course Content

Unit:1

Introduction to Dynamic analysis - Elements of vibratory systems. Simple Harmonic Motion D'Alembert's principle – Degrees of freedom – Lumped mass procedure - Single degree of **freedom system**

Unit:2

Free vibration of single degree of freedom system- undamped free vibration - Damped free vibration - Evaluation of damping – Response to harmonic loading − response to impulsive loading loading (blast or earthquake) - Duhamel's integral – Transmissibility

Unit:3

Multi degree of freedom system (MDOF) – Equation of motion for mdof systems - Eigen value problem - Natural frequencies and mode shapes − orthogonality conditions – Response to free and forced excitations - Modal Analysis - Vibration isolation

Unit:4

Numerical evaluation of dynamic response – Time stepping method – methods based of interpolation of excitation. Idealization of multi-storeyed frames - Deterministic analysis of earthquake response – response spectrum - Numerical analysis in the frequency domain, fast Fourier transform analysis.

Unit:5

Approximate solutions - Rayleigh's method, Rayleigh-Ritz method, Dunkerley's method, Holzer's and Stodola's methods

References

- Mario Paz, Structural Dynamics, CBS, Publishers, 1987.
- Roy R Craig, Jr., Structural Dynamics, John Wiley & Sons, 1981.
- A.K. Chpora "Dynamics of Structures Theory and Application to Earthquake Engineering" Pearson Education, 2001
- Madhujit Mukhopadhyay "Structural Dynamics Vibrations and Systems" Springer,2021
- Keith D. Hjelmstad "Fundamentals of Structural Dynamics Theory and Computation"Springer, 2023

PE-VI (Maintenance And Rehabilitation Of Structures)

Course Code **L: T: P-3:0:0**

Rationale-

CLO1 To provide a comprehensive knowledge on the diagnosis of damage, condition assessment of structures and quality of material application relating to maintenance and rehabilitation of structures.

CLO2 To identify performance factors and design errors affecting structural integrity.

CLO3 To apply preventive measures and condition rating procedures for structural

Course Outcomes

CO1 identify and describe various environmental and occupational hazards

CO2 apply relevant health and safety regulations

CO3 implement strategies for managing and mitigating risks

CO4 suggest effective environmental, health, and safety audit programs

CO5 develop effective environmental pollution mitigation plans

Course Content

Unit:1

Performance of construction materials and components in services for strength, permeability, thermal properties and cracking effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, Effects of cover thickness

Unit:2

Maintenance and Diagnosis Maintenance, Repair and rehabilitation, Facets of Maintenance, Importance of Maintenance, Preventive measures based on various aspects of inspection-Condition assessment and rating procedure for evaluating a damaged structure. Diagnosis of construction failures. Different types of concrete deterioration

Unit:3

Corrosion damages and protection Corrosion damage of reinforced concrete, methods of corrosion protection, Corrosion inhibitors, corrosion resistant steels, coatings, cathodic

protection, rust eliminators. Causes of deterioration of concrete, steel, masonry and timber structures, surface deterioration, efflorescence, causes, prevention and protection. Materials and Techniques

Unit:4

Surface repair strategies and materials - Special concrete and mortar, concrete chemicals, expansive cement, polymer concrete sulphur infiltrated concrete, Ferro cement, fiber reinforced concrete, Surface preparation and protective treatments, - surface coatings, Waterproofing materialsMethods of repair in concrete, steel and masonry structures. Gunite and shotcrete, epoxy injection.

Unit:5

Strengthening and demolition-Strengthening of existing structures - repairs to overcome low member strength, deflection, cracking, chemical disruption, weathering, wear, fire, leakage, marine exposure, coatings for set concrete and steel reinforcement. Demolition techniques of structures - case studies.

References

1. Raiker .R.N, "Learning from Failures, Deficiencies in Design, Construction and Service", - R&D Centre (SDCPL), Raikar Bhavan, Bombay 1987.

2. Emmons P.H., Concrete Repair and Maintenance Illustrated, RS Means InC., 1993.

4. Varghese P.C., Maintenance Repair and Rehabilitation & Minor Works of Buildings, PHI Learning Pvt. Ltd., 2014

4. Repair & Rehabilitation", Compilation from The Indian Concrete Journal,– ACC – RCD, Publication 2001.

5. Allen .R.T, and Edwards .S.C, Shaw D.N, "Repair of Concrete Structures",Chapman and Hall, 2005

6 Newman A., Structural Renovation of Buildings, McGraw-Hill Education, 2000

7 Woodson R. D., Concrete Structures – Protection, Repair and Rehabilitation, Butterworth-Heinemann, Elsevier, 2009.

PE-VII (Conceptual Design Of Structures)

Course Code **L: T: P-3:0:0**

Rationale-

CLO1: To teach the importance of conceptual design of structures in the development of civilization

CLO2: To make students interpret structural behaviour from nature and the evolution of structural forms

CLO3: To motivate students to make various physical models of structures and learn the development of structural forms

CLO4: To teach the role of materials in shaping the structural forms, systems and analysis

CLO5: To provide a hands-on experience to students on the conceptual design of structures

Course Outcomes

CO1: To understand the importance of conceptual design of structures

CO2: To interpret the structural behaviour from nature and the evolution of structural forms

CO3: To create physical models of structures and learn the development of structural forms

CO4: To learn the role of materials in shaping the structural forms, systems and analysis

CO5: To get a hands-on experience on the conceptual design of structures

Course Content

Unit:1

Introduction – Need for conceptual design of structures – logic of forms – material and technology – chronological development of structures

Unit:2

Understanding and interpretation of structural behaviour – Lessons from nature, primitive structures, master builders – Design through new possibilities

Unit:3

Lessons from physical models – Experiments on buildings, towers and bridge models - Case studies on structures based on conceptual design

Unit:4

Role of materials in shaping the structural forms, systems and analysis - Light and slender systems – Role of analysis, construction technology in the evolution of structures

Unit:5

Conceptual design of structures (hands-on) – a footbridge – a railway bridge – a tensegrity tower – a stadium – a building.

References

1.Lecture notes of Professor Mike Schlaich on Conceptual and Structural Design,Technical University of Berlin

2.Jean-Paul Lebet, Manfred A. Hirt, Conceptual and Structural Design of Steel and Steel-concrete composite bridges, EPFL Press, 2013

3.Olga Popovic Larsen and Andy Tyas, Conceptual Structural Design bridging the gap between architects and engineers, Thomas Telford Publishing, 2003

4.GIAN course content by Professor Mike Schlaich on Conceptual and Structural Design,Technical University of Berlin

PE-VII (Prestressed Concrete Structures)

Course Code **L: T: P-3:0:0**

Rationale-

CLO1 To learn the principles, materials, methods and systems of prestressing

CLO2 To know the different types of losses and deflection of prestressed members

CLO3 To learn the design of prestressed concrete beams for flexural, shear and tension and to calculate ultimate flexural strength of beam

CLO4 To learn the design of anchorage zones, composite beams, analysis and design of continuous beam

CLO5 To learn the design of water tanks

Course Outcomes

CO1 Design a prestressed concrete beam accounting for losses

CO2 Design the anchorage zone for post tensioned members

CO3 Design prestressed composite members

CO4 Design prestressed continuous beams

CO5 Design prestressed water tanks

Course Content

Unit:1

Principles of prestressing - Materials of prestressing - Systems of prestressing - Losses in prestress – Analysis of members - Deflection of Prestressed Concrete members.

Unit:2

Slabs - Pre-tensioned and Post-tensioned beams - Design for flexure, bond , shear, and Torsion - IS code provisions - Ultimate flexural and shear strength of prestressed concrete sections – Transmission of prestress - Design of end anchorage zones using IS code method.

Unit:3

Composite beams - Analysis and design. Partial prestressing - non-prestressed reinforcements.

Unit:4

Analysis of Cantilever and Continuous beams - Cable layout - Linear transformation - Concordant cables.

Unit:5

Design of compression members and tension members. Special topics Circular prestressing - Water tanks - Pipes - Analysis and design - IS Codal provisions.

References

- Lin. T.Y., Burns, N.H., Design of Prestressed Concrete Structures, John Wiley & Sons,1982.
- RajaGopalan N. Prestressed Concrete, Narosa Publishing House, New Delhi, 2002.
- Raju K. N., Prestressed Concrete, McGraw Hill Education, 6th edition, 2018
- Nawy, E. G., Prestressed concrete a fundamental approach 4th edition, Pearson Education, Inc. New Jersery, US., 2003
- IS 1343: 2012. Prestressed concrete - code of practice, Bureau of Indian Standards (BIS), New Delhi, India., 2012

PE-VII (Advanced Reinforced Concrete Design)

Course Code **L: T: P-3:0:0**

Rationale-

CLO1: To understand the design concept of various structures and detailing of reinforcements

CLO2: To understand the design of underground and elevated liquid retaining structures

CLO3: To study the design of material storage structures

Course Outcomes

CO1: Apply the concepts of liquid retaining structures

CO2: Design material storage structures using various theories

CO3: Apply the concepts of environmental and transportation structures

CO4: Demonstrate the detailing of reinforcement

CO5: Draw the various RCC structures

Course Content

Unit:1

Earth Retaining structures - Retaining walls- types - cantilever and counterfort - design - drainage and other construction details.

Unit:2

Liquid Retaining structure - Water tanks - types - square, rectangular, circular - Design of underground and elevated tanks - design of staging - spherical & conical roof for circular tanks.

Unit:3

Material storage structures - Determination of lateral pressure on side walls of bunker - Rankine's theory - design of bunker - design of circular silo using Jansen's theory.

Unit:4

Environmental Structures - Chimneys - Principles and Design - Design of long columns.

Unit:5

Transportation structures - Bridges - Slab bridge - Design of single span slab bridge - Tee beam bridge - Design of Tee beam bridge with stiffness - Tee beam bridge with cross girders - Introduction to earthquake design.

Note: Assignments include the design and drawings of various RCC structures

References

- Vazirani, V.N., and Ratwani, Concrete Structures, Vol. IV, Khanna Publishers, New Delhi, 1995.
- Dayaratnam, P., Design of Reinforced Concrete Structures, Oxford & IBH Publishers & Co., New Delhi, 2005.
- Victor, D.J., Essentials of Bridge Engineering, Oxford & IBH Publishers Co., New Delhi,1991.
- Raju N. K., Advanced Reinforced Concrete Design, CBS Publishers and Distributors Pvt. Ltd., India, 2016
- Varghese P.C., Advanced Reinforced Concrete Design, PHI, India, 2nd Edition, 2010.
- IS456-2000 Code of practice for Plain and reinforced concrete code of practice.

PE-VII (Advanced Steel Structural Elements)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO1 Design eccentrically loaded compression members (Beam-Columns) and their base plates.

CO2 Design welded plate girder and Gantry girder for industrial structures

CO3 Calculate the wind load acting on various structures to be built in various locations.

CO4 Design Industrial structures and their components such as girts, wind girders, bracings systems purlins etc.

CO5 Design the moment resisting connections used in steel frames

Course Content

Unit:1

Introduction to beam-column - behavior - strength interaction - design of beam column - beam - column subjected to combined forces - column bases - slab base - gusseted base- moment resistant base plate.

Unit:2

Welded plate girders – analysis and design using IS800-2007 - curtailment of flange plates – stiffeners – Introduction to hybrid girders - analysis and design of gantry girder.

Unit:3

Design of industrial building - roofing, cladding and wall material - structural components and framing - types of roof trusses - components - wind load estimation for different type of structures for various zones.

Unit:4

Approximate analysis of industrial bents/PEB - design of purlins and wall girts using Channel and Angle sections; cold formed steel purlin – Design of wind bracings – wind girders – gable columns Analysis and design of framed connections.

Note: Assignments include the design and drawings of various steel structures

References

1. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi 2008.
2. Bhavikatti, S.S., Design of Steel Structures, I.K. International Publishing House Pvt. Ltd., New Delhi, 2010.
3. IS 800 - 2007, Code of practice for general construction in steel, Bureau of Indian Standards, New Delhi.
4. IS875 Part (3) - 1987, Code of Practice for Design Loads (other than earthquake) for buildings and structures: Wind loads. Bureau of Indian Standards, New Delhi.
5. SP6 (1) - 1964, IS hand book for structural Engineers. Bureau of Indian Standards, New Delhi

PE-VII (Advanced Structural Analysis)

Course Code **L: T: P-3:0:0**

Rationale-

CLO1: To teach the importance of conceptual design of structures in the development of civilization

CLO2: To make students interpret structural behaviour from nature and the evolution of structural forms

CLO3: To motivate students to make various physical models of structures and learn the development of structural forms

CLO4: To teach the role of materials in shaping the structural forms, systems and analysis

CLO5: To provide a hands-on experience to students on the conceptual design of structures

Course Outcomes

CO1: To understand the importance of conceptual design of structures

CO2: To interpret the structural behaviour from nature and the evolution of structural forms

CO3: To create physical models of structures and learn the development of structural forms

CO4: To learn the role of materials in shaping the structural forms, systems and analysis

CO5: To get a hands-on experience on the conceptual design of structures

Course Content

Unit:1

Influence lines - Maxwell Betti's theorem - Muller Breslau's principle and its application. Influence lines for continuous beams and single bay, single storey portals with prismatic members.

Unit:2

Analysis of plane truss with one or two redundants - trusses with lack of fit - Thermal stresses - Settlement of supports - Trussed beams.

Unit:3

Theory of arches - Analysis of three hinged, two hinged and fixed arches - influence lines, rib shortening, settlement and temperature effects.

Unit:4

Analysis of cables - Suspension bridges with three and two hinged stiffening girders - influence lines.

Unit:5

Analysis of multistorey frames for gravity and lateral loads by approximate methods - Substitute frame - Portal and Cantilever methods – Introduction to earthquake load

References

1. Punmia, B.C, Theory of Structures, Laxmi Publications, 2000.
2. Timoshenko, S.P.,Young, D.H., Theory of Structures, Tata McGraw Hill, 1983.
3. Wang. C.K., Intermediate Structural Analysis, International Text Book Co, 1983.
4. Hibbeler. R.C., Structural Analysis, Pearson Education (Singapore) Ptc. Ltd., Indian, Branch, 2002.
5. Moskvin V, Concrete and Reinforced Structures - Deterioration and Protection, Mir Publishers, Moscow, 1980.

PE-VII (Applied Hydraulics Engineering)

Course Code **L: T: P-3:0:0**

Rationale-

CLO1 To classify the types of flows in open channel and also to design open channel sections in a most economical manner.

CLO2 To study about non uniform flows in open channel and longitudinal slopes in open channel and also to learn about the characteristics of hydraulic jump.

CLO3 To develop an understanding of fluid flow patterns and learn to use boundary layer theory and Drag.

CLO4 To Provide insights to the Open channel hydraulics and introduce dimensional analysis for fluid flow problems.

CLO5 To understand the flow profiles and different methods of profile determination.

Course Outcomes

CO1 Acquire specific knowledge regarding fluid flow phenomena observed in Civil Engineering systems such as flow in open channel flow

CO2 Develop understanding of the basic principles of fluid flow patterns and boundary layer theory and provide skills in analyzing fluid flows in open channel hydraulics

CO3 Understand gradually varied flow profile in detail.

CO4 Understand rapidly varied flow profile in detail

CO5 Knowledge is useful for the design of open channels for rectangular and non-rectangular channels for hydraulic jump phenomena.

Course Content

Unit:1

Open channel flow and its classifications, and properties, energy and momentum principles, Critical flow computation and its applications, transitions with sub critical and super critical flows. Types and regimes of flow – Velocity distribution in open channel Wide open channel

Unit:2

Design of non- erodible channels for uniform flow, most efficient channel section, compound Sections. Velocity measurement – Manning's and Chezy's formula – Determination of roughness coefficients – Determination of normal depth and velocity. Gradually varied flow: Theory and analysis, gradually-varied flow computations in prismatic channels, gradually varied flow in non-prismatic channels. Characteristics of flow profiles.

Unit:3

Draw down and back water curves – Profile determination – Graphical integration, directstep And standard step method – Flow through transitions

Unit:4

Rapidly varied flow- Theory of hydraulic jump, evaluation of jump elements in rectangular and non-rectangular channel, location of jump on horizontal floor, channel controls and transition – surges

Unit:5

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

References

1. Streeter, V.L. Fluid Mechanics, Tata McGraw Hill, 1998.
2. Chow, V.T. Open Channel Hydraulics, Tata McGraw Hill, 1975.
3. Nagaratnam, S. Fluid Mechanics, Khanna Publishers, 1989.
4. Chaudhry, M and Hanif. Open Channel Flow. Englewood Cliffs, NJ: Prentice- Hall, 1993.
5. Chanson, H (2004b).The Hydraulics of Open Channel Flow-An Introduction, (Butterworth-Heinemann, Oxford, UK) 2ndEdition (ISBN 07506 59785).

PE-VII (Simulation Modelling for Water Resources Engineering)

Course Code **L: T: P-3:0:0**

Rationale-

CLO1 To build on the student's background in basics of simulation modelling.

CLO2 To develop the skills in modelling of linear and nonlinear regression.

CLO3 To learn about dynamic programming techniques for water allocation and

distribution networks.

CLO4 To develop skills in the artificial intelligence tools such as fuzzy systems, neural networks and genetic programming.

CLO5 To provide wide knowledge on optimization tools.

Course Outcomes

CO1: Incorporate skills in developing models for various systems.

CO2: Acquires knowledge on fundamentals of regression techniques.

CO3: Develops and improves the knowledge of dynamic programming and stochastic programming.

CO4: Apply neural networks and genetic algorithms for solving complex problems using AI techniques.

CO5 Provides basic knowledge on fuzzy system and optimization tools.

Course Content

Unit:1

Introduction – Concepts of systems and systems Analysis; Systems Techniques in Water Resources: Optimization with methods using calculus. Regression – linear regression - multiple regression – non linear regression – types – modelling concepts – Probabilistic functions in hydrology- Monte Carlo simulation - Linear Programming- simplex method – dual simplex method - graphical method.

Unit:2

Dynamic programming – forward recursion – backward recursion – water allocation problem – shortest path algorithm – water distribution network – stochastic dynamic programming.

Unit:3

Artificial Intelligence – Neural networks – concepts – back propagation – bias, neuron, weights - radial basis function – case studies – Genetic algorithm – ANN- basics.

Unit:4

Optimization tool- roulette wheel selection – mutation – crossover- case studies Reservoir optimization – Fuzzy inference system – Fuzzy linear programming.

References

- Chintalacheruvu Madhusudana Rao, Advanced Modelling and Innovations in Water Resources Engineering, Volume 176 of Lecture Notes in Civil Engineering, Springer Nature, 2021
- Richard H. McCuen, Hydrologic Analysis and Design, Pearson Education, 2016
- Russell & Norvig, Artificial Intelligence: A Modern Approach, Global Edition, 4, Pearson Higher Ed, 2021
- Dimitri Bertsekas, Dynamic Programming and Optimal Control: Volume II; Approximate Dynamic Programming, Athena Scientific, 2012
- Terano, Asai & Sugeno Applied Fuzzy Systems, Academic Press, 2014.

PE-VII (Coastal Engineering)

Course Code **L: T: P-3:0:0**

Rationale-

CLO1 To provide basic knowledge on two dimensional wave equation

CLO2 To describe the various types of wave theories.

CLO3 To study the effect of wave loads on different coastal structures

Course Outcomes

CO1 Develop knowledge in basics of wave hydrodynamics

CO2 Provides understanding various aspects of coastal engineering

CO3 Describes wave forces, wave pressures and currents in the coastal areas.

CO4 Improves knowledge on sea defence structures

CO5 Develop knowledge in basics of wave hydrodynamics

Course Content

Unit:1

Basic Fluid Mechanics: Conservation of mass and momentum, Euler Equation, Bernoullis equation, potential flow, stream function. Waves: Classification of water waves – Two dimensional wave equation and wave characteristics.

Unit:2

Indian Scenario – Classification of Harbours. Introduction - wind and waves – Sea and Swell - Introduction to small amplitude wave theory – use of wave tables- Mechanics of water waves – Linear (Airy) wave theory, Introduction to Tsunami

Unit:3

Wave theories - Small amplitude waves – Finite amplitude waves - Stoke, Solitary and CnoidalWater particle kinematics - wave refraction; wave breaking; wave diffraction random

Unit:4

and 3D waves- Short term wave analysis – wave spectra and its utilities - Long term wave analysis- Statistics analysis of grouped wave data – Currents: Classification - Behaviour - Design Criteria, Scour and other effects of currents

Unit:5

Dynamic beach profile; cross-shore transport; along shore transport (Littoral transport), sediment movement – Estuaries – Creek – Harbour – Littoral drift.

Field measurement; models, groins, sea walls, offshore breakwaters, artificial beach nourishment - planning of coast protection works - Design of shore defense structures Case studies.

References

1. Subratakumar Chakrabarti, Handbook of offshore engineering, Volume 1, Elsevier, 2005
2. Coastal, Estuaries and Harbour Engineer's reference book, Michael Abbott, W Alan Price, CRC Press, 1993
3. Coastal Engineering Manual, U. S. Army Corps of Engineers, Books Express Publishing, 2012
4. Mani J.S, Coastal Engineering, Second Edition, PHI Learning Pvt. Ltd., 2018
5. Leo H. Holthuijsen, Waves in Oceanic and Coastal Waters, Cambridge University Press, 2007

PE-VII (Basic Bridge Engineering)

Course Code **L: T: P-3:0:0**

Rationale-

CLO1: To learn the components of bridges, classification of bridges, importance of bridges

CLO2: To study the specification of road bridges, loads to be considered

CLO3: To familiarize students with various types of concrete bridges such as slab-bridge, T beam bridge

CLO4: To familiarize students with various types of steel bridges such as truss bridge and girder bridge and also railway bridges by IRS loadings

CLO5: To get exposure the substructure of bridge substructures and the evaluation and importance of bearings

Course Outcomes

CO1 To be familiar with the components of bridges, classification of bridges, importance of bridges

CO2 To understand the specification of road bridges, loads to be considered

CO3 To be familiar with various types of concrete bridges such as slab-bridge, Tbeam bridge, prestressed concrete bridge

CO4 To be familiar with various types of steel bridges such truss bridge and girder bridge

CO5 To get exposed to evaluation of sub structures, type of foundations, importance of bearings

Course Content

Unit:1

Components of Bridges - Classification - Importance of Bridges - Investigation for Bridges - Selection of Bridge site - Economical span - Choice of bridge type.

Unit:2

Specification of road bridges - width of carriageway - loads to be considered - dead load - IRC standard live load and IRS loading - Impact effect.

Unit:3

General design considerations - Concrete bridges - Slab Bridge - Design of T - beam bridge (superstructure only)

Unit:4

Steel bridges - truss bridge - plate girder bridge (superstructure only)

Unit:5

Importance of Bearings - Bearings for slab bridges - Bearings for girder bridges - Electrometric bearing - Joints - Expansion joints - substructure (theory only): piers, pier caps, types of foundations, piles and pile caps.

Note: Assignments include the design and drawings of bridge superstructures.

References

1. Ponnuswamy, S., Bridge Engineering, Tata McGraw –Hill, New Delhi, 1997

2 Victor, D. J., Essentials of Bridge Engineering, Oxford andIBH Publishers Co., New Delhi, 1980

3 N. Rajagopalan, Bridge Superstructure, Narosa Publishing House, New Delhi, 2006.

4 Rangwala, Bridge Engineering, Charotar Publication, Anand, India, 2015

5 Raju N. K., Design of Bridges, Oxford andIBH Publishers Co., New Delhi, 2019

PE-VII (Advanced Mechanics of Solids)

Course Code **L: T: P-3:0:0**

Rationale-

CLO1 To learn the elastic and plastic behaviour of materials

CLO2 To understand principal stresses and Mohrs circles in 3D

CLO3 To get exposed to unsymmetrical bending of beams

CLO4 To familiarize with the analysis of curved beams

CLO5 To know the fundamentals of vibration and resonance

Course Outcomes

CO1 Characterize the elastic and plastic behaviour of materials

CO2 Draw Mohrs circle for 3D stress states

CO3 Find the stresses and deflections in unsymmetrical loaded beams

CO4 Find the stresses and deflections in curved beams

CO5 Solve fundamental problems in vibrations of SDOF systems

Course Content

Unit:1

Mechanical Properties of Materials - Stress-Strain Diagrams- Elastic and Plastic Deformation - Brittle and Ductile Failures of Materials - Mechanical Tests like Surface Hardness, Fatigue, Creep etc.

Unit:2

Principal stresses in a 3D field.- Computation -Mohr's Circle - Lame's Ellipsoid. Theories of failure - Criteria for Failure - Different failure theories for ductile and brittle materials. Equivalent bending and twisting moments.

Unit:3

Unsymmetrical bending- Properties of unsymmetrical sections- Stresses and deflection due to unsymmetrical bending

Unit:4

Shear Centre - Concept and significance - Shear flow for thin walled open sections Location of shear centre for singly symmetric sections.Stresses in curved flexural members-Winkler Bach Formula - Crane hooks - rings and links.

Unit:5

Fundamentals of vibration - free vibration of single degree of freedom systems - Undamped and damped free vibration with different types of damping.- Resonance-Harmonic response of single degree of freedom systems with and without damping.

References

- 1 L S Srinath, Advanced Mechanics of Solids, Tata McGraw Hill, 2017
- 2 A. P. Boresi, R. J. Schmidt, Advanced Mechanics of Materials, Wiley, 2021
- 3 A. P. Boresi, K. P. Chong, Elasticity in Engineering Mechanics, Wiley-Interscience, 2000.

OE-II (Building Technology)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO-1 Apply basic principles to develop building plans

CO-2 Identify general and special requirements for planning and design

CO-3 Identify different prefabricated building components

CO-4 Comprehend application of different construction equipment and technologies

Course Content

Unit:1

Building planning: Types of Buildings – components, definitions, economy and design, Principles and aspects of building planning, Definitions and importance of Grouping and circulation; Lighting and ventilation; Sustainability and Green Buildings.

Unit:2

General requirements: Requirements for safety against fire, termite, damping, earthquakes, Vertical transportation in building – planning of vertical transportation, Stairs, different forms of stairs, Other modes of vertical transportation.

Unit:3

Special Requirements: Air conditioning – process and classification of air conditioning, Dehumidification. Systems of air-conditioning, ventilation, functional requirements of ventilation. Thermal insulation. Acoustics, effect of noise, properties of noise and its measurements, Principles of acoustics of building. Sound insulation.

Unit:4

Prefabrication systems: Prefabricated walls, openings, cupboards, shelves etc., planning and modules and sizes of components in prefabrication. Plumbing services – water supply system, maintenance of building pipe line, Sanitary fittings, Design of building drainage.

Unit:5

Construction Equipment: Introduction and Planning for construction Equipment, Earthmoving and Excavating equipment, Pile driving equipment, Lifting and Concreting Equipment.

Learning Resources:

Text Books:

1. Punmia B. C., Jain A.J., and Jain A.J., Laxmi, Building Construction, Publication, 2016, Eleventh Edition.

2. Arora S. P., and Bindra S. P., The Text book for Building Construction, Dhanpat Rai Pubications, 2010.

Reference Books:

- Varghese P.C., Building Construction, PHI Learning Pvt. Ltd., 2017, 2nd Edition.
- Robert P., Clifford J. S., and Aviad S., Construction Planning, Equipment and Methods, McGrawHill Education, 2010
- Other suggested Readings:
- https://nptel.ac.in/courses/105/103/105103206/
- https://nptel.ac.in/courses/105/102/105102175/

OE-II (Environmental Management)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO-1 Comprehend the need for Environmental Management

CO-2 Identify the attributes of Environment Management system and standards

CO-3 Apply different methodologies for impact assessment

CO-4 Identify the techniques and control measures for Environment management

Course Content

Unit:1

Introduction to Environmental Management: Scope and nature of Environment Management. Its need and brief discussion on the ethical, legal and financial reasons for Environment Management, the framework and approach to develop Environment management system. Policies and legal aspect in India.

Unit:2

Environment management system (EMS) standard: Guideline to implement effective Environment management system, core element of EMS, EMS standard: ISO 14000, its evolution, principle and specification, benefit of EMS. Planning and its implementation, Comparison of other standards with ISO 14000.

Unit:3

Environmental Impact Assessment: EIA definition, its need and principle, scoping, screening and the baseline condition, different methodologies, Impact identification and decision making. EIA case studies in India.

Unit:4

Environment management plan: Planning and identification of baseline condition and impact, monitoring and evaluation of risk, mitigation plan, legislation and environmental audit, disaster management plan, Life cycle assessment and risk analysis.

Unit:5

Environmental management techniques and control measure: Environmental monitoring, modelling and risk assessment. Implementation of sustainable design, control measure for different environment pollution such as air pollution, water pollution, soil and noise pollution.

Learning Resources:

Text Books:

1. Iyyanki V. Muralikrishna and Valli Manickam, Environmental management: Science and Engineering for Industry, Butterworth-Heinemann, 2017.

2. Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations, Second Edition, NSF International, Ann Arbor, Michigan, January 2001

Reference Books:

- Harry W. Canter, Environmental Impact Assessment, McGraw Hill, 1996, 2nd edition.
- Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., New York, 1996.
- Anjaneyulu.Y., and Manickam. V., B.S. Environmental Impact Assessment Methodologies, Publications, Hyderabad, 2007.
- Wathern.P., Environmental Impact Assessment- Theory and Practice, Routledge Publishers, London, 2004.
- ISO 19011: 2002, "Guidelines for quality and/or Environmental Management System auditing, Bureau of Indian Standards, New Delhi, 2002 Paul L Bishop 'Pollution Prevention: Fundamentals and Practice', McGraw- Hill international, Boston, 2000.

Other suggested Readings:

- MEVE-001: Environmental Impact Assessment for Environmental Health - Course (swayam2.ac.in)
- 120108004.pdf (nptel.ac.in)
- environmentclearance.nic.in/writereaddata/Form-1A/HomeLinks/ommodel2.html
- environmentclearance.nic.in/writereaddata/Form-1A/HomeLinks/ommodel3.html
- https://nptel.ac.in/courses/120/108/120108004/

OE-II (Indoor and Ambient Air Quality Management)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO-1: analyze the sources, effects and control measures of environmental air pollution

CO-2: analyze air quality parameters and its impact

CO-3: recognize air pollution measurement methodology

CO-4: apply the concept of Exhaust system for better IAQ

CO-5: identify the Control devices related to air pollution

Course Content

Unit-1 - Introduction

Hazard vs. risk; Concentrations of air pollutants; Fundamentals of contaminant mixture the respiratory system: Anatomy of the lungs, modeling gas exchange, diseases; Body burden;1st order system

Unit-2 - Design Criteria

Contaminant concentration limits; Fire and explosion; Hearing and sound; Heat stress; Odor Pollutant emission rates: Physical measurements, flux chambers, mass balances, emission factors. Diffusion Evaporation: Evaporation from liquid surfaces, evaporation in confined spaces, thermodynamics of evaporation

Unit-3 - Ventilation

General ventilation: Dilution vs. displacement ventilation; The well-mixed model: sources, wall losses, recirculation, air cleaners, infiltration and exfiltration, various room configurations; Clean rooms; Effectiveness of ventilation systems; Heating and cooling costs; Ventilation in tunnels Local ventilation: Hood design, bulk materials, proper selection and design of hoods, buoyant plumes, canopy hoods, air curtains. Air cleaners in series and parallel

Unit-4 - Exhaust Duct System Design

Energy equation, major and minor losses, fan performance curves, fan selection (matching fan to duct system requirements) 13 Particulate air pollution: Particle sizes/classifications/terminology; Aerodynamic drag and drag coefficient, particles settling in quiescent air (gravimetric settling - terminal settling speed); Equations of particle motion and particle trajectory calculations in an air flow, using Runge-Kutta to predict 2-D particle trajectories; Non-spherical particles - equivalent diameters; Gravimetric settling in rooms and ducts; Inertial separation in curved ducts

Unit-5 - Air Pollution Control Devices

(APCSs): Lapple cyclones and other APCSs; Performance and efficiency of APCSs; Series and parallel APCSs for particle removal; Filters Control of particulates. Cyclones. Scrubbers. Electrostatic precipitators. Baghouse filters. Control of gases. Absorption. Wet scrubbers and packed scrubbers. Flue gas desulfurization. Adsorption. Incineration. Carbon sequestration.

Learning Resources

1. Mukherjee, “Environmental Pollution and Health Hazards”, causes and effects, 1986

2. Kenneth wark, Cecil F.Warner, “Air Pollution its Origin and Control”, Harper and Row Publishers

3. Noel De Nevers, “Air pollution control Engineering”, McGraw Hill International Edition

4. M. N. Rao, H. V. N. Rao, Air pollution, Tata McGraw Hill Pvt Ltd, New Delhi, 1993.

OE- II (Intelligent Transportation Systems)

Course Code **L: T: P-3:0:0**

Rationale-

CLR-1: know the fundamentals of road traffic and its features

CLR-2: understand the importance of telecommunication and data collection of ITS

CLR-3: learn the various functional areas of ITS

CLR-4: know the user specific ITS implementation

CLR-5: explore the ITS applications globally

Course Outcomes

CO-1: define the fundamentals of road traffic and features

CO-2: assess the telecommunication requirements and data collection of ITS

CO-3: demonstrate the functional areas of ITS

CO-4: disseminate the implementations of ITS for various user needs and services

CO-5: interpret the global applications of ITS

Course Content

Unit-1

Road user and vehicle characteristics, Basic road geometric elements, Fundamental parameters and relations, Measurement at a Point (Volume data collection and analysis, PCU, PHF etc.), Measurement over a Short Section (Speed data collection and analysis), Measurement along a Length of Road (Density and travel time measurement and analysis), Moving Observer Method, Traffic forecasting and growth studies, Parking and Accident data analysis methods

Unit-2

Introduction to Intelligent Transportation Systems (ITS) – Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS - Importance of telecommunications in the ITS system, Information Management, Traffic Management Centres (TMC). Application of sensors to Traffic management; Traffic flow sensor technologies, ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI),

Geographic Information Systems (GIS), video data collection. Vehicle – Road side communication – Vehicle Positioning System

Unit-3

Advanced Traffic Management Systems (ATMS), Advanced Traveller Information Systems(ATIS) - Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS) - Advanced Public Transportation Systems (APTS) - Advanced Rural Transportation Systems (ARTS)

Unit-4

Travel and Traffic management - Public Transportation Management - Electronic Payment - Commercial Vehicle Operations - Emergency management - Advanced Vehicle Safety systems, Information management

Unit-5

Automated Highway Systems, vehicles in platoons - Integration of Automated Highway Systems, a case study - ITS programs globally - Overview of ITS implementations in developed countries, ITS in developed countries - Case studies

Learning Resources

1. Sussman, J. M., “Perspective on ITS”, Artech House Publishers, 2005.

2. Intelligent Transport Systems, Intelligent Transportation Primer, Washington, US, 2001

3. Choudury M A and Sadek A, “Fundamentals of Intelligent Transportation Systems Planning” Artech House. 4. Kadiyali, L. R. (1987), “Traffic Engineering and Transportation Planning”, Khanna Publishers, India

5. US Department of Transportation, “National IT’S Architecture Documentation”, 2007 (CDROM). 6. Cycle W.Halsapple and Andrew B.Winston, "Decision Support Systems – Theory and Application“, Springer Verlog, New York, 1987.

OE-II (Traffic Management Systems)

Course Code **L: T: P-3:0:0**

Rationale-

CLR-1: study the traffic flow parameters

CLR-2: explore the traffic flow management techniques

CLR-3: know the intersection control measures

CLR-4: learn the parking systems and management

CLR-5: understand the public transportation systems

Course Outcomes

CO-1: Determine the traffic flow parameters for traffic management

CO-2: Apply the various measures of managing the traffic

CO-3: Adopt the control measure at the intersections

CO-4: Determine the parking characteristics and apply the management techniques

CO-5: Design the public transportation management system

Course Content

Unit-1

Urban Road Systems - Highway System Classification, Types of Transportation Facilities - Traffic Flow Theory - Time Space diagram, Variables of Interest - Primary Elements of Traffic Flow, Flow Speed Density, Fundamental Diagram of Traffic Flow, Mathematical Relationships Describing Traffic Flow - Volume Studies, Traffic Counts, travel Time and Delay Studies, Spot Speed Studies, Capacity and Level of Service for Highway Segments.

Unit-2

Introduction, Travel demand management - Traffic management measures, Restrictions to turning movements, one way streets, tidal flow operations, Traffic segregation, Traffic calming, conflict point diagram for various types of streets

Unit-3

Objectives, Demand management, Engineering measures, Junction types(Uncontrolled non-priority junctions, Priority junctions, Channelization, Roundabouts, Traffic signals, Grade separation), Road markings, Traffic Signs

Unit-4 - Parking Systems and Management

Traffic and parking problems, Types of Parking Facilities, Ill effects of parking, Definitions of Parking Terms, Methodology of Parking Studies, Analysis of Parking Data, Zoning and parking space requirement standards, Design standards for on street parking, Off street parking facilities, Peripheral parking system, Parking control systems.

Unit-5

Design objectives, Bus priority measures, Bus lanes and busways, and parking management measures, Bus stop improvements, Exclusive bus lanes systems, Bus Preemption at signals, encouraging car pooling.

Learning Resources

1. Dr. Kadiyali L. R., Traffic Engineering and Transport Planning, Khanna Publishers
2. Khanna S.K., Justo C.E.G., Highway Engineering, Nem Chand & Bros., Roorkee.
3. Bindra S.P., A course in Highway Engineering, Dhanpat Rai Publications
4. Martin Whol, Brian V Martin , Traffic system Analysis for Engineers and Planners, McGraw Hill, NY, 1967
5. IRC-SP -12 2015 Parking facilities in Urban Roads
6. IRC 65 - 1976 Traffic Rotaries
7. IRC 93 - 1985 Design & Installation of Road Traffic Signals.

OE-II (Traffic Flow Modeling And Simulation Techniques)

Course Code **L: T: P-3:0:0**

Rationale-

CLR-1: understand various traffic stream parameters and data collection methods

CLR-2: study the traffic control measures and LOS analysis

CLR-3: explore the traffic stream modeling

CLR-4: know the various methods and techniques of simulation

CLR-5: learn the validation of simulation models with case studies

Course Outcomes

CO-1: Evaluate the traffic stream characteristics

CO-2: Analyse the traffic control measures

CO-3: Develop the traffic stream models

CO-4: Simulate traffic at mid blocks and intersections

CO-5: Apply the techniques of calibration and validation of models

Course Content

Unit:1

Traffic Stream Characteristics: Road user and vehicle characteristics, Fundamental parameters and relations, Measurement at a Point (Volume data collection and analysis, PCU, PHF etc.), Measurement over a Short Section (Speed data collection and analysis), Measurement along a Length of Road (Density and travel time measurement and analysis), Moving Observer Method, Traffic forecasting and growth studies.

Unit: 2

Traffic Analysis and Management: Basics of traffic management, Principles of Traffic Control and Traffic Signs, Road Markings and Channelization, Uncontrolled Intersection: Gap acceptance and capacity concepts, Uncontrolled Intersection, Traffic Rotaries and Grade Separated Intersection. Capacity and Level of Service concepts, Queuing models and applications. Traffic Signal,

Evaluation of a Traffic Signal: Delay Models, Capacity and LOS Analysis of a Signalized, Coordinated Traffic Signal, Vehicle Actuated Signals and Area Traffic Control.

Unit: 3

Traffic Stream Modelling: Traffic Stream Models, Modelling vehicle arrivals: Continuous distributions to model Headways and speed, Modelling vehicle arrivals: Discrete distributions to model flow and evaluation of distributions, Car Following Models: Linear models, Car Following Models: Non-linear models, Lane Changing Models, Microscopic Traffic Simulation (Vehicle generation, model frame work, calibration and validations, statistical error analysis, applications)

Unit: 4

Simulation Methodologies: Monte Carlo method, Generation of Pseudorandom Numbers, Discrete Random deviates - Simulation methods, Fundamentals of simulation, Introduction to factorial experimental designs, Fractional factorial design - Components of traffic simulations models, vehicle arrival and movement models, mixed traffic flow simulation, Simulation model development strategies - Study of large scale simulation models; Scanning Technique; Time based and Even-based methods - Examples of Macro, Meso, and Microscopic based simulation models.

Unit: 5

Calibration and Validation of Simulation of Models: Simulation scenario evaluation, Number of runs and factors influencing simulation output, Calibration and validation definitions, methodology for calibrating and validating a microscopic traffic simulation model. Calibration and validation guidelines, data requirements, Goodness-of-fit measures - Case studies of application of simulation for various transportation engineering problems.

Learning Resources

- Kadiyali,L.R.(1987),“Traffic Engineering and Transportation Planning”,Khann Publishers, India.
- Banks, J; Carson, JS; Nelson, B.L. Discrete-event system simulation. 5th ed. Upper Saddle
- Drew, DR., Traffic flow theory and control, McGraw Hill Book Company, 1976.
- May, A.D. Traffic Flow Fundamentals, Prentice Hall, 1st Edition, 1990.
- Fred L. Mannering, Scott S. Washburn, Kilareski Walter P., Principles Of Highway Engineering And Traffic Analysis, Wiley India Pvt Ltd., 4th edition, 2011.
- Highway Capacity Manual, Transportation Research Board, Washington, D.C., 2010.
- Kadiyali, L.R, "Traffic Engineering and Transport Planning", Khanna Publishers, Delhi,2006.

OE-II (Viscoelasticity)

Course Code **L: T: P-3:0:0**

Rationale-

CLR-1: understand the concepts of linear viscoelasticity

CLR-2: explore different models to model the behavior of linear viscoelastic materials

CLR-3: comprehend the relation between linear viscoelastic material functions

CLR-4: explore different experimental approaches to characterize the behavior of viscoelastic material

CLR-5: know the correspondence principle and it application towards studying the behavior of viscoelastic material

Course Outcomes

CO-1: discriminate the viscoelastic material based on it response to different loading conditions

CO-2: apply different models to the material that exhibits linear viscoelastic behavior

CO-3: analyze the relation between viscoelastic characteristic functions

CO-4: characterize the mechanical properties of the viscoelastic material

CO-5: apply basic principles to models the behavior of viscoelastic material

Course Content

Unit: 1 Linear Viscoelastic Behavior

Introduction to Viscoelasticity - Review of the structure of viscoelastic materials - Linear viscoelastic behavior, Creep, recovery, relaxation and oscillatory shearing

Unit: 2

Constitutive Equations: Constitutive equations using mechanical analogs - Maxwell model, Kelvin model, standard linear solid and Burgers' model, generalized models, Integral models,

Unit: 3

Relation Between Viscoelastic Functions : Boltzmann Superposition Principle - Creep compliance, relaxation modulus, complex modulus, phase lag – Relation between different functions.

Unit: 4

Mechanical Characterization of Viscoelastic Material: Time-temperature superposition, WLF and Arrhenius equation - Mechanical characterization of viscoelastic materials and experimental Investigation

Unit: 5

Correspondence Principle: Viscoelastic beam problems - elastic-viscoelastic correspondence principle - Effect of pressure and temperature.

Learning Resources

- A.S. Wineman and K. R. Rajagopal, Mechanical Response of Polymers: An Introduction, Cambridge University Press, 2000.
- M. T. Shaw and W. J. MacKnight, Introduction to Polymer Viscoelasticity, 3rd Ed., Wiley Interscience, 2005.
- E. Riande, R. Diaz-Calleja, M. G. Prolongo, R. M. Masegosa, C. Salom, Polymer viscoelasticity, CRC Press, 1999
- W. N. Findley, J. S. Lai and K. Onaran, Creep and Relaxation of Nonlinear Viscoelastic Materials, Dover, 1989.
- A.C. Pipkin, Lectures on Viscoelasticity Theory, 2nd Ed., Springer, 1986
- R. M. Christensen, Theory of Viscoelasticity, Dover, 2nd Ed., 1982
- J. D. Ferry, Viscoelastic Properties of Polymers, 3rd Ed., Wiley, 1980.

OE-II (SOIL SCIENCES)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO-1: gain a thorough knowledge on the characterization and management of soil structure

CO-2: recommend the concept of ion exchange process in the soil chemistry

CO-3: apply the soil classification, mineralogy and soil maps for the Indian scenario CO-4: demonstrate efficient soil conservation techniques

CO-5: illustrate the geomorphology of soil condition in India

Course Content

Unit-1

Scope of soil physics and its relation with other branches of soil science; soil as a three phase system - Soil texture, textural classes, mechanical analysis, specific surface - Soil consistence; dispersion and workability of soils; soil compaction and consolidation; soil strength; swelling and shrinkage - Basic concepts - Soil structure - Genesis, types, characterization and management soil structure; Soil aggregation, aggregate stability.

Unit-2

Chemical (elemental) composition of the earth's crust and soils - Soil colloids: inorganic and organic colloids - Origin of charge, concept of point of zero-charge (PZC) and its dependence on variable - Charge soil components, surface charge characteristics of soils; diffuse double layer theories of soil colloids, zeta potential, stability, coagulation/flocculation of soil colloids - Ion exchange processes in soil; cation exchange- theories based on law of mass action - Chemistry of acid soils - Chemistry of salt-affected soils .

Unit-3

Classification, structure, chemical composition and properties of clay minerals; genesis and transformation of crystalline and non-crystalline clay minerals; identification techniques; amorphous soil constituents and other non-crystalline silicate minerals and their identification; clay minerals in Indian soils - Soil classification, soil mineralogy and soil maps - Usefulness.

Unit-4

Soil conservation planning; land capability classification; soil conservation in special problem areas such as hilly, arid and semi-arid regions, waterlogged and wet lands - Watershed management - concept, objectives and approach; water harvesting and recycling; flood control in watershed management; socio- economic aspects of watershed management; case studies in respect to monitoring and evaluation of watersheds; use of remote sensing in assessment and planning of watersheds.

Unit-5 -

Soil biota, soil microbial ecology, types of organisms in different soils; soil microbial biomass; microbial interactions; unculturable soil biota - General introduction to geology and geochemistry, major and minor morphogenic and genetic landforms, study of schematic landforms and their elements with special reference to India.

Learning Resources

1. Baver LD, Gardner WH & Gardner WR. 1972. Soil Physics. John Wiley & Sons.
2. Bolt GH & Bruggenwert MGM. 1978. Soil Chemistry. Elsevier.
3. McBride MB. 1994. Environmental Chemistry of Soils. Oxford Univ. Press.
4. Indian Society of Soil Science 2002. Fundamentals of Soil Science. ISSS, New Delhi.
5. Hudson N. 1995. Soil Conservation. Iowa State Univ. Press.
6. Alexander M. 1977. Introduction to Soil Microbiology. John Wiley & Sons.
7. Brikland PW. 1999. Soils and Geomorophology. 3rd edition. Oxford Univ. Press

OE-II (Rural Development And Technology)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO-1: describe the various dimensions of rural developments

CO-2: develop a solutions for reducing waste and make waste product into useful resources

CO-3: apply multidisciplinary approaches in Public Health practice

CO-4: acquire knowledge on policies, schemes and programs for the development of rural community

CO-5: implement practical solutions for managing unemployment issues through entrepreneurship

Course Content

Unit:1

Basic introduction about rural development- History of Rural development- Rural Settlement of UBA Villages Analysis (Practically in the field) * - concept for Rural Settlements- Types of Rural Settlements and its significance- Land use pattern Analysis of UBA Villages (Practically in the field) *- The function and pattern of rural settlements - Rural Settlement analysis- Technological Intervention in Rural Settlement Practically in Lab

Unit-2

Different energy sources in rural areas- Biomass based energy systems - Assessment of Waste in the University Campus (Practically in the field) * - concepts of pyrolysis and its types - concepts of pyrolysis and its types - Pyrolysis technology and waste management technique- Biomass methodologies (Practically in the field) *- Bio gas and its uses- Biogas production using various substrates including MSW and industrial wastes - Various Digesters and Its Materials (Practically in the field) *

Unit-3

Rural Water Supply and Sanitation current status - National and State level programme of RWS-Sanitation practices and strategies of Rural UBA Villages (Practically in the field) *- The Basic principles of rural water supply and sanitation - sewage collection and treatment - Hygiene practices at Workplace (Practically in the field) * - Identification of shortcomings for potential improvement - The Latest developments in rural water supply and sanitation practices - Campaign and Concept of 3 R (Practically in the field) *

Unit-4

Rural Development Legislations and Policies in India - CSR Policy - Policy Framework for rural community and development (Practically in the field) * - Implementation program or plan in Rural development - National Rural Livelihood Mission - Analysis of various Govt. Schemes and Policies (Practically in the field) * - Community Based Natural Resources Management (CBNRM) - Integrated Natural Resources Management (INRM), PMGSY, PMAY - Implementing Rural Employment Schemes in UBA Villages (Practically in the field) *

Unit-5

Entrepreneurship Evolution of Entrepreneurship in Rural India - Types of Rural Entrepreneurship - Practicing Business environment in the rural villages (Practically in the field) * - Challenges for Rural Entrepreneurs - Social and Political Aspects of Rural Development - Networking with all Rural Support Systems(Practically in the field) * - Entrepreneurial Opportunities-Potential and Limitations Active - Rural infrastructure development - Development of Cultural Integrity in Rural Entrepreneurship (Practically in the field) * *Practical exposure will be given to the students on the specified topics

Learning Resources

1. U. C. Sharma, Non-Conventional Sources of Energy, Studium Press LLC, USA, 2014.

2. S. Gupta, Rural Water Supply and Sanitation, Vayu Education of India, New Delhi, 2013.

3. M.C. Dash, Concepts of Environmental Management for Sustainable Development Publisher: I K International Publishing House Pvt. Ltd., 2013.

4. G.Shivakoti, U. Pradhan, H. Helmi (editors), Redefining Diversity and Dynamics of Natural Resources Management in Asia, Volume 1st Edition, Sustainable Natural Resources Management in Dynamic Asia, Editors: ISBN: 9780128054543, Elsevier, 2016.

5. P.Rogers, K. F. Jalal, J. A. Boyd, an Introduction to Sustainable Development. Publisher: Routledge; 1 edition, ISBN-10: 1844075206, 2007

OE-III (FLOODS AND FLOOD MANAGEMENT)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO-1: estimate design floods and flood flows

CO-2: appraise flood routing and flood control

CO-3: design various flood control structures

CO-4: analyze and design earthen embankments

CO-5: analyze stability of slopes and foundation

Course Content

Unit-1

Floods and Flood Estimation: Definition and causes of floods, design flood, SPF, PMF and its importance - Estimating design flood and flood flows - Envelop curves - Methods of flood frequency - Flood frequency studies - Unit hydrograph method - DAD analysis

Unit-2

Flood Forecasting and Flood Routing: Flood forecasting, need, problems and limitations - River forecasting procedure - Flood forecasting methods - Flood routing - Reservoir routing - Channel routing, Muskingham method - Flood control, structural and non-structural measures for flood control

Unit-3

Flood Control Structures: Gully control structures, temporary check dams - Permanent structures for gully control - Design of chute spillway, design of drop inlets - Ravine reclamation - Control and training of rivers - Objectives, classification, methods of river training - Marginal embankments - Guide banks - Groynes

Unit-4

Earthen Embankments: Types and methods of construction - Foundation design – Grouting - Seepage through embankments- Flownet and its properties - Seepage line in composite earth embankments - Drainage filters, piping and its causes - Design of earth dams

Unit-5

Stability Analysis: Stability analysis of slopes, stability of foundation against shear - Small earthen embankments - Subsurface dams, site selection and constructional features - Planning of flood control projects and their economics.

Learning Resources

1. Mutreja K. N. 1986, Applied Hydrology, Tata McGraw-Hill Publishing Co, Delhi.

2. Subramanya K., 2008, Engineering Hydrology, 3rd Edi., Tata McGraw-Hill Publishing Co., Delhi

3. Garg S.K., 2009, Irrigation Engineering and Hydraulic Structures, Khanna Publishers Pvt. Ltd, New Delhi.

4. Murthy, V.V.N. 2002, Land and Water Management Engineering, 4thEdi., Kalyani Publishers, New Delhi.

OE-III (Climate Change And Water Resources Management)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO-1: identify the components of climate system ad greenhouse effect

CO-2: disseminate the impacts of climate change in Indian and Global scenarios

CO-3: recognize the usage of tools to prepare different models

CO-4: illustrate bio energy crops, hydro power and crop land management 3 -

CO-5: solve the real time issues by adapting different strategies

Course Content

Unit-1

The Climate System: Definitions- Climate, climate system, climate change - Drivers of climate change - Characteristics of climate system – Greenhouse effect - Carbon cycle - Wind systems – Ozone hole in the atmosphere – El Nino, La Nina - ENSO, Teleconnections

Unit-2

Impacts of Climate Change: Global scenario - Indian scenario - Observed changes and projected changes of IPCC - Impacts on water resources – NATCOM report - Impacts on sectoral vulnerabilities – Special Report on Emissions Scenarios (SRES) - Different scenarios

Unit-3

Tools for Vulnerability Assessment: Need for vulnerability assessment – Steps for assessment - Approaches – Models – Quantitative and Economic models - Impact matrix approach - Box models - Zero dimensional models - Higher dimension models - Global climate models – Regional models - Sectoral models

Unit-4

Adaptation and Mitigation Water related adaptation to climate change in the fields of Eco systems and biodiversity – Agriculture and food security, land use, human health, water supply and sanitation - Adaptation and vulnerability and sustainable development – Carbon dioxide capture and storage (CCS), Bio energy crops, Biomass electricity, Hydropower – Energy use in buildings, Land use change and management, cropland management. Implications for policy and sustainable development

Unit-5-

CaseStudies: Water resources assessment case studies - Ganga Damodar project – Ganga valley project – Adaptation strategies in assessment of water resources – Hydrological design practices- Dam safety - Flood management strategies - Drought management strategies - Temporal and spatial assessment of water for irrigation.

Learning Resources

1. Shukla P.R , Subobh K Sarma Climate change and India: Vulnerability assessment and adaptation , University press (India)Pvt ., Ltd., Hyderabad

2. IPCC Report technical paper IV – Climate change and water, 2008

3. UNFCC Technologies for adaptation to climate change , 2006

4. Preliminary consolidated report on effect of climate change on water resources, GOI, CWC, MOWR, 2008.

OE-III (Principles Of Satellite Remote Sensing)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO-1: understand the physical principles and sensing process in remote sensing

CO-2: study different type of sensors and their characteristics

CO-3: analyze preprocessing techniques and discuss various Digital Image Processing techniques

CO-4: explain statistical outlook of satellite images and different classification approaches with respect to diverse applications

CO-5: apply the knowledge of satellite remote sensing in various thematic studies

Course Content

Unit-1

Remote Sensing: History, Development, Definition, Concept & Principles - Electromagnetic Radiation (EMR) and Its Characteristics - Wavelength Regions and their Significance - Interaction of EMR with Atmosphere and Earth's Surface: Absorption - Reflectance and Scattering - Atmospheric Windows - Energy Balance Equation - Spectral Response and Spectral Signature - Spectral, Spatial, Temporal and Radiometric resolutions.

Unit-2

Platform and their Specifications: Balloon, Rocket, Helicopter, Aircraft and Spacecraft - Sensors and their Specifications: MSS, TM, LISS (I, II,III,IV), PAN, WiFS, AWiFS, MODIS, Weather & Communication Satellites – Scanning mechanisms – Optical and thermal scanners - Satellites and their Specifications: IRS, SPOT, LANDSAT, SENTINEL, RADARSAT.

Unit-3

Imaging and Non-Imaging - Active and Passive - Multispectral and Hyperspectral Sensors - Electro-Optical Systems - Microwave Remote sensing concepts: Backscattering – Range and Azimuth Direction, Polarization - Dielectric Properties - Surface Roughness and Interpretation - Applications of optical, thermal and microwave remote sensing.

Unit-4

Concepts about digital image and its characteristics - Radiometric and Geometric correction technique - Types of image displays and FCC - Radiometric enhancement techniques - Spatial enhancement techniques - Contrast stretching: Linear and non-linear methods - Low Pass Filtering: Image smoothing - High Pass Filtering: Edge enhancement and Edge detection - Gradient filters, Directional and non-directional filtering Unsupervised and Supervised classification techniques.

Learning Resources

1. Joseph, George and Jeganathan, C, Fundamentals of Remote Sensing, 3rd Edition, Universities press (India) Pvt. Ltd., Hyderabad, 2017

2. John A. Richards, Remote Sensing Digital Image Analysis, Springer-Verlag Berlin and Heidelberg GmbH & Co. KG, ISBN: 9783642441011, 2022

3. Jensen, J.R, Introductory Digital Image Processing: A remote sensing perspective, Prentice Hall Series in GIS, USA, 1996

4. Lillesand, Thomas M. and Kiefer, Ralph, W, Remote Sensing and Image Interpretation, 4th Edition, John Wiley and Sons, New York, 2007

5. D. Jude Hemanth, Artificial Intelligence Techniques for Satellite Image Analysis, Springer Nature Switzerland, Indian Edition, https://doi.org/10.1007/978-3-030-24178-0, 2020

OE-III (SPATIAL INFORMATION SYSTEM)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO-1: understand concepts and data representation of geospatial data

CO-2: learn how geospatial data are stores in GIS

CO-3: understand the operation with vector and raster data

CO-4: analyze the various interpolation techniques in GIS

CO-5: evaluate the functions of various GIS modeling

Course Content

Unit-1

Definition of Map – Mapping Organisation in India- Classification based on Function, Scale, Characteristics – Ellipsoid and Geoid – Co-ordinate Systems – Rectangular and Geographic Coordinates – UTM and UPS – Projection – Function – Types of Map Projections – Transformations – Function - Affine transformation – Choice of Map Projection – Evolution of cartography – Geo-Spatial, Spatial and Non-spatial data – Definition of GIS – Evolution GIS – Components of GIS

Unit-2

Point, Line Polygon / Area, elevation and surface – Tessellations – Attributes and Levels of Measurement – Data Sources – Ground and Remote Sensing survey – Collateral data collection – Input: Map scanning and digitisation, Registration and Georeferencing – Concepts of RDBMS – Raster Data Model – Grid – Data Encoding - Data Compression – Vector Data Model – Topological properties – Arc Node Data Structure – Raster Vs. Vector Comparison – File Formats for Raster and Vector – Data conversion between Raster and vector.

Unit-3

Raster Data analysis: Local, Neighborhood and Regional Operations – Map Algebra – Vector Data Analysis: Topological Analysis, point-in-polygon, Line-in-polygon, Polygon-in-Polygon –

Proximity Analysis: buffering, Thiessen Polygon – Non-topological analysis: Attribute data Analysis- concepts of SQL– ODBC

Unit-4

Network – Creating Network Data - Origin, Destination, Stops, Barriers – Closest Facility Analysis, Service Area Analysis, OD Cost matrix analysis, Shortest Path Analysis – Address Geocoding – Surface Analysis – DEM, DTM - Point data to Surface interpolation – DEM Representation – Applications.

Unit-5

Map Compilation – Cartographic functionalities for Map Design – Symbolization – Conventional signs and symbols – Spatial Data Quality – Lineage, Positional Accuracy, Attribute Accuracy, Completeness, Logical Consistency – Meta Data – Web based GIS: Definition, Merits – Architecture – Map Server – Spatial Data Infrastructure – Spatial Data Standard.

Learning Resources

1. C.P. Lo, Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, 2nd Edition, Prentice Hall, 2006, ISBN-13: 9780131495029

2. John Jensen, Ryan Jensen, Introductory Geographic Information Systems, International Edition, Pearson Publishers, 2012, ISBN-10: 0136147763, ISBN-13: 9780136147763

3. Kang-tsung Chang, Introduction to Geographic Information Systems with Data Set CD- ROM, 6th Edition, Mc Graw Hill, 2013, ISBN-10: 0077805402,

4. Anji Reddy .M, "Textbook of Remote Sensing and Geographical Information Systems", BS Publications, Hyderabad. 2011. ISBN: 81-7800-112-8.

5. Michael N. DeMers, "Fundamentals of Geographic Information Systems", 2008.

6. Rolf A. de "Principles of Geographic Information Systems An introductory textbook" The International Institute for Aerospace Survey and Earth Sciences (ITC), The Netherlands, 2001.1

7. https://nptel.ac.in/courses/105107155/

OE-III (Remote Sensing And GIS Applications In Engineering)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO-1: apply the acquired knowledge on remote sensing application data separately and in combination with

GIS techniques for forest and Water potentialities

CO-2: identify various types of rock minerals and soil moisture estimation in combination with remote sensing and GIS application techniques

CO-3: apply the acquired knowledge on urban and environmental mapping with remote sensing and GIS techniques

CO-4: disseminate the knowledge on various data analysis tools in GIS software's

CO-5: recognize the GIS techniques for various GIS earth sciences applications

Course Content

Unit-1

Forests – Forest type classification using multispectral data and density mapping. Forest stock mapping. Forest change detection. Forest fire detection and burned area mapping and fire vulnerability assessment. Applications of Laser in vegetation studies – Aerial and terrestrial.Water –Surface water resources assessment and management, Reservoir sedimentation. Performance evaluation of command areas. Integrated watershed development, water quality monitoring and mapping. Wetland mapping. Snow and Glaciers: Snow Cover Mapping, Glacier Mapping, Forecasting snow melt runoff.

Unit-2

Significance of Geological structures – Role of satellite Image interpretation characters – structural mapping – Fold, fault, Lineaments, Direction circular features. Intrusive rocks, rock exposure, Fractures and Joints – Rose diagram – Significance of landform – Geomorphological guide – Tectonic landforms – Fluvial landforms – Denudational landforms – Volcanic landforms

– Importance of ground truth and geological field data collection – Geophysical survey – surface investigation – subsurface investigation. Soils– Soil mapping including generation of derivative maps like land capability, land irrigation and suitability for specific purpose. Land degradation mapping and monitoring, Soil erosion assessment and modeling, Soil moisture estimation using thermal and microwave data.

Unit-3

Concepts of Urban infrastructure demand analysis – regional planning and its applications – urban renewal land suitability analysis and services, and network planning – Urban landuse plan formulation – Urban growth /Sprawl modeling; Slum detection, monitoring and updating – Expert systems in mapping – Transportation interaction models – Intelligent transportation systems. Remote Sensing satellites for environmental Studies- an Overview; Environmental Policy- Legislation on water, air, noise, environmental protection act with special reference to legislation in India. Environmental Impact Assessment- an overview concepts, strategies, & methodologies – Web GIS.

Unit-4

GIS – Data Input – Storage – Retrieval – Suitability of GIS software for Remote Sensing application in Engineering – Modeling with GIS – Decision support systems – Spatial interpolation, measurement and analysis methods, reclassification techniques, Buffer analysis, overlay analysis, Vector over lay analysis, Topological overlay, raster over lay analysis – measurement of length, perimeter and area – queries –2D to 3 D conversion- DTM and DEM, advantages and disadvantages, Network modeling – The Spatial Analyst Extension and Model Builder – Metadata – Georeferencing – Geocoding – Network Analyst – Interpolation and Surface Modeling – Interpolation Methods – Geodatabase – Building a Geodatabase – Cartographic Design. Overview of Application Software

Unit-5

GIS modeling, basic elements – classification, model processing, integration, Binary models, index model, regression models – linear regression model, logistic regression model, process model, applications – problem identification– designing data model, project management and evaluation – implementation. Remote sensing Applications in Engineering automated mapping (AM)/ Facility management (FM) Multi criteria evaluation using GIS Techniques – case studies - use of knowledge based tools with GIS - Expert system and DSS. Object oriented GIS, WEB based GIS Applications.

Learning Resources

1. Anji Reddy .M, “Remote sensing and Geographical information system”, B.S Publications, 2011.

2. Chestern, “Geo Informational Systems - Application of GIS and Related Spatial Information Technologies », ASTER Publication Co., 1992.

3. Jeffrey Star and John Estes, “Geographical Information System - An Introduction”, Prentice Hall, 1990.

4. Burrough. P.A, “Principles of GIS for Land Resources Assessment”, Oxford Publication,1980

5. SatheeshGopi, “Global Positioning System - Principles and Applications,” Tata McGrawHill Publishing Company Limited, New Delhi (India), 2005

6. NPTEL: Course – GIS in Civil Engineering: https://nptel.ac.in/courses/105102015/8

OE-III (SPATIAL TECHNOLOGY IN ENGINEERING)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO-1: study and understand the basics of spatial data acquisition satellites

CO-2: learn various data acquisition technology for spatial data generation

CO-3: explore the current technology and its importance in spatial data acquisition

CO-4: apply the obtained knowledge in data processing and analysis

CO-5: evaluate the role of spatial technology and its applications in various industries

Course Content

Unit-1

GNSS and Positioning: Introduction to Global Navigation Satellite System - GNSS Satellites – GPS Satellites – GPS System segments – Signal Structure of GPS – GPS Coordinate System – GPS Errors – Data processing - Applications

Unit-2

Introduction to spatial data – Data acquisition techniques - Satellite systems and Sensors – Remote Sensing Satellites – Indian Satellites – Aerial photos – Aerial Photo types - Data processing Techniques

Unit-3\

Introduction to Drone and Laser scanning - Drone data acquisition - Drone Date processing software and hardware – Drone application in Engineering Industries – Terrestrial and Aerial Laser Scanner – Components of Laser scanning – Laser scanning data acquisition approaches – Data processing

Unit-4

Introduction to data processing – Processing Software – Types - Data Format (Satellite, Aerial, Drone, Laser Scanning) – Data Types – Data Analysis – Vector & Raster – Network Analysis – Digital Elevation Models – Surface Analysis.

Unit-5

Introduction to applications of spatial technology – Construction Engineering – Transportation Engineering – Urban Planning – Vehicle Tracking – Disaster Management – Health industry earning

Resources

1. Alfred Leick, GPS Satellite Surveying, Wiley, Fourt Edition, ISBN 978-1-118-67557-1.

2. David Wheatley and Mark Gillings, Spatial Technology and Archaeology, Taylor and Fancis, ISBN 0-203-30239-7

3. Michael D., Introducing Geographic Information System with ArcGIS: A workbook Approach to Learning GIS, Jhon Wiley & Sons. Canada, ISBN 987-1-118-15980-4;

4. Otto Huisman and Rolf A. de By, Principles of Geographic Information Systems, The International

Institute for Geo-Information Science and Earth Observation (ITC) Netherlands.

5. Kang – Tsung Chang, Introduction to Geographic Information Systems, McGraw Hill Publishing, 2nd Edition, 2011.

OE-III (Gis And Spatial Analysis)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO-1: awareness on GIS concepts and principles

CO-2: knowledge on data used in GIS and its standards and accuracy

CO-3: apply the knowledge on GIS models and data base management

CO-4: analyze the different uses of spatial data analysis

CO-5: evaluate the advanced application of spatial data analysis for decision making

Course Content

Unit-1

Introduction to GIS, Components, GIS Software, GIS Data types – Spatial – Non-spatial, Data Representations, Coordinate System, Geographic coordinate system – Projected coordinate system Projection,

Unit-2

Sources of GIS data, Maps – Types, Data Input methods, Output products and methods, Data Conversion - Vectorization- Rasterisation, Meta data, Data Errors, Data Standards

Unit-3

Topology, Data Accuracy, Vector data model – Georelational Data model – Coverage data structure - Raster data models – Elements - Raster data structure, DEM – Types

Unit-4

Terrain mapping and Analysis, Viewshed analysis, Least cost path analysis, Query - Types, Buffering, Vector Overlay Operations, Raster Overlay, Measurements

Unit-5

Reclassification, Interpolation – Local – Global, Spatial Models – Cartographic models – Spatio-temporal models - Cell based Models, Multi-Criteria analysis

Learning Resources

1. Paul Bolstad," GIS Fundamentals: A First Text on Geographic Information Systems" 5th Edition, Eider Press, Minnesota 2016.

2. Burrogh. P.A, "Principles of Geographical Information System for Land Resources Assessment", Oxford Publications, | ISBN-13: 978-0198545927, 1986.

3. Kang Tsung Chang, "Introduction to Geographical Information System", Tata McGraw Hill, 9th edition, 2019.

4. Paul A. Longley, Michael F. Goodchild, David J. Maguire, David W. Rhind, "Geographic Information Science & Systems", Fourth Edition, John Wiley & Sons, Inc.,2015.

5. Chandra. A. M. and Ghosh S. K, "Remote Sensing and GIS", Narosa Publishing House, New Delhi, 2000.

6. Michael N. DeMers, "Fundamentals of Geographic Information Systems", 2008.

OE-III (WEB GIS)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO-1: Understand concepts of Open Web Mapping

CO-2: Remember the concepts of Web GIS

CO-3: Gain the Technical Basics of Web GIS

CO-4: Apply the mashup concepts

CO-5: Obtain the knowledge of Geo portals and Open Source web concepts

Course Content

Unit-1

Web Page Basics, Web Mapping, Geospatial Web Services, OGC-framework of open web mapping, importance of open web mapping, international open web standards as published by the Open Geospatial

Consortium, explain the importance of international open standards to developers, users and businesses.

Unit-2

Overview of Internet concepts & features: Internet protocol, Domain Name System, Internet services, www, Web servers, Web clients. CGI, The web and GIS, Web GIS origin and Evolution-concept-Applications.

Unit-3

Fundamentals-principles-architecture-components-Thin VS. Thick Client architecture- design development. Geospatial web services- Website to web service-geospatial webservice function-service types interoperability and web service standard

Unit-4

Evolution-Impact-web content-function and interfaces –Mashup design and implementation - challenges and prospects-uses and benefits-supporting technology- solution and production.

Unit-5

Concept-uses-functions-architectures-geoportal applications-challenges and prospects. Web page design principles, HTML, XML, data formats, helper applications, Java, databases and the Web. Application of Internet services to GIS, Internet GIS software, interoperability issues & Open GIS-GSDI and NSDI, Applications-e-business, e-government.

Learning Resources

1. Burrogh P.A., Principles of Geographical Information System for Land Resources Assessment, Oxford Publications, 1980

2. Pinde Fu and Jiulin Sun,Web GIS: Principles and applications, ISBN:9781589482456, ESRI, 2010

3. Randy Connolly & Ricardo Hoar, Fundamentals of Web Development, Pearson

4. https://swayam.gov.in/nd1_noc20_de04/preview

5. Kang-tsung Chang, Introduction to Geographical Information System, Fourth Edition, Tata McGraw Hill,2008

6. AM Chandra SK GOSH "REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM, Narosa Publishing House Pvt LTD., India

7. https://nptel.ac.in/courses/105/107/105107155

OE-III (Building Materials)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO-1: gain knowledge of building materials such as stones, bricks, aggregates, cements and its properties for better construction -

CO-2: gain knowledge on non-Load bearing materials, innovative materials

CO-3: Identify the suitable floors, roofs in buildings

CO-4: gain knowledge about doors, windows, plastering, painting, damp proofing, scaffolding, shoring, underpinning and to take suitable engineering measures

CO-5: Identify the suitable services in building at various aspects

Course Content

Unit-1

Introduction to conventional materials used in construction - stones, bricks, cement, mortar, concrete, steel and timber - manufacturing process, types, applications, properties, testing procedures and availability, methods of improving ductility and fire resistance of concrete (principles only) - reinforced concrete, fibre reinforced concrete, prestressing principles, ferrocement - high strength concrete and high performance concrete - admixtures.

Unit-2

Wood based products – varnishes – distempers – asbestos – glass – tiles –terracotta – porcelain – stoneware –earthenware – geosynthetics - polymer products -fibre reinforced plastics - types, process of manufacture and application- innovative sustainable green building materials – translucent wood, other planet urbanizing materials etc:

Unit-3

Definition - Function and classification of lintels - Balconies - Chajja and canopy – Arches - Elements and Stability of an Arch – Floors - Requirement of good floor - Components of ground floor - Selection of flooring material -Laying of Concrete - Mosaic, Marble – Granite - Tile flooring - Cladding of

tiles – Roof - Requirement of good roof - Types of roof - Elements of a pitched roof - Trussed roof, King post Truss, Queen Post Truss, Steel Truss, Different roofing materials, R.C.C. Roof – Introduction to façade materials

Unit-4

Plastering and Pointing - purpose, materials and methods of plastering and pointing - defects in plastering -Stucco plastering - lathe plastering. Damp proofing- causes, effects and methods - Paints- Purpose – types - ingredients and defects - Preparation and applications of paints to new and old plastered surfaces - wooden and steel surfaces.

Unit-5

Integration of services in buildings - water supply & plumbing layout for a residential building - elevators & escalators - planning & installation - basic components of the electrical system for a residence - typical electrical layout diagram. Lay out of external services -water supply- sewage disposal-electrical cabling

Learning Resources

1. Punmia. B.C., Ashok Kumar Jain, Arun Kumar Jain, Building Construction, Laxmi Publishing (P).Ltd. New Delhi-2, 2012.

2. Bhavikatti.S.S, Building Materials, Vikas Publishing House.Pvt. Ltd., New Delhi, 2012.

3. Rangwala .S.C," Engineering Material"s, Charotar Publishing House, Anand, 2012.

4. K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. Alternative Building Materials and Technologies. New Age International, 2007.

5. https://www.scientific.net/book/binders-materials-and-technologies-in-modern-construction iii/978-3-0357-3157-6.

OE-III (Introduction To Environmental Studies)

Course Code **L: T: P-3:0:0**

Rationale-

Course Outcomes

CO-1: Apply the acquired knowledge on environmental protection

CO-2: Identify natural resources and its conservation

CO-3: Identify variety of environmental problems, and solutions, in a scientific context

CO-4: Gain the knowledge on various social issues

CO-5: Know the environmental laws and ethics

Course Content

Unit-1

Introduction to Environmental studies - Definition, scope and importance, Ecology-Ecosystem, Types, Structure and Function of Ecosystem - Forest ecosystem, grassland ecosystem, desert ecosystem, aquatic

ecosystems- Food chains, food webs and ecological pyramids -Biodiversity and its Conservation, Threats to biodiversity -Need for Public Awareness.

Unit-2

Forest resources, Water resource, Mineral resources, , Food resources : World food problems, changes caused by agriculture and overgrazing, Energy resources : Growing energy needs, renewable and nonrenewable energy sources, Land Resources soil erosion and causes for soil erosion, causes and effects of desertification, Role of an individual in conservation of natural resources -Equitable use of resources for sustainable development

Unit-3

Environmental Pollution: Definition, causes, effects and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution and nuclear hazards, Role of an individual in prevention of pollution. Case studies.: Floods, earthquake, cyclone and landslides, Climate change, global warming

Unit-4

From Unsustainable to Sustainable development- Resource for a Growing Population and Political Implications, Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Ewaste and plastic waste: recycling and reuse Water conservation: Rain water harvesting, watershed management. Resettlement and rehabilitation of people: its problems and concerns.

Unit-5

Environment Ethics, Environmental Laws, Environmental Impact Assessment, RS and GIS in EIA, Environment Management Plan, Disaster management, Green Politics, Earth Hour, Green Option Technologies, ISO standards: ISO 9000 and 14000. Environmental communication and public awareness, Role of National Green Tribunal; EIA Formulations, stages, Merits and demerits: case studies (e.g., CNG vehicles, Bharat IV stage) Role of NGOs in the protection of environment

Learning Resources

1. Erach Bharucha, Textbook of Environmental Studies for Undergraduate Courses, 2nd ed., UGC

2. Kamaraj. P, Arthanareeswari. M, Environmental Science–Challenges and Changes, 6th ed., Sudhandhira Publications, 2013