Sixth Semester Structure and Detail Syllabus

Department of Civil Engineering

NIST University, Institute Park, Berhampur,

Odisha-761008

B. Tech Program Structure			Semester: Sixth (6th)	Department: CE			
S. N.	**Category**	**Subject Code**	**Subject Name**	**L**	**T**	**P**	**C**
1	BSC	22CM6BS01T	Optimization Engineering	3	1	0	4
2	PCC	22CE6PC01T	Irrigation Engineering	3	0	0	3
3		22CE6PC02T	Design of Steel Structure	3	0	0	3
4	PEC	22CE6PE01T	Advanced Mechanics of Materials	3	0	0	3
		22CE6PE02T	Ground Improvement Techniques				
		22CE6PE03T	Construction Practice				
		22CE6PE04T	Building and Town Planning				
5	**PEC**	22CE6PE05T	Estimation and Project Management	3	0	0	3
		22CE6PE06T	Open Channel Flow				
		22CE6PE07T	Pavement Materials and Traffic control				
		22CE6PE08T	Environmental Geotechnics				
Open elective for non-CE students							
6	OEC1	22CE6OE01T	Structural Dynamics	3	0	0	3
		22CE6OE02T	Waste Management				
Open elective for CE students							
7	OEC1	22IT6OE01T	Introduction to Operating System	3	0	0	3
		22CS6OE01T	Data Analytics				
		22EE6OE01T	Electrical Energy Utilization				
		22EE6OE02T	Introduction to Robotics and Autonomous Vehicle				
		22ME6OE01T	Introduction to hybrid and Electrical Vehicles				
		22ME6OE02T	Engineering management				
		22EC6OE01T	Fundamentals of Satellite Communication				
8	HSMC	22CM6MC01T	Business Communication & Interview Skills	0	0	2	2
9	PSI	22CM6PS01L	Research/Lab based Project	0	0	2	2
10	PCC	22CE6PC01L	Irrigation Engineering Sessional	0	0	2	1
11	PCC	22CE6PC02L	Design of Steel Structure Sessional	0	0	2	1
Total				19	0	8	25

Detailed Syllabus

Course Code: 22CE6PC01T	**Course Name: Irrigation Engineering**	**L**	**T**	**P**	**C**
		3	0	0	3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 and 2023				

Course Objective:

- Understand irrigation systems, techniques, and water requirements for crops.
- Learn about canal design, waterlogging solutions, and river training techniques.
- Understand cross-drainage works, diversion headworks, and canal falls.
- Study gravity dams, earth dams, and spillway types.

Expected Course Outcomes

- Calculate crop water requirements, irrigation frequency, and efficiency.
- Design stable and lined canals, manage waterlogged soils, and control rivers.
- Design weirs, barrages, aqueducts, and canal falls using theories like Bligh's and Khosla's.
- Design safe and stable gravity and earth dams with seepage control measures.

Module I	**Introduction to irrigation**	**Contact Hours (08)**

Introduction to irrigation: Necessity of Irrigation in India, Advantages and disadvantages of Irrigation, Systems of irrigation: Lift irrigation, Flow irrigation, Techniques of distribution of water to farm. Quality of irrigation water. Water requirement of crops, factors affecting water requirement, crop season, crop period, base period, delta and duty, consumptive use of water, frequency of irrigation, irrigation efficiency.

Module II	**Canal System and River Control**	**Contact Hours (10)**

Canal Irrigation: Classification of canals, Canal losses, Alignment of canals, Design of stable channels using Kennedy's and Lacey's theory, Garret's diagram, Cross section of irrigation canals **Lining of Irrigation Canals**: Advantages and economics of lining, Various types of lining, Design of lined canals. **Reclamation of Waterlogged and Saline Soils**: Causes and control of water logging. Reclamation of saline and alkaline land, Surface and Sub-surface drainage, Design. **Behaviour of river control and training**: Importance of rivers and Necessity of controlling them, Types of rivers and their characteristics, Indian rivers and their classification, Behaviour of rivers, Control and training of rivers

Module III	**Hydrologic Analysis and Design**	**Contact Hours (08)**

Types of Cross-Drainage Works: Types of CD works, Selection of a suitable type to suite a particular condition, Design consideration of Aqueduct design. **Diversion Head works**: Weirs and Barrages, Types of weirs and barrages, Layout of a diversion head works, Introduction to different components of a diversion head works. **Design of weirs and barrages**: Bligh's creep theory, Design of weir using Bligh's theory, Lane's weighted creep theory, Khosla's theory, Khosla's method of independent variables, Exit gradient. **Canal Falls**: Necessity, Proper location, Types, Design and detailing of one type of fall.

Module IV	**Ground water & Well Hydraulics**	**Contact Hours (09)**

Gravity Dams: Typical cross section, Various forces acting on gravity dam, Combination of forces for design, Modes of failure and criteria for structural stability, High and low gravity dam, Design of high dam, Typical section of low gravity dam. **Earth Dams**: Types, Causes of failure, Preliminary section of an earth dam, Seepage control in earth dams. Spillways: Descriptive study of various types of spillways.

Total Lecture Hours	35

Textbooks

1. S. K. Garg, *Irrigation Engineering and Hydraulic Structures*, First Edition, KhannaPublication, New Delhi, 1976
2. B.C. Punmia, A. K. Jain, A. K. Jain and B. B. L. Pande, *Irrigation and Water PowerEngineering*, Seventh Edition, Laxmi Publication, New Delhi, 2021.

Reference Books

1. Birdie and Das, *Irrigation Engineering - Including Water Power Engineering*, Third Edition,Dhanpat Rai Publication Company, New Delhi, 2014
2. S.K. Sharma,*Irrigation Engineering and Hydraulic Structures*, First Edition, S. ChandPublishing. Cuttack, Odisha, 2017.

Digital Learning Resources

Course Name: Irrigation and Drainage
Course Link: https://nptel.ac.in/courses/126/105/126105010/
Course Instructor: Prof. D.R. Maillapalli, Department of Agricultural and Food Engineering, IIT Kharagpur

Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)

Recommended by Board of Studies	No.: BoS_2	Date:
Approved by Academic Council	No.:	Date:

Course Code:	Course Name:	L	T	P	C
22CE6PC01L	Irrigation Engineering Sessional	0	0	1	1

Pre-requisite:	**NIL**
Branch:	**Civil Engineering**
Course Type	**Theory**
Batch	**2022 and 2023**

Course Objective:

- To equip students with knowledge of modern irrigation methods, canal systems, and water management techniques.
- To provide hands-on experience in the design of irrigation structures like canals, canal falls, headworks, and dams.
- To analyze the stability and functionality of water resource systems and design efficient solutions for field applications.

Expected Course Outcomes

- Students will gain the ability to design and evaluate irrigation systems such as sprinkler, drip, and canal networks based on hydrological and agricultural needs.
- Students will demonstrate the capability to plan, analyze, and design critical hydraulic structures, including canal falls, weirs, barrages, and dams.
- Students will develop problem-solving skills to address issues like waterlogging, soil salinity, and groundwater management for sustainable development.

Subject of Sessional

1. Design and Layout of Sprinkler and Drip irrigation Method
2. Design of Cross section of Canals in Cutting, filling, partly in cutting and filling
3. Design of Alluvial canal using Lacey's and Kennedy's method.
4. Design of Lined Canal.
5. Design of Canal Falls.
6. Design of Cross drainage work.
7. Layout of Diversion of Headwork

8. Deign of weir and barrage 9. Study different type of Spillway 10. Analysis and Design of Gravity dam
Mode of Evaluation: Internal Assessment (Record Book, Observation, Quiz, Final lab)

Recommended by Board of Studies	No.: BoS_2	Date:
Approved by Academic Council	No.:	Date:

Course Code: 22CE6PC02T	Course Name: Design of Steel Structure	L	T	P	C
		3	0	0	3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 and 2023				

Course Objective:

- To understand the fundamentals of steel structures and design bolted and welded connections.
- To learn the behavior and design principles of tension and compression members.
- To study the design of beams considering lateral stability, bending, and shear effects.
- To introduce the design concepts of plate girders and connections under complex loading.

Expected Course Outcomes

- Explain the basics of structural steel, analyze joint failures, and design bolted and welded.
- Design tension members, compression members, and their connections, including gusset plates and column bases.
- Design steel beams addressing bending, shear strength, and lateral torsional buckling.
- Design plate girder components and eccentric or moment connections.

Module I	Introduction to steel and Design of bolted connection	Contact Hours (08)

Introduction: advantages/disadvantages of steel, structural steel, rolled steel section, various types of loads. Design philosophy: Limit state design method; limit states of strength and serviceability, probabilistic basis for design.
Bolted connections: types, design and failure of joints. Welded connections: assumptions, types, design of fillet welds, intermittent fillet weld, plug and slot weld, failure of welded joints, welded joints vs bolted joints

Module II	Tension and Compression Members	Contact Hours (10)

Tension members: types, net cross-sectional area, types of failure, slenderness ratio, design of tension members, gusset plate.
Compression members: effective length, slenderness ratio, types of cross-section, classification of cross section, design of axially loaded compression members, lacing, battening, design of column bases.

Module III	Design of Beams	Contact Hours (08)

Design of beams: types of cross-section, lateral stability of beams, lateral torsional buckling, bending and shear strength, web buckling and web crippling, deflection, design procedure.

Module IV	Plate Girders	Contact Hours (09)

Plate girders: various elements and design of components Eccentric and moment connections

	Total Lecture Hours	35

Textbooks

1. S.K. Duggal, Limit State Design of Steel structures , Mc-Graw Hill
2. N. Subramanian, Steel Structures-Design and Practice , Oxford University Press

Reference Books

1. S.S.Bhavikatti ,Design of steel structures, I.K. International Publishing house.
2. M.L.Gambhir ,Fundamentals of Structural Steel Design by, Mc Graw Hills

Digital Learning Resources

Course Name: Design of steel structures
Course Link: https://archive.nptel.ac.in/courses/105/105/105105162/#
Course Instructor: Prof. Damodar Maity, Department of Civil Engineering, IIT Kharagpur

Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)

Recommended by Board of Studies	No.: BoS_2	Date:
Approved by Academic Council	No.:	Date:

Course Code:	Course Name:	L	T	P	C
22CE6PC02L	Design of Steel Structure Sessional	0	0	1	1

Pre-requisite:	**NIL**
Branch:	**Civil Engineering**
Course Type	**Theory**
Batch	**2022 and 2023**

Course Objective:

- To understand the principles of designing and detailing bolted, welded, and other steel connections.
- To learn the design and detailing process for structural steel members, including tension members, compression members, and column bases.
- To analyze and design advanced components like plate girders, seated connections, framed connections, and roof trusses.

Expected Course Outcomes

- Design and detail bolted and welded connections as per codal provisions.
- Apply design procedures to tension and compression members, including column bases and gusseted bases.
- Develop the ability to design plate girders, roof trusses, and framed/seated connections.

Subject of Sessional

1. Design and detailing of bolted joints
2. Design and detailing of welded joints
3. Design and detailing of tension members
4. Design and detailing of compression members
5. Design and detailing of column base and gusseted base
6. Design and detailing of structural steel connections, seated and framed connections
7. Design and detailing of plate girders
8. Design and detailing of roof truss

Mode of Evaluation: Internal Assessment (Record Book, Observation, Quiz, Final lab)

Recommended by Board of Studies	No.: BoS_2	Date:
Approved by Academic Council	No.:	Date:

Course Code: 22CE6PE01T	Course Name: Advanced Mechanics of Materials	L	T	P	C
		3	0	0	3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 and 2023				

Course Objective:

- Understand principal stresses, strain, and failure theories.
- Analyze stress in pressure vessels.
- Study stress in unsymmetrical and curved beams.
- Learn 3D stress states and advanced mechanics topics.

Expected Course Outcomes

- Apply and compare failure theories for safe design.
- Evaluate stresses in thin, thick, and compound cylinders.
- Analyze stresses, deflections, and shear center for beams and curved structures.
- Solve problems on fatigue, stress concentration, and plane stress equilibrium.

Module I	Theories of failure	Contact Hours (08)

Determination of principal stresses and principal strains, strain rosettes. Theories of failure: Maximum principal stress theory, maximum shear stress theory, maximum strain theory, total strain energy theory, maximum distortion theory, octahedral shear stress theory graphical representation and comparison of theories of failure.

Module II	Thin and Thick cylinders	Contact Hours (07)

Stresses in thin cylinders, thin spherical shells under internal pressure. Thick cylinders subjected to internal and external pressures, compound cylinders

Module III	Unsymmetrical and Curved Beams	Contact Hours (13)

Unsymmetrical bending: Properties of beam cross selection, slope of neutral axis, stresses and deflection in unsymmetrical bending, shear center.
Curved Beam: Bending of beam with large initial curvature, Stress distribution in beam withrectangular, circular and trapezoidal cross section, stresses in crane hooks, ring and chain links.

Module IV	Theory of Elasticity	Contact Hours (07)

Elementary concept of theory of elasticity, stresses in three dimensional, equations of equilibrium and compatibility, plane stress, Stress tensor at a point, stress invariants. Advanced topics in mechanics of materials: Repeated stresses and fatigue in metals, concept ofstress Concentration, notch and stress concentration factors.

Total Lecture Hours	35

Textbooks

1. K. Kumar and R.C. Ghai, *Advanced Mechanics of Materials*, Seventh Edition, KhannaPublisher. 1976.
2. L.S. Srinath, *Advanced Mechanics of Solids*, Third Edition, Tata McGraw Hill EducationPrivate Limited. 2010.

Reference Books

1. R. Subramaniam, *Strength of Materials*, Third Edition, Oxford University Press, 2016
2. S. S. Ratan, *Strength of Material*, Third Edition, McGraw Hill Education, 2017

Digital Learning Resources

Course Name: Advanced Solid Mechanics Course Link: https://nptel.ac.in/courses/105/106/105106049 Course Instructor: Dr. U. Saravanan, Department of Civil Engineering, IIT Madras		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.: BoS_2	Date:
Approved by Academic Council	No.:	Date:

Course Code: 22CE6PE02T	Course Name: Ground Improvement Techniques	L	T	P	C
		3	0	0	3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 and 2023				

Course Objective:

- Understand soil formation, problematic soils, and ground improvement techniques.
- Learn mechanical and hydraulic methods of soil compaction and stabilization.
- Understand grouting methods and dynamic soil modification techniques.
- Explore the principles and applications of soil reinforcement and geosynthetics.

Expected Course Outcomes

- Identify suitable ground improvement methods for various soil conditions.
- Apply compaction, drainage, and stabilization techniques for soil improvement.
- Design and implement advanced grouting and in-situ soil densification processes.
- Analyze and design reinforced soil structures, embankments, and slopes.

Module I	Introduction to Ground Improvement	Contact Hours (07)

Need for ground improvement, different types of problematic soils, emerging trends in ground improvement, rock cycle, classification of rocks and rocks forming minerals. weathering process and formation of soil. engineering properties of the soft, week and compressible deposits, natural on land, offshore and man-made deposits. role of ground improvement in foundation engineering, methods of ground improvement, selection of suitable ground improvement techniques

Module II	Ground Modification	Contact Hours (13)

Mechanical modification: shallow and deep compaction requirements, principles and methods of soil compaction, factors affecting compaction, effect of compaction on various soil properties. shallow compaction and methods. properties of compacted soil and compaction control, deep compaction, vibratory methods, dynamic compaction.
Hydraulic modification: ground improvement by drainage, dewatering methods. design of construction of dewatering systems, preloading, vertical drains, vacuum consolidation, electro-kinetic dewatering, cement stabilization and cement columns, lime stabilization and lime columns. stabilization using bitumen and emulsions, stabilization using industrial wastes construction techniques and applications.

Module III	Grouting and Dynamic Modification	Contact Hours (08)

Dynamic compaction and consolidation: vibro-flotation, sand pile compaction, preloading with sand drains and fabric drains, granular columns, micro piles, soil nailing, ground anchors, lime piles, grouting technique, thermal, electrical and chemical methods, electro osmosis, soil freezing
Grouting: permeation grouting, compaction grouting, jet grouting, different varieties of grout materials, grouting under difficult conditions. in-situ treatments methods: in-situ densification soils,

Module IV	Soil Reinforcement	Contact Hours (07)

Reinforced soil: the mechanism, reinforcement materials, reinforcement - soil interactions, geosynthetics, analysis and design of reinforced retaining structures, reinforced embankments and reinforced slopes. Case studies of ground improvement projects.

Total Lecture Hours	35

Textbooks

1. N. V. Nayak, *Foundation Design Manual*, Dhanpat Rai and Sons, Delhi.
2. G. V. Rao and G. V. S. Rao, *Text Book On Engineering with Geotextiles*, Tata McGraw Hill

Reference Books

1. B. M. Das, *Principles of Foundation Engineering*, Thomson, Indian Edition
2. R. M. Korner, *Design with Geosynthetics*, Prentice Hall, New Jersy, 3rd Edn .

Digital Learning Resources

Course Name: Ground Improvement Techniques
Course Link: https://nptel.ac.in/courses/105/108/105108075/
Course Instructor: Prof. G.L. Sivakumar Babu, Department of Civil Engineering, IISc Bangalore

Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)

Recommended by Board of Studies	No.: BoS_2	Date:
Approved by Academic Council	No.:	Date:

Course Code: 22CE6PE03T	Course Name: Construction Practice	L	T	P	C
		3	0	0	3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 and 2023				

Course Objective:

- Learn the processes, specifications, and principles of construction practices.
- Study methods for damp proofing, plastering, and building maintenance.
- Understand the use of earthmoving equipment in construction projects.
- Learn about pumps and advanced equipment used in construction processes.

Expected Course Outcomes

- Understand the construction sequence, foundation types, and masonry techniques for durable structures.
- Implement techniques to prevent and repair dampness, cracks, and leaks in buildings.
- Plan and select equipment like trucks, bulldozers, and loaders for efficient construction.
- Operate and select equipment for piling, lifting, concreting, and bitumen mixing.

Module I	Introduction to Construction Practice	Contact Hours (12)

Construction Practices**:** Specifications, details and sequence of activities and construction co- ordination, Site Clearance, Marking, Earthwork, masonry, Bond in masonry. Foundation: Types of foundation.
Brick Masonry**:** Types of bonds, Brick laying, Joints in brickwork, Reinforced brickwork, Joint between old and new masonry, Maintenance of brick work.
Stone Masonry**:** Types of stone masonry-rubble and ashlar, general principles of construction, joints of stone, maintenance of stonework.

Module II	Maintenance of Buildings	Contact Hours (08)

Damp Proofing**: C** auses and effects, materials used for damp proofing, methods of preventingdampness, damp proof course.
Plastering: Definition, materials used for plastering, types of plastering, methods of plastering,defects and remedial measures in plastering.
Maintenance of Buildings**: C** auses and prevention of cracks in building, leakage of buildings,special repair of buildings, annual maintenance.

Module III	Construction Planning	Contact Hours (05)

Construction equipment's: Conceptual planning of new project, site access and services, mechanicalv/s manual construction

Module IV	Construction Equipment's	Contact Hours (10)

Earth moving equipment's: Fundamentals of earth moving and earth moving equipment Type of earth work equipment: Trucks, bulldozers, power shovels, scrapers, frond end loaders, excavators. Types of pumps used in Construction, Foundation and Pile Driving Equipment, lifting equipment, Concreting equipment. Plants for grading, batching, mixing, types of mixers, concrete pumps, bitumen plants.

	Total Lecture Hours	35

Textbooks

1. B.C.Punmia, A. K. Jain and A. K. Jain, "*Building Construction*, Laxmi Publications (P) ltd.,New Delhi
2. R.L. Peurifoy, "*Construction Planning and Equipment*" -McGraw-Hill Publishing Co.; 6thedition, 2001.

Reference Books

1. Mahesh Verma, "*Construction Equipment and Its Planning and Application*", MetropolitanBook Co; 2nd edition, 1975.
2. U. K. Shrivastava, "*Construction Planning and Management*", Galgotia Publications PvtLtd, 2000.
3. S.C Sharma, "*Construction Equipment and Management*", Khanna Publishers New Delhi,1988.

Digital Learning Resources

Course Name: Civil Engineering - Building materials and Construction
Course Link: https://nptel.ac.in/courses/105/102/105102088/
Course Instructor: Dr. B. Bhattacharjee , IIT Delhi

Course Name: Civil Engineering - Construction method and equipment management
Course Link: https://nptel.ac.in/courses/105/103/105103206/
Course Instructor: Dr. Indu Shiva Ranjani Gandhi , IIT Guwahati

Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)

Recommended by Board of Studies	No.: BoS_2	Date:
Approved by Academic Council	No.:	Date:

Course Code:	Course Name:	L	T	P	C

22CE6PE04T	Building and Town Planning	3	0	0	3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 and 2023				

Course Objective:

- Learn principles, orientation, and standards for functional building planning as per codes.
- Understand building drawings, from site layouts to service plans, with proper scale and detailing.
- Study the evolution, principles, and modern concepts of town planning and zoning.
- Understand causes, effects, and solutions for slum issues, and the classification of urban roads.

Expected Course Outcomes

- Apply building codes and design standards for residential, public, commercial, and earthquake-resistant structures.
- Create comprehensive building plans, including floor plans, elevations, sections, and service provisions.
- Develop city plans, master plans, and urban layouts considering historical and future needs.
- Design measures for slum prevention, clearance, and aesthetically planned urban roads.

Module I	Introduction to Building Planning	Contact Hours (07)

Functional planning of buildings: Planning, designing and construction, General building requirements as per the National building Code, Principles of building planning, Orientation of building, building by–laws as per National Building Code, building by–laws of local authority, Standards for Residential, Public, Commercial, Industrial and Institutional Buildings Planning, Planning of Earthquake Resistant Building, Principles of architecture composition.

Module II	Elements of Building Drawing	Contact Hours (07)

Elements of Building Drawing, Planning and Preparing working drawing of Residential Building with scale proportion, Layout of Public Building, Industrial Building etc., Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundation plan. Roof drainage plans. Provision of Building services (like water supply, drainage, electrification, etc).

Module III	Concept of Town Planning	Contact Hours (07)

Town Planning: evolution of towns, history and trends in town planning, origin and growth, Historical development of town planning in ancient India; Indus Valley Civilization. Objects and necessary of town planning; Surveys and analysis of a town.
New concepts in town planning: Garden city movement, linear city and satellite city concepts, neighborhood planning. elements of city plan, estimating future needs, planning standards, zoning: definition, procedure and districts, height and bulk zoning, far, master plan; concepts of urban planning, design and landscaping.

Module IV	Urban Development	Contact Hours (07)

Slums: Causes of slums, effect of slums, slum clearance, prevention of slum formation. the Indian slum. Urban Roads: Objective, classification, outer and inner ring roads, expressways, freeways, road aesthetics.

	Total Lecture Hours	35
Textbooks		
1. B. S. C. Rangwala and K. S. Rangwala, *Town Planning*, First Edition, Charotar PublishersHouse Pvt. Ltd, Gujrat, India, 2009 2. Y.S. Sane, *Planning and Designing Building*, First Edition, Allies Book Stall, Gujrat, India,1964		
Reference Books		
1. G. K. Hiraskar, *Fundamentals of Town Planning*, First Edition, Dhanpat Rai Publication,New Delhi, India, 2018. 2. S. C. Agarwal, *Architecture and Town Planning*, Second Edition, Dhanpat Rai & Co , NewDelhi, India, 2013. 3. National Building Code of India, 2005, New Delhi.		
Digital Learning Resources		
Course Name: Introduction to Urban Planning Course Link: https://onlinecourses.nptel.ac.in/noc21_ar12 Course Instructor: Prof. Harshit Sosan Lakra , IIT Roorkee (Swayam course)		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.: BoS_2	Date:
Approved by Academic Council	No.:	Date:

Course Code: 22CE6PE05T	Course Name: Estimation and Project Management	L	T	P	C
		3	0	0	3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 and 2023				

Course Objective:

- Learn estimation techniques, specifications, and rate analysis for construction projects.
- Understand tendering processes and contract management in construction.
- Learn stages and methods of construction project planning and role delegation.
- Understand project planning techniques using bar charts, Gantt charts, CPM, and PERT.

Expected Course Outcomes

- Prepare detailed estimates, rate analyses, and specifications for buildings, roads, and bridges.
- Prepare tender documents, analyze contracts, and implement e-tendering practices.
- Develop project schedules, work breakdown structures, and assess activity durations effectively.
- Create and analyze CPM/PERT networks, compute critical paths, and evaluate project completion probabilities.

Module I	Estimate of Building, Culverts and Bridges Specification and Rate Analysis	Contact Hours (13)

General items of work in Building – Standard Units Principles of working out quantities for detailed and abstract estimates – Approximate method of Estimating. Detailed Estimates of Buildings, Culverts and bridges.
Specifications-Types, requirements and importance, detailed specifications for buildings, roads, minor bridges and industrial structures. Rate analysis-Purpose, importance and necessity, factors affecting Analysis of rates, Prime cost, Schedule rates, Analysis of rates for various types of works.

Module II	Tenders	Contact Hours (07)

Tender- Types of Tenders, Preparation of tender documents, inviting tenders, general and special conditions, contract types. termination of contracts, penalty and liquidated charges, Settlement of disputes, Arbitration, R.A. Bill & Final Bill, Payment of advance, insurance, claims, price variation,Introduction to e-tendering

Module III	Construction and Project Planning	Contact Hours (07)

Construction project planning- Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data

Module IV	Construction Planning and Management	Contact Hours (08)

Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three-

time estimates, analysis, slack computations, calculation of probability of completion		
Total Lecture Hours	35	

Textbooks

1. B.N. Dutta, "*Estimating and Costing in Civil Engineering*", UBS Publishers' DistributorsLtd; 25th edition, 2002.
2. G.S. Birdie, "*A Text Book of Estimating and Costing for Civil Engineering*", Dhanpat RaiPublishing Company Private Limited-New Delhi; Sixth edition,2014.
3. B.C. Punmia, K.K. Khandelwal, "*Project Planning with PERT and CPM*", LaxmiPublications, 2016.
4. K. K. Chitkara, "*Construction Project Management*", Tata McGraw-Hill Education, 2014.

Reference Books

1. Standard schedule of rates and standard data book by public works department
2. I.S:1200 (Part I toXXV-1974/method of measurement of building and civil engineering works-B.I.S.)
3. M. Chakraborthi, "Estimation, costing and specification", Laxmi Publications.
4. R.L. Peurifoy, "Construction Planning, methods of Equipment", McGraw hill, 2011
5. S.W. Nunnally, "Construction methods and management", Prentice Hall,2006
6. Neeraj Kumar Jha, "Construction Projects Management, Theory and Practice", Pearson Education India,2015.

Digital Learning Resources

Course Name: **Estimation and Project Management**
Course Link: https://nptel.ac.in/courses/105/103/105103093/
Course Instructor: **Prof. Arbind Kumar Singh, IIT Guwahati**

Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)

Recommended by Board of Studies	No.: BoS_2	Date:
Approved by Academic Council	No.:	Date:

Course Code: 22CE6PE06T	Course Name: Open Channel Flow	L	T	P	C
		3	0	0	3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 and 2023				

Course Objective:

- Understand open channel flow dynamics, energy, and momentum principles.
- Learn the principles and characteristics of uniform flow in open channels.
- Study gradually and spatially varied flow profiles and their computations.
- Understand the mechanics of hydraulic jumps and flow through non-prismatic sections.

Expected Course Outcomes

- Analyze critical flow, velocity distribution, and energy variations in prismatic and non-prismatic channels.
- Apply Manning's and Chezy's equations to determine normal depth, velocity, and economical channel sections.
- Analyze flow transitions and compute flow profiles using numerical and graphical methods.
- Evaluate jump characteristics, energy dissipation, and flow behavior in culverts, bridge piers, and transitions.

Module I	Open Channel Flow	Contact Hours (12)

Open Channel Flow**:** Kinds of open channel flow, channel geometry, types and regimes of flow, Velocity distribution in open channel, wide open channel, specific energy, critical flow and its computation, Energy in non-prismatic channel, momentum in open channel flow, specific force.
Energy and Momentum Principles Critical depth, concepts of specific energy and specific force, application of specific energy principle for interpretation of open channel phenomena, flow throughvertical and horizontal contractions

Module II	Uniform Flow	Contact Hours (07)

Uniform Flow: Qualification of uniform flow, velocity measurement, Mannings and Chezy's formula, Determination of roughness coefficients, determination of normal depth and velocity Most economical sections, nonerodable channels, flow in a channel section with composite roughness, flow in close conduit with open channel flow.

Module III	Varied Flow	Contact Hours (08)

Varied Flow: Dynamic equations of gradually varied flow, assumptions and characteristics of flow profiles. Classification of flow profile, draw down and back water curves, profile determination, graphical integration, direct step and standard step method. Numerical methods, flow through transitions, dynamic equation of spatially varied flow, analysis of spatially varied flow profile, computation of spatially varied flow using numerical integration.

Module IV	Hydraulic Jumps and Flow Through Non-Prismatic Channel Sections	Contact Hours (08)

Hydraulic Jumps**:** Hydraulic jump, types of jumps, basic characteristics of jump, length and location of jump, jump as energy dissipation, control of jump, surges, surge channel transitions.

Flow Through Non-Prismatic Channel Section**:** Sudden transition, sub-critical flow through suddentransition, flow through culverts, flow through bridge piers, obstructions, channel junction		
	Total Lecture Hours	35
Textbooks		
1. C.S.P.OJha, R. Berndtsson, and P.N. Chadramouli,"*Engineering Fluid Mechanics"* OxfordUniversity Press, 2009 2. P.N. Chanrdamouli, C.S.P.Ojha and K.M.Singh, "*Hydraulic Machines*" Oxford UniversityPress, June 2010.		
Reference Books		
1. K Subramanya ,"Flow through open channels" TataMcGraw Hill.		
Digital Learning Resources		
Course Name: **Advanced Hydraulics** Course Link: https://nptel.ac.in/courses/105/107/105107059/# Course Instructor: **Prof. C. S. P. Ojha, IIT Roorkee**		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.: BoS_2	Date:
Approved by Academic Council	No.:	Date:

Course Code: 22CE6PE07T	Course Name: Pavement Materials and Traffic Control	L	T	P	C
		3	0	0	3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 and 2023				

Course Objective:

- Understand sub-grade soil properties and methods for evaluation and stabilization.
- Learn the properties and classification of aggregates for pavement construction.
- Understand the mechanical properties and modifiers in bituminous mixes.
- Study traffic regulations, control measures, and traffic management systems.

Expected Course Outcomes

- Analyze soil suitability and apply stabilization techniques using chemical and physical methods.
- Evaluate and optimize aggregate proportions for desired mechanical and surface characteristics.
- Analyze bitumen behavior under loading and ageing to enhance pavement performance.
- Design and evaluate traffic control devices, signals, and road lighting for improved safety and efficiency.

Module I	Sub-grade Soil Characterization and Soil Stabilization	Contact Hours (12)

Sub-grade Soil Characterization: Soil classification; index & engineering properties of soil, properties of sub-grade; in-situ procedures for evaluating the mechanical properties of soils viz cbr, plate load test, resilient modulus, dcpt, suitability of different type of soil for the construction of highway embankments and pavement layers; field compaction and control. **Introduction to Soil Stabilization:** Physical and chemical modification: stabilization with admixtures like cement, lime, calcium chloride, fly ash and bitumen.

Module II	Aggregate Characterization	Contact Hours (07)

Aggregate Characterization: Origin, classification, types of aggregates; sampling of aggregates; mechanical and shape properties of aggregates, aggregate texture, and skid resistance, polishing of aggregates; proportioning and blending of aggregates.

Module III	Properties of Bituminous Mixes	Contact Hours (08)

Properties of Bituminous Mixes: Elastic modulus, dynamic modulus; stiffness modulus; visco- elastic and fatigue, creep test; resilient modulus, complex (dynamic) moduli of bituminous mixes.
Modified bitumen: Crumb Rubber Modified bitumen, Natural rubber modified bitumen, polymer modified bitumen; Long term and short-term ageing and its effect on bitumen performance.

Module IV	Traffic Control Devices and Regulations	Contact Hours (08)

Traffic Regulations and Control: General regulations, regulations on speed, vehicles, drivers, and flow; other regulations and control. traffic management; noise and air pollution due to road traffic and methods of control.
Traffic Control Devices: Traffic signs, markings, islands, and signals. different methods

of signal design; redesign of existing signal including case studies. signal system and co-ordination. evaluation and design of road lighting.		
	Total Lecture Hours	35
Textbooks		
1. L.R Kadiyali, "Traffic Engineering and Transport Planning", Khanna Publishers.1999 2. Das and P. Chakraborty, "Principles of Transportation Engineering", 1st Edition, PHIPublication. 3. S.K. Khanna, C.E.G. Justo, "Highway Engineering", Nem Chand & Bros., Roorkee,1990.		
Reference Books		
1. L.R Kadiyali, "Principles & Practice of Highway Engineering", Khanna Publishers,2017. 2. T M Matson, F W Hurd, W S Smith, "Traffic engineering", McGraw-Hill Book Co., New York, N.Y., 1955.		
Digital Learning Resources		
Course Name: **Traffic Engineering and Management** Course Link: https://nptel.ac.in/courses/105/101/105101008/ Course Instructor: **Dr. Tom V Mathew, Department of Civil Engineering, IIT Bombay**		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.: BoS_2	Date:
Approved by Academic Council	No.:	Date:

Course Code: 22CE6PE08T	Course Name: Environmental Geotechnics	L	T	P	C
		3	0	0	3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 and 2023				

Course Objective:

- Understand the scope and practices of managing solid and hazardous waste.
- Learn site selection and design factors for waste and ash disposal facilities.
- Study components and design criteria of ash ponds and mine tailing impoundments.
- Explore landfill design, operations, and environmental impacts.

Expected Course Outcomes

- Analyze waste generation, treatment methods, and environmental legislation for effective management systems.
- Design ash disposal systems considering geotechnical, environmental, and maintenance issues.
- Implement remediation techniques like bioremediation, soil washing, and source control.
- Analyze landfill components, leachate, and gas collection systems to reduce environmental effects.

Module I	Solid and Hazardous Waste Management	**Contact Hours (13)**

Introduction: Scope, Multidisciplinary aspects of Geoenvironmental Engineering, Waste generation, Geotechnical and Geo-environmental testing: Grain size distribution, consistency limits, pH, specific surface, ion Exchange capacity, thermal & electric properties.

Module II	Waste Disposal Site Selection and Ash Disposal	**Contact Hours (07)**

Soil-water-contaminant interaction, Subsurface contamination, Contaminant Transport: Transport process, Mass-transfer process, Bioremediation: In-situ and Ex-situ Techniques, Phytoremediation and plants used for Phytoremediation

Module III	Tailing Dams Design	**Contact Hours (08)**

Solid and Hazardous Waste Management: Principle of waste management, Classification of waste, Characterization solid wastes, Elements of Solid Waste Management System, methods of solid waste disposal, Hazardous waste and its management, Waste management strategies, Regulatory Framework.

Module IV	Landfills and Remediation Techniques	**Contact Hours (07)**

Remediation Techniques: Objectives of site remediation, various active and passive methods, Soil washing, Emerging Remediation Technologies, Geo-synthetics: Types, manufacturing functions, applications and economics. Landfills: Types of landfills, Site Selection, Waste Containment Liners, Leachate collection system, Cover system, Gas collection system

Total Lecture Hours	35

Textbooks

1. B.B. Phillip, H. S. Refai, andC. J. Newell "*Ground Water Contamination*" PrenticeHallPublications.
2. H. D. Sharma and K. R. Reddy "*Geoenvironmental Engineering*", John Wiley & Sons

Reference Books

1. R. K. Rowe "*Geotechnical andGeoenvironmental Engineering Handbook*" KluwerAcademic.
2. L. N. Reddi and H. I. Inyang "*Geoenvironmental Engineering Principles andApplications*",Marcel. Dekker, Inc., New York.
3. M. D. LaGrega, P. L. Buckingham, and J. C. Evans,–"*Hazardous Waste Management*",McGraw-Hill.

Digital Learning Resources

Course Name: **Geo-Environmental Engineering**
Course Link: https://nptel.ac.in/courses/105/102/105102160/
Course Instructor: **Prof. Manoj Datta, Department of Civil Engineering, IIT Delhi**

Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)

Recommended by Board of Studies	No.: BoS_2	Date:
Approved by Academic Council	No.:	Date:

Course Code: 22CE6OE01T	Course Name: Structural Dynamics	L	T	P	C
		3	0	0	3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 and 2023				

Course Objective:

- Understand dynamic loading, structural vibration, damping, and motion types.
- Study the dynamics of SDOF systems, including free and forced vibration.
- Learn the principles and methods for analyzing MDOF systems.
- Study the time and frequency domain analysis for dynamic responses of MDOF systems.

Expected Course Outcomes

- Analyze the response of structures to vibrations under various dynamic conditions.
- Model, analyze, and evaluate vibration isolation and dynamic responses using mathematical methods.
- Perform modal analysis, determine natural frequencies and mode shapes, and study the forced vibration responses of MDOF systems.
- Analyze vibrations in strings, beams, and bars using differential equations and approximate methods for natural frequencies.

Module I	Introduction	Contact Hours (07)

Time Dependent Problems, Types of Dynamic Loading, Degrees of Freedom, Simple, Harmonic Motion, Structural Vibration, Damping, Types of Vibration, Response of Structures to Vibration

Module II	Single Degree Of Freedom (SDOF) System	Contact Hours (10)

Equations of Motion and Natural Frequency, Modeling of SDOF Structures, Undamped, Free Vibration Response, Critically - Damped, Under - Damped and Over - Damped Systems, Damped Free Vibration Response, Logarithmic Decrement, Forced Harmonic Response, Vibration Isolation and Force Transmissibility, Vibration Measuring Instruments, Energy Dissipated by Damping, Forced Vibration Response to Periodic Forces, Forced Vibration Response to Impulsive Forces.

Module III	Multi Degree Of Freedom (MDOF) System	Contact Hours (10)

Simple MDOF Systems, Reduction of DOF's and Static Condensation, Modeling of MDOF System Structures, Concept of Generalized Coordinate, Lagrange's Equations of Motion, Free Vibration Analysis of Undamped MDOF System, Natural Vibration, Frequencies and Mode Shapes, Modal Expansion, Free Vibration Response of MDOF Systems, Normal Coordinates and Normal Mode Theory.

Module IV	Linear Dynamic Analysis for MDOF System	Contact Hours (08)

Time Domain Analysis for General Dynamic Loading, Frequency Domain Analysis for General Dynamic Loading, Frequency Domain Analysis for Support Motion
Partial Differential Equations of Motion (for String, Bar, Beam), Transverse Vibration of a String, Transverse Vibration of a Beam, Axial Vibration of a Bar,

Total Lecture Hours	35

Textbooks

1. Clough R. W., Penzien 3, "Dynamics of Structures", McGraw Hill.
2. Chopra A. K., "Dynamics of Structures : Theory and Applications to Earthquake Engineering", Prentice Hall.

Reference Books

1. Paz, M.,and Leigh, W., "Dynamics of Structures- Theory and Computation", Kluwer Academic Publisher.,
2. Thompson, W. T., "Theory of Vibration with Applications", Prentice-Hall

Digital Learning Resources

Course Name: **Structural Dynamics**
Course Link: https://archive.nptel.ac.in/courses/105/106/105106151/
Course Instructor: PROF. RAMANCHARALA PRADEEP KUMAR, IIT Hyderabad

Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)

Recommended by Board of Studies	No.: BoS_2	Date:
Approved by Academic Council	No.:	Date:

Course Code: 22CE6OE01T	Course Name: Waste Management	L	T	P	C
		3	0	0	3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 and 2023				

Course Objective:

- Understand solid waste sources, classification, and disposal.
- Learn hazardous waste treatment methods.
- Understand biomedical and radioactive waste management practices.
- Learn e-waste management and soil remediation techniques.

Expected Course Outcomes

- Design waste collection, treatment, and sanitary landfill systems.
- Apply thermal, physicochemical, and biological treatment techniques.
- Implement safe waste treatment and disposal methods as per standards.
- Design systems for e-waste handling and soil bioremediation.

Module I	Introduction to Solid Waste	Contact Hours (10)

Solid Waste: Sources and engineering classification, characterization, generation and quantification. Transport: Collection systems, collection equipment, transfer stations, collection route optimization.
Solid Waste Treatment Method - Various methods of refuse processing, recovery, recycle and reuse, composting - aerobic and anaerobic, incineration, pyrolysis and energy recovery, Disposal Methods - Impacts of open dumping, site selection, sanitary land filling – design criteria and design examples, leachate and gas collection systems, leachate treatment.

Module II	Solid Waste Management	Contact Hours (09)

Hazardous waste management- Introduction, sources, classification, physico-chemical, chemical and biological treatment of hazardous waste, regulations.
thermal treatment - incineration and pyrolysis

Module III	Biomedical and Radioactive waste Management	Contact Hours (08)

Biomedical waste management: Definition, sources, classification, collection, segregation treatment and disposal.
Radioactive waste management: Definition, sources, low level and high level radioactive wastes and their management, radiation standard by ICRP and AERB

Module IV	E-Waste Management	Contact Hours (08)

E-waste management: Waste characteristics, generation, collection, transport and disposal
Soil contamination and site remediation: bioremediation processes, monitoring of disposal sites.

	Total Lecture Hours	35

Textbooks

1. Tchobanoglous G., Theissen H., and Eliassen. R.(1991), “Solid Waste Engineering – Principles and Management Issues”, McGraw Hill, New York.
2. S.K. Garg, “Environmental Engineering (Volume II)”, Khanna Publishers.

Reference Books

1. Purnima, B.C., "Environmental Engineering (Volume II)", Khanna Publishers.
2. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., "Environmental Engineering", MGH.
3. Pavoni, J.L., "Handbook of Solid Waste Disposal", 1973.
4. Mantell, C.L., "Solid Waste Management", John Wiley, 1975.
5. Central Public Health and Environmental Engineering Organization (CPHEEO), "Manual on Municipal Solid Waste Management".

Digital Learning Resources		
Course Name: Municipal Solid Waste Management Course Link: https://archive.nptel.ac.in/courses/105/103/105103205/# Course Instructor: PROF. AJAY KALAMDHAD, IIT Guwahti		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.: BoS_2	Date:
Approved by Academic Council	No.:	Date: