



MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous Institute affiliated to RGPV, Bhopal)

NAAC Accredited with A++ Grade

Department of Civil Engineering

Scheme of Evaluation

B. Tech. I Semester *CIVIL ENGINEERING*

(for batch admitted in academic session 2023-24)

No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	Mode of Exam.	Duration of Exam.
				Theory Slot				Practical Slot				L	T	P				
				End Term Evaluation		Continuous Evaluation		End Sem. Exam	Continuous Evaluation									
				End Sem. Exam	\$Proficiency in subject /course	Mid Sem. Exam.	Quiz/Assignment		Lab Work & Sessional	Skill Based Mini Project								
1.	3100011	BSC	Engineering Mathematics – I (BSC - 1)	50	10	20	20	-	-	-	100	3	1	-	4	Offline	PP	2 Hrs
2.	3110121	ESC	Computer Programming (ESC - 1)	50	10	20	20	40	30	30	200	2	1	2	4	Blended	AO	2 Hrs
3.	3100014	ESC	Engineering Graphics (ESC - 2)	50	10	20	20	-	-	-	100	1	2	-	3	Offline	AO	2 Hrs
4.	3110122	DC	Building Materials & Construction (DC - 1)	50	10	20	20	40	30	30	200	3	-	2	4	Blended	PP	2 Hrs
5.	3110123	DC	Engineering Mechanics (DC - 2)	50	10	20	20	-	-	-	100	3	-	-	3	Blended	PP	2 Hrs
6.	3100018	ESC	Engineering Graphics Lab (ESC - 3)	-	-	-	-	40	30	30	100	-	-	2	1	Offline	SO	-
Total				250	50	100	100	120	90	90	800	12	4	6	19	-	-	-
7.	3000005	Natural Sciences & Skills	Environmental Engineering	50	10	20	20	-	-	-	100	2	-	-	GRADE	Blended	MCQ	1.5 Hrs

Induction programme of three weeks (MC): Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations.

\$Proficiency in course/subject – includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in that particular course/subject

Natural Sciences & Skills: Engineering Physics / Engineering Chemistry / Environmental Engineering / Language, Credits of natural Sciences & Skills will be added in VI Semester.

MCQ: Multiple Choice Question AO: Assignment + Oral OB: Open Book PP: Pen Paper SO: Submission + Oral

Mode of Teaching				Mode of Examination				Total Credits
Theory			Lab	Theory			Lab	
Offline	Online	Blended	Offline	PP	AO	MCQ	SO	
7		9	3	10	6		3	
37%		49%	16%	51%	33%		16%	
								19
								Credits %



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Scheme of Evaluation

B. Tech. II Semester *CIVIL ENGINEERING*

(for batch admitted in academic session 2023-24)

No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	Mode of Exam.	Duration of Exam.
				Theory Slot				Practical Slot				L	T	P				
				End Term Evaluation		Continuous Evaluation		End Sem. Exam	Continuous Evaluation									
				End Sem. Exam	\$Proficiency in subject /course	Mid Sem. Exam.	Quiz/Assignment		Lab Work & Sessional	Skill Based Mini Project								
1.	3110221	DC	Surveying (DC - 3)	50	10	20	20	-	-	-	100	3	-	-	3	Blended	PP	2 Hrs
2.	3110222	DC	Strength of Materials (DC - 4)	50	10	20	20	40	30	30	200	2	1	2	4	Blended	PP	2 Hrs
3.	3100021	ESC	Basic Mechanical Engineering (ESC - 4)	50	10	20	20	-	-	-	100	2	1	-	3	Blended	MCQ	1.5 Hrs
4.	3100022	ESC	Basic Electrical & Electronics Engineering (ESC - 5)	50	10	20	20	40	30	30	200	2	1	2	4	Blended	MCQ	1.5 Hrs
5.	3110224	ESC	Python Programming (ESC - 6)	50	10	20	20	40	30	30	200	2	1	2	4	Blended	AO	2 Hrs
6.	3110223	DLC	Survey Practice Lab (DLC - 2)	-	-	-	-	40	30	30	100	-	-	2	1	Offline	SO	-
Total				250	50	100	100	160	120	120	900	11	4	8	19	-	-	-
7.	3000004	Natural Sciences & Skills	Language	50	10	20	20	30	10	10	150	1	-	2	GRADE	Blended	MCQ	1.5 Hrs

Summer Internship Project – I (Institute Level) (Qualifier): Minimum two-week duration: Evaluation in III Semester.

\$Proficiency in course/subject – includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in that particular course/subject

Natural Sciences & Skills: Engineering Physics / Engineering Chemistry / Environmental Engineering / Language, Credits of natural Sciences & Skills will be added in VI Semester.

MCQ: Multiple Choice Question AO: Assignment + Oral OB: Open Book PP: Pen Paper SO: Submission + Oral

Mode of Teaching				Mode of Examination				Total Credits
Theory			Lab	Theory			Lab	
Offline	Online	Blended	Offline	PP	AO	MCQ	SO	
		15	4	6	3	6	4	19
		89%	21%	32%	15%	32%	21%	Credits %

Department of Civil Engineering
Scheme of Evaluation
B. Tech. III Semester

(for batch admitted in academic session 2023-24)

No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	Mode of Exam	Duration of Exam
				Theory Slot				Practical Slot				L	T	P				
				End Term Evaluation		Continuous Evaluation		End Sem. Exam	Continuous Evaluation									
				End Sem. Exam	\$Proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assignment		Lab Work & Sessional	Skill Based Mini Project								
1.	3100025	BSC	Engineering Mathematics - II (BSC - 2)	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP	2 Hrs
2.	3110321	DC	Fluid Mechanics - I (DC - 5)	50	10	20	20	40	30	30	200	2	1	2	4	Blended	PP	2 Hrs
3.	3110322	DC	Theory of Structure – I (DC - 6)	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP	2 Hrs
4.	3110323	DC	Geotechnical Engineering (DC - 7)	50	10	20	20	40	30	30	200	2	1	2	4	Blended	MCQ	1.5 Hrs
5.	3110324	DC	Transportation Engineering (DC - 8)	50	10	20	20	40	30	30	200	2	1	2	4	Blended	MCQ	1.5 Hrs
6.	3110325	DLC	Self-learning /Presentation (SWAYAM/NPTEL/MOOC)*	-	-	-	-	-	40	-	40	-	-	2	1	Online + Mentoring	SO	-
7.	3110326	DLC	Skill Internship Project (Institute Level) (Evaluation)	-	-	-	-	60	-	-	60	-	-	4	2	Offline	SO	-
8.	200XXX	CLC	Novel Engaging Course (Informal Learning)	-	-	-	-	50	-	-	50	-	-	2	1	Interactive	SO	-
Total				250	50	100	100	230	130	90	950	10	5	14	22	-	-	-
9.	1000005	MAC	Project Management & Financing	50	10	20	20	-	-	-	100	2	-	-	GRADE	Blended	MCQ	1.5 Hrs
10.	3000001	Natural Sciences & Skills	Engineering Physics (Applicable for both regular and Lateral entry admitted students)	50	10	20	20	30	10	10	150	1	-	2	GRADE	Blended	MCQ	1.5 Hrs
11.	3000005	Natural Sciences & Skills	Environmental Engineering (Applicable only for Lateral Entry admitted students)	50	10	20	20	30	10	10	150	2	-	-	GRADE	Blended	MCQ	1.5 Hrs

*compulsory registration for one online course using SWAYAM/NPTEL/ MOOC, evaluation through attendance, assignments and presentation

\$Proficiency in course/subject – includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in that particular course/subject

Natural Sciences & Skills: Engineering Physics / Engineering Chemistry / Environmental Engineering / Language, Credits of natural Sciences & Skills will be added in VI Semester.

MCQ: Multiple Choice Question AO: Assignment + Oral OB: Open Book PP: Pen Paper SO: Submission + Oral

Mode of Teaching						Mode of Examination					Total Credits
Theory			Lab/SIP	Seminar	NEC	Theory			Lab	SIP/SLP/NEC	
Offline	Online	Blended	Offline	Online Mentoring	Interactive	PP	AO	MCQ	SO	SO	
		15	5	1	1	9		6	3	4	22
		68%	23%	4.5%	4.5%	41%		27%	13%	19%	Credits %



**Scheme of Evaluation
B. Tech. IV Semester (Civil Engineering)**

For batches admitted in academic session 2023-24

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Teaching (Offline/ Online)	Mode of Exam	Duration of Exam	
				Theory Slot				Practical Slot			L	T	P					
				End Term Evaluation		Continuous Evaluation		End Sem Exam	Continuous Evaluation									
				End Sem Exam	Proficiency in subject /course	Mid Sem Exam	Quiz/ Assignment		Lab Work & Sessional		Skill Based Mini Project							
1.	3100028	BSC	Engineering Mathematics – III (BSC-3)	50	10	20	20	-	-	-	100	3	1	-	4	Offline	PP	2 Hrs
2.	3110421	DC	Fluid Mechanics - II (DC - 9)	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP	2 Hrs
3.	3110422	DC	Theory of Structure - II (DC -10)	50	10	20	20	-	-	-	100	2	1	-	3	Offline	PP	2 Hrs
4.	3110423	DC	Water Supply Engineering (DC - 11)	50	10	20	20	40	30	30	200	2	1	2	4	Blended	PP	2 Hrs
5.	3110424	DC	Water Resources Engineering (DC – 12)	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP	2 Hrs
6.	3110425	DLC	Civil Drawing Lab (DLC – 3)	-	-	-	-	40	30	30	100	-	-	2	1	Offline	SO	-
7.	3110426	MC	Cyber Security	50	10	20	20	-	-	-	100	2	-	-	2	Online	MCQ	1.5 hrs
8.	200XXX	CLC	Novel Engaging Course (Informal Learning)	-	-	-	-	50	-	-	50	-	-	2	1	Interactive	SO	-
Total				300	60	120	120	130	60	60	850	13	5	6	21	-	-	-
9.	3000002	Natural Science & Skills	Engineering Chemistry	50	10	20	20	30	10	10	150	1	-	2	Grade	Blended	MCQ	1.5 hrs
10.	1000001	MAC	Indian Constitution & Traditional Knowledge	50	10	20	20	-	-	-	100	2	-	-	Grade	Online	MCQ	1.5 hrs

Summer Internship Project-II (Soft skills Based) for two weeks duration: Evaluation in V Semester

[§]Proficiency in course/subject – includes the weightage towards ability/ skill/ competence /knowledge level /expertise attained /attendance etc. in that particular course/subject

MCQ – Multiple Choice Questions, PP – Pen paper Mode, A+O – Assignment + Oral, SO – Submission + Oral

**Natural Sciences & Skills: Engineering Physics / Engineering Chemistry / Environmental Science/ Language

(“Natural Sciences & Skills” treated as Mandatory Audit Courses from first to fourth semester and cumulative marks converted as a cluster of credits and awarded in the VI semester)

NOTE: Under Natural Science & Skills, Lateral Entry Admitted students have to appear for two courses in this semester: Engineering Chemistry & Language.

Mode of Teaching					Mode of Examination					Total Credits
Theory			Lab	NEC	Theory			Lab	NEC	
Offline	Online	Blended	Offline	Interactive	PP	A+O	MCQ	SO	SO	
7	2	9	2	1	16	-	2	2	1	21
33%	9%	43%	9%	5%	76%	-	9%	9%	5%	Credits %



DEPARTMENT OF CIVIL ENGINEERING

Scheme of Evaluation

B. Tech. V Semester (Civil Engineering)

For batches admitted in academic session 2023 – 24 onwards

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching (Offline/ Online)	Mode of Exam
				Theory Slot				Practical Slot				L	T	P			
				End Term Evaluation		Continuous Evaluation		End Sem Exam	Continuous Evaluation								
				End Sem Exam	Proficiency in subject /course	Mid Sem	Quiz/ Assignment		Lab Work & Sessional	Skill Based Mini Project							
1.	3110520	MC	Data Science	50	10	20	20	40	30	30	200	3	0	2	4	Blended	MCQ
2.	3110511	DC	Wastewater Engineering (DC - 10)	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP
3.	3110512	DC	Estimating Costing & Contracting (DC - 11)	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP
4.	3110513	DC	Structural Design & Drawing (RCC) (DC - 12)	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP
5.	3110514	DC	Railway, Airport and Tunnel Engineering (DC - 13)	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP
6.	3110515	DLC	Minor Project – I (DLC – 3)**	-	-	-	-	40	60	-	100	-	-	4	2	Offline	SO
7.	3110516	DLC	Self-learning /Presentation (SWAYAM/NPTEL/ MOOC)*	-	-	-	-	-	40	-	40	-	-	2	1	Online + Mentoring	SO
8.	200XXX	CLC	Novel Engaging Course (Informal Learning)	-	-	-	-	50	-	-	50	-	-	2	1	Interactive	SO
9.	3110517	DLC	Soft Skill Internship (Institute Level) (Evaluation)	-	-	-	-	60	-	-	60	-	-	4	2	Offline	SO
Total				250	50	100	100	230	100	20	850	11	4	14	22	-	-
10.	1000006	MAC	Disaster Management	50	10	20	20	-	-	-	100	2	-	-	Grade	Blended	MCQ
Additional Courses for obtaining Honours or Minor Specialization				Permitted to opt for <u>maximum 02 additional courses</u> for the award of Honours or Minor Specialization													

*compulsory registration for one online course using SWAYAM/NPTEL/ MOOC, evaluation through attendance, assignments and presentation

*Proficiency in course/subject – includes the weightage towards ability/ skill/ competence /knowledge level /expertise attained /attendance etc. in that particular course/subject

MCQ – Multiple Choice Questions, PP – Pen paper Mode, A+O – Assignment + Oral, SO – Submission + Oral

Note: Students of 2020-21 admitted batch needs to appear and complete an additional MAC course of 30 Hrs. duration on Project Management & Financing. / other modules related to futuristic technologies (Drones/ Robotics etc.)

** The Minor Project-I may be evaluated by an internal committee for awarding sessional marks.

Mode of Teaching						Mode of Examination					Total Credits
Theory			Lab / SIP	Seminar	NEC	Theory			Lab	SIP/SLP/NEC	
Offline	Online	Blended	Offline	Online Mentoring	Interactive	PP	A+O	MCQ	SO	SO	
-	-	15	5	1	1	12	-	3	4	3	22
-	-	68%	23%	4.5%	4.5%	54%	-	14%	18%	14%	Credits %

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DEPARTMENT OF CIVIL ENGINEERING

SYLLABUS B.Tech Civil Engineering

**2023 ONWARDS ADMITTED
BATCHES**

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
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SEMESTER-I & II

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Course Code: 3110122

Course Name: Building Materials & Construction

L	T	P	Credit
3	0	2	4

Course Objectives:

1. To study the properties of concrete ingredients i.e. cement. Sand and coarse aggregate by conducting different tests.
2. To select of different types of admixtures to improve the properties of concrete for different field applications.
3. To conduct the field and laboratory tests on concrete in fresh and hardened state.
4. To provide knowledge about various types of bricks, stones, woods & timber, ferrous & nonferrous construction material & their applications.
5. To provide knowledge on design of foundation, including selection of appropriate foundation.
6. To understand laying & construction of brick & stone masonry and various methods of damp proofing etc.
7. To provide knowledge about stairs, floors & roofs in various types of buildings.

Syllabus:

Unit-I

Types of Foundation& its design: masonry construction, masonry classification, stone v/s brick masonry, joints in stone masonry, brick masonry (bonds in brick masonry, characteristics of bonds, type of bonds), typical structures in brickwork, Damp prevention (causes, effects, control & prevention techniques, material used for damp proofing), Anti termite treatment, water proofing treatment, Arches & lintels, stair & stair case, (types & design of stair case), Types of floor & flooring, Roof & roof covering.

Unit – II

Ingredients of Concrete: Portland cement Chemical composition of cement, Hydration of cement, setting of cement, tests on physical properties of cement. Types of Portland cement – Ordinary Portland cement – Rapid Hardening Portland cement – low heat Portland cement- Sulphate Resisting cement – Portland Blast furnace cement- Super Sulphated cement- Portland Pozzolana cement and Pozzolanas: Fly ash; use of pozzolanas, white cement, Expansive cements – High alumina cement.

Aggregates: General classification of aggregates, natural and artificial aggregates, particle shape and texture, strength of aggregate, Mechanical properties of aggregate, specific gravity, Bulk density, porosity and absorption of aggregate, moisture content of aggregate, Bulking of sand deleterious substances in aggregates, Soundness of aggregates, Alkali- aggregate reaction, Fineness modulus, Grading requirements.

Admixtures: Introduction, functions of admixtures, classification of admixtures, Accelerators, Retarders, Water Reducing Agents, Super plasticizers, air entraining admixtures.

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Unit-III

Fresh and Hardened Concrete: Fresh Concrete, Workability of concrete, factors affecting workability, measurement of workability using slump test, Compaction factor test, Flow test, Vee-Bee Test, Ball penetration test, Segregation and Bleeding of concrete, process of concrete manufacturing.

Hardened Concrete: Compressive & Flexural strength of concrete, drying shrinkage of concrete, Creep of concrete, Permeability and durability of concrete, Thermal properties of concrete.

Unit IV

Bricks (classification, characteristics, manufacturing, testing, and types). Stones (classification, Quarrying, seasoning characteristics, testing, selection & uses, preservation), Wood & Timber (Classification, Structure & characteristics, seasoning and its methods, defects & diseases, preservation & various treatment testing), wood products and their applications

Unit V

Mortar (Classification, characteristics, functions of ingredients). Types of mortar and their uses grout, guniting, ferrous material (Pig iron, CI, Mild steel, wrought iron, stainless steel, compositions & proposition). Reinforced steel bars (classification, types, designation), Aluminium (its alloys & uses). Copper (its alloys & uses), Ceramics (classification, properties, commercial forms), Paint varnishes & enamels (types, composition, method of application, defects)

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Explain the basic elements of buildings, engg. materials & construction.

CO2: Evaluate the properties of various materials like cement, aggregate, concrete, admixture, brick, stone etc.

CO3: Distinguish the suitability of building materials in the construction of elements of buildings.

CO4: Evaluate various types of concrete in building construction accordingly.

CO5: Apply various techniques for finishing & protection works of various elements of building.

Text Books:

1. Concrete Technology, M. L. Gambhir, Tata McGraw Hill education Pvt. Ltd., 5th edition 2013
2. Concrete Technology, M.S. Shetty, S. Chand Publications, 2006
3. Building Materials, M.L. Gambhir, Tata McGraw Hill education Pvt. Ltd., 2017
4. Building Construction, B.C. Punmia, A.K. Jain, Laxmi Publishers New Delhi, 2016

Reference Books:

1. Properties of Concrete, Neville, ELBS, Pearson Education, 5th edition 2012
2. Building Material, S.K. Duggal, New Age Publishers, 4th revised edition 2012

List of Experiments:

1. Determination of properties of cement.
 2. Determination of properties of sand.
 3. Determination of properties of aggregate.
 4. Determination of Fineness of cement.
 5. Determination of consistency of cement.
 6. Determination of workability of concrete by slump test.
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7. Determination of workability of concrete by compacting factor apparatus.
8. Determination of workability by Vee Bee consistometer.
9. Determination of water absorption of bricks.
10. Determination of efflorescence of brick.
11. Field testing on bricks.
12. Determination of crushing strength of bricks.

Upon completion of practical course, the students will be able to:

CO 1: Determine the properties of cement, sand & aggregate as per IS code.

CO 2: Determine the workability of concrete for suitability of concrete mix in different construction works.

CO 3: Evaluate compressive strength of various concrete mixes.

CO 4: Determine physical properties of brick by experiment and practice accordingly.

CO 5: Examine the properties of the cement mortar for various elements of the buildings.

Suggestive List of Skill Based Mini Project:

1. Mix Design – (M20 & M25)
 2. Fresh & Hardened Concrete Design.
 3. Development of Innovative Building Materials like brick etc using waste materials.
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Course Code: 3110123

Course Name: Engineering Mechanics

L	T	P	Credit
3	0	0	3

COURSE OBJECTIVES:

1. To learn about basic laws of Mechanics and its application for different types of force systems.
2. To learn the Laws of friction and its applications
3. To study the applications of equilibrium concepts in Engineering problems.
4. To study about properties of areas like Centroid and Moment of Inertia.
5. To learn the basics of kinematics and Kinetics of particles and its applications in free vibration.

SYLLABUS

Unit-I

Forces and Equilibrium: Graphical and Analytical Treatment of Concurrent and non-concurrent coplanar forces, free body Diagram, Force Diagram and Bow's notations, Introduction to force system in space; Equilibrium Concepts.

Unit-II

Equilibrium Problem involving Frictional forces, Friction: Laws of Coulomb friction, inclined plane; ladder friction; wedge friction, square threaded screws; belt friction; rolling resistance

Unit-III

Support Reactions, Analysis of plane Trusses, method of joints, method of Sections, Graphical method. Shear force and bending moment diagram for cantilever, simply supported and overhanging beam with concentrated, distributed load and Couple.

Unit-IV

Properties of areas: Centroid of plane areas, Moments of inertia, theorem of parallel axis and theorem of perpendicular axis; product of inertia of areas, polar moment of inertia, principal axes and principal moments of inertia.

Unit-V

Kinematics and Kinetics of particles: Particle dynamics; Free Vibrations of undamped Single Degree of Freedom system

COURSE OUTCOMES

On successful completion of teaching-learning and evaluation activities, a student would be able to

1. Apply basic laws of Mechanics for different types of force systems.
2. Apply the Laws of friction in engineering problems.
3. Apply the concept of equilibrium in statically determinate beams and trusses.
4. Determine the properties of areas for different shapes.
5. Apply the basics of Kinematics and Kinetics of particles in motion and undamped free vibration.

Text book:

1. R. C. Hibbeler, *Engineering Mechanics (Statics and Dynamics)*, Pearson Education Asia Pvt. Ltd
2. RS Khurmi and N Khurmi, *A Textbook of Engineering Mechanics*, S. Chand and Co. Ltd.
3. R. K. Rajput, *Engineering Mechanics*, Dhanpat Rai Publications (P) Limited
4. J. L. Meriam and L.G. Kraige, *Engineering Mechanics (Static & Dynamics)*, John Wiley

Reference books

1. F. P. Beer and E. R. Johnston, *Mechanics for Engineers (Static & Dynamics)*, McGraw Hill
 2. S. P. Timoshenko, D. H. Young, and J. V. Rao, *Engineering Mechanics*, Tata-McGraw Hill.
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Course Code: 3000005

Course Name: Environmental Engineering

L	T	P	Credit	Mode of Teaching	Mode of End Sem Exam
2	0	0	GRADE	Blended	MCQ (1.5 Hrs)

Course Objectives:

1. To create awareness about various sources of energy and their applications.
2. To create awareness about various environmental issues and how to deal with those environmental issues.
3. To impart fundamental concepts in environmental engineering dealing with air, water and waste management.
4. To create awareness about sustainability concepts and need of sustainable development for development of society.
5. To create awareness about various environmental policies.

Syllabus:

Unit 1: Energy: Various forms of Renewable and non-renewable energy and their applications, Solar Energy, Hydro, wind, biomass, geothermal, tidal and nuclear energy, green energy, clean energy, role of energy in economic and social development.

Unit 2: Water Environment: Ecosystems & its components, Water Cycle, Water availability & uses, Water resources problems and its solutions, Water pollution problems, Water quality characteristics & standards, Introduction to water treatment mechanisms.

Unit 3: Air Environment: Air pollution, causes, global effects, climate change and its impact, Introduction to air pollution control measures, Carbon credit, Carbon trading, Clean Development Mechanism (CDM).

Unit 4: Waste Management: Introduction to management of municipal solid waste, E-waste and plastic waste, various initiatives in management of waste.

Unit 5: Sustainability: Introduction to the concept of sustainability & sustainable development, Sustainable development goals, TBM, Challenges for sustainable development.

Policies: Multilateral environmental agreements and Protocols – Kyoto Protocol, Montreal Protocol, Indian policies - Environment Protection Act 1986, Waste Management rules 2000.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1. Explain the fundamental concepts of energy, ecosystems & environment.

CO 2. Recognize various environmental problems and their effects.

CO 3. Apply various air & water remediation methods.

CO 4. Apply waste management techniques.

CO 5. Apply the concepts of sustainability

Text Books:

1. D. K. Asthana, Meera Asthana, A Text Book of Environmental Studies, S Chand & Co., New Delhi.
2. P. Meenakshi, Elements of Environmental Science & Engineering, PHI, New Delhi

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3. M.M. Sulphery, M.M. Safer, Introduction to Environment Management, PHI, New Delhi
 4. S K Dhameja, Environmental Engineering & Management, S K Kataria & Sons, new Delhi
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Course Code: 310020

Course Name: Basic Civil Engineering & Mechanics

L	T	P	Credit
3	0	0	3

Course Objectives:

1. To understand the utility of various types of building materials.
2. To understand the location, construction detail and suitability of various building elements.
3. To determine the location of object on ground surface.
4. To stabilize the position of various object.
5. To understand the effects of system of forces on rigid body in static conditions.
6. Analysis of determinate structure (beam & truss)

Syllabus:

Unit- I

Building Materials: Stones, bricks, cement, timber - types, properties, test & uses, Introduction of concrete properties & Laboratory tests on concrete, curing of concrete and mortar Materials.

Unit- II

Surveying & Positioning: Introduction to surveying, Survey stations, Measurement of distances- conventional and EDM methods, Measurement of directions by different methods, Measurement of elevations by different methods, reciprocal leveling.

Unit- III

Mapping & Sensing: Mapping details and contouring, Plane tables and related devices. Introduction of theodolite. Measurement of areas and volumes, application of measurements in quantity computations, Introduction of remote sensing and its applications.

Unit- IV

Forces and Equilibrium: Graphical and Analytical Treatment of Concurrent and non-concurrent coplanar forces, free body Diagram, Force Diagram and Bow's notations, Application of Equilibrium Concepts: Analysis of plane Trusses, method of joints, method of Sections. Frictional force in equilibrium problems.

Unit -V

Centre of Gravity and moment of Inertia: Centroid and Centre of Gravity, Moment of Inertia of Composite section, Radius of Gyration, Introduction to product of Inertia and Principle Axes. Support Reactions, Shear force and bending moment diagram for cantilever & simply supported beam with concentrated, distributed load and Couple.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Explain concepts and terminologies of building materials, surveying and mechanics.

CO 2: Apply various methods for surveying and mechanics.

CO 3: Determine the location, area and volume of objects on ground surface.

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CO4: Solve the problems of surveying and mechanics by using various methods.

CO5: Analyse the effects of system of forces on rigid bodies in static conditions.

Text Books:

1. Surveying, Vol. – 1, Punmia B.C., Laxmi Publications, 17th edition, 2016
2. Building Material, B. C. Punmia, Laxmi Publications, 2016
3. A textbook of Engineering Mechanics, D. S. Kumar, Katsons Publications, 2013

Reference Books:

1. Basic Civil Engineering, S. Ramamrutam & R. Narayan, Dhanpat Rai Pub., 3rd edition, 2013
 2. Applied Mechanics, Prasad I.B., Khanna Publication 17th edition, 1996
 3. Surveying, Duggal, Tata McGraw Hill New Delhi, 4th edition, 2013
 4. Engineering Mechanics - Statics & Dynamics, R.C. Hibbler, Pearson Publications, 14th edition, 2015
 5. Engineering Mechanics - statics dynamics, A. Boresi & Schmidt, Cengage learning, 1st edition, 2008.
 6. Applied Mechanics, R.K. Rajput, Laxmi Publications, 3rd edition, 2016
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Course Code: 3110221

Course Name: Surveying

L	T	P	Credit
3	0	0	3

Course Objectives:

- 1) To understand the working of Theodolite, Tacheometer and Total Station.
- 2) To understand the determination of distances, direction and elevation.
- 3) To understand the surveying techniques and their application in various fields.
- 4) To provide knowledge on setting out civil engineering works & detailed field surveying.
- 5) To understand various types of curves used in practice and concepts of hydrographic & photographic surveying.

Syllabus:

Unit I: Surveying Measurements

Introduction to surveying, their classification, methods and principles, Measurement of distance and direction. Introduction to Remote Sensing & LiDAR technology in Survey, Global Positioning System (GPS) and its application.

Unit II: Levelling & Contouring

Method of levelling, methods of reduction of level, Reciprocal and trigonometric levelling, Contouring and Plotting, Use of Contour maps, Measurement of area and volume.

Unit III: Tachometry & Traversing

Principles and Instruments used in Tachometry, Methods of Theodolite traversing, Plotting and Adjustment, Omitted measurement in traverse, Plane Table Surveying.

Unit IV: Curves

Curve surveying, their use, elements of circular curves, Methods of setting out curves, obstacles and special problems, compound curves, reverse curves, transition curves, vertical curve, computation and setting out.

Unit V: Surveying Techniques

Systems and Principles of Triangulation, Baseline measurement and its extension, Total Station and its application in surveying, Introduction to Aerial Survey using UAV/ Drones, Introduction to photogrammetry and hydrographic survey.

Course Outcomes:

Upon completion of the course, the students will be able to:

- CO1: Explain** the techniques used for linear and angular measurements in surveying.
 - CO2: Explain** the various concepts of levelling, contours and its application.
 - CO3: Apply** various methods of surveying.
 - CO4: Analyse** various techniques of controlling points.
 - CO5: Evaluate** various methods for curve setting.
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Text Books:

1. Surveying Vol. I, II, III, B.C. Punmia, Laxmi Publications New Delhi, 2016
2. Surveying Vol. I & II, K.R. Arora, Standard book House, New Delhi, 13th edition 2016
3. Surveying Volume – I & II, S. K. Duggal, McGraw Hill Publication, 2015

Reference Books:

1. Surveying theory & Practice, R.E. Devise, McGraw Hill, New York, 4th revised edition 2001
 2. Fundamentals of surveying, S.K. Roy, Prentice Hall of India New Delhi, 2nd edition, 1999
 3. Surveying & Levelling, N N Basak, McGraw Hill Publications, 2015
 4. Plane & Geodetic surveying Vol. I & II, David Clark & J Clendinning, Constable & C. London, 2017
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Course Code: 3110223

Course Name: Survey Practice Lab

L	T	P	Credit
0	0	2	1

Syllabus:

List of Experiments:

1. Measurement of distance using chain & tape of given survey area.
2. Measurement of direction by prismatic compass & surveyor's compass.
3. Exercise of flying levelling by dumpy level.
4. Profile Levelling & Cross Sectioning of Road using dumpy level.
5. Determination of R.L. of a point whose base is accessible & inaccessible by Trigonometrical levelling.
6. Prepare Contour map by using Grid Pattern & Tachometric Method.
7. Preparation of contour map by total station.
8. Determination of horizontal & vertical position of a point by Total Station & measurement of area.
9. Traversing by Total Station.
10. Measurement of horizontal and vertical angle by Vernier Theodolite.
11. Determination of height & distance by using Stadia method & Tangential tachometry
12. Preparation of map of given survey field by Radiation and intersection method using Plane table.
13. Resection by Two point problem & Three point problem.
14. Setting out of a simple circular curve by using Rankine's method.
15. Setting out of a simple circular curve by using Offset from the chord produced or deflection distance.
16. Measurement of base line by using Substance Bar.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Follow the guidelines for field surveying.

CO 2: Follow the working principles of survey instruments for measurements.

CO 3: Measure horizontal & vertical angle by theodolite for traversing and levelling.

CO 4: Determine tachometric constants for linear measurements by tachometry.

CO 5: Create a simple circular curve by using Rankine's method for alignment

CO 6: Develop contour map by using tachometer & total station.

Suggestive List of Skill Based Mini Project:

1. Development of contour map using Total Station.
2. Setting out of Horizontal Curve using Total Station & Theodolite.
3. Area Volume calculations using Total Station.

Text Books:

1. Surveying Vol. I, II, III, B.C. Punmia, Laxmi Publications New Delhi, 2016
2. Fundamentals of surveying, S.K. Roy, Prentice Hall of India New Delhi, 2nd edition, 1999

Reference Books:

1. Surveying theory & Practice, R.E. Devise, McGraw Hill, New York, 4th revised edition 2001
2. Surveying Volume –II, S. K. Duggal, McGraw Hill Publication, 2015
3. Surveying Vol. I & II, K.R. Arora, Standard book House, New Delhi, 13th edition 2016

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Course Code: 3110222

Course Name: Strength of Materials

L	T	P	Credit
2	1	2	4

Course Objectives:

- 1) To understand the concepts of simple and compound stresses and strains.
- 2) To understand the behaviour of elastic materials in bending, shear and torsion.
- 3) To understand the stability behaviour of long columns under axial load.
- 4) To understand the power transmission by shaft.
- 5) To understand stresses & strain developed in storage vessels
- 6) To calculate stresses / strain in statically indeterminate structures.

Syllabus:

Unit-I

Stress and Strains: Concept of Elastic body, stress and strain. Hooke's law various types of stress and strains. Elastic constants and their relation Stresses in compound bars, composite and tapering bars, temperature stresses.

Two-dimensional stress system. Normal and tangential stresses, Principal Planes, Principal Stresses and strains. Mohr's circle of stresses. Strain energy and theories of failure.

Unit - II

Theory of simple bending: Concept of pure bending and bending stress, equation of bending, Neutral axis, Section-Modulus, Bending stress distribution across a section, Shear Stresses in Beams, beams of uniform strength, shear centre.

Unit-III

Torsion of Shafts: Concept of pure torsion, Torsion equation, Determination of shear stress and angle of twist of shafts of circular section, Hollow circular shafts. Combined bending and torsion.

Pressure Vessels: Thin cylinders and spheres. Stress due to internal pressure. Change in diameter and volumes.

Unit-IV

Columns and Struts: Euler's buckling load for uniform section, various end conditions. Slenderness Ratio. Merchant Ranking formulae, Eccentric loading on columns.

Unit-V

Deflection of statically determinate structure by Geometrical methods & Introduction of method of virtual work.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Apply the concepts of stress and strain.

CO 2: Apply theory of simple bending in beams.

CO 3: Apply the concept of pure torsion in shaft and determine the stresses in pressure vessels.

CO 4: Evaluate columns & struts with different end conditions.

CO 5: Analyse the structure using geometrical methods and virtual work to determine the deflection.

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Text Books:

1. Strength of Materials, Sadhu Singh, Khanna Publishing, 1st edition 2016
2. Strength of Materials, S. Ramamrutham, R. Narayanan, Dhanpat Rai Publishing Company, 18th edition 2014
3. Strength of Materials, R. K. Bansal, Laxmi Publication; 6th edition 2018

Reference Books:

1. Strength of Materials, Timoshenko, Publisher CBS, 3rd edition 2004
2. Strength of Materials, HigdonStyle, Publisher Wiley, 3rd edition 1978
3. Strength of Materials Vol. I& II, B.C. Punmia, Laxmi Publication, 10th edition 2018
4. Mechanics of Materials, R.C. Hibbler, Pearson Publication, 2016
5. Mechanics of Materials, J. M. Gere & B.J. Goodno, Cengage Publisher, 8th edition 2014

List of Experiments:

1. Impact Test
2. Brinell Hardness Test
3. Behaviour of columns with Different End Conditions
4. Tensile test
5. Compression test
6. Flexure test
7. Shear test
8. Spring test
9. Torsion test
10. Verification of Maxwell's Reciprocal Theorem.
11. Bending of Beam (One Point loading only).
12. Bending of Beam (Two Point loading only).

Upon completion of practical course, the students will be able to:

CO1: Evaluate properties of material by impact test.

CO2: Evaluate properties of material by hardness test.

CO3: Evaluate properties of material by tensile test.

CO4: Determine compressive & flexural strength of materials.

Suggestive List of Skill Based Mini Project:

1. Determination of unsymmetrical bending & shear center.
 2. Beam Deflection
 3. Determination of Stress Strain curve for steel.
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DEPARTMENT OF CIVIL ENGINEERING

SYLLABUS B.Tech Civil Engineering

2023 ADMITTED BATCH

SEMESTER-III

Course Code: 3110321**Course Name: Fluid Mechanics - I**

L	T	P	Credit
2	1	2	4

Course Objective:

To provide a comprehensive understanding of fluid properties, fluid continuum, kinematics and dynamics of fluid flow, fluid measurement mechanisms, simulation and dimensional analysis methods, and the concepts of laminar flow, enabling students to apply these principles to various fluid flow problems.

Syllabus:**Unit I**

Review of Fluid Properties: Engineering units of measurement, density, specific weight, specific volume, specific gravity, surface tension, capillary, viscosity, bulk modulus of elasticity, pressure and vapour pressure.

Fluid Statics: Pressure at a point, pressure variation in static fluid, Absolute and gauge pressure, manometers, Forces on plane and curved surfaces (Problems – gravity dams and Tainter gates), buoyant force, Stability of floating and submerged bodies, Relative equilibrium.

Unit II

Kinematics of Flow: Types of flow-ideal & real, steady and unsteady, uniform & non-uniform, one, two and three dimensional flow, path lines, streamlines, streamlines and stream tubes, continuity equation for one and three dimensional flow, rotational & irrotational flow, circulation, stagnation point, separation of flow, sources & sinks, velocity potential, stream function, flownets-their utility & method of drawing flownets.

Unit III

Dynamics of Flow: Euler's equation of motion along a streamline and derivation of Bernoulli's equation, application of Bernoulli's equation, energy correction factor, linear momentum equation for steady flow, momentum equation, forces of fixed and moving vanes, velocity triangles.

Fluid Measurements: Velocity measurement, flow measurement (Orifices, nozzles, mouth pieces, orifice meter, Nozzle meter, venturimeter, weirs and notches).

Unit IV

Dimensional Analysis and Hydraulic Similitude: Dimensional analysis, dimensional homogeneity, use of Buckingham-pie theorem, calculation of dimensionless numbers, similarity laws, specific model investigations (submerged bodies, partially submerged bodies, weirs, spillways, etc.)

Unit V

Laminar Flow: Introduction to laminar, transition & turbulent flow, Reynolds experiment & Reynolds number, relation between shear & pressure gradient, laminar flow through circular pipes, laminar flow between parallel plates, laminar flow through porous media, stokes law, Bach wash processing, Instability of laminar flow to turbulent flow.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Define various fluid properties & states of fluid.

CO 2: Apply principles of fluid flow & dimensional analysis.

CO 3: Solve fluid flow problems.

CO 4: Analyze characteristics of fluid at rest, fluid at motion & dimensionless numbers.

CO 5: Discriminate different types of fluid flow, measurement techniques & principles.

CO 6: Apply the concepts of laminar flow in solving various fluid flow problems.

Text Books:

1. Fluid Mechanics, Modi & Seth, Standard Book House, Delhi, 21st edition, 2018.
2. Fluid mechanics, Girde & Mirazgaonkar, SCI Tech Publishers, 2019
3. Fluid Mechanics, R.K. Bansal, Laxmi Publishers, 2015

Reference Books:

1. Fluid Mechanics, A.K. Jain, Khanna Publishers, Delhi, 2014
2. Fluid Mechanics, Streeter, McGraw Hill Publishers, 9th edition, 2017

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1					1						1		
CO2	2	1	1	2	1	1	1					2		1
CO3	2	2	1	2	2	2	2					2		2
CO4	2	3	1	2	1	2	2					2		2
CO5	2	2		2	2	2	2					2		
CO6	2	2	1	2	1	1	1					2		2

1 - Slightly; 2 - Moderately; 3 – Substantially

List of Experiments:

1. Determination of viscosity of fluid by redwood viscometer
2. Determination of metacentric height of floating body
3. Calibration of Venturimeter
4. Determination of C_c , C_d , C_v of Circular Orifice
5. Calibration of Mouthpiece
6. Calibration of Orifice Meter
7. Reynolds experiment for demonstration of stream lined & turbulent flow
8. Determination of Friction Factor for a pipe
9. Verification of Stoke's law.

Course Outcomes:

Upon completion of practical course, the students will be able to:

CO 1: Differentiate between different flow measurements devices.

CO 2: Notice flow through pipes & fall velocity of particle.

CO 3: Correct the instrumental errors.

CO 4: Apply Stoke's law to calculate terminal velocity.



Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2		3	2	2		2	2	2		2		1
CO2	2		1	3	2	2			2	2		2		2
CO3	2	2		2	2				2	2		2		
CO4	2	2	1	3	2			2	2	2		2		2

1 - Slightly; 2 - Moderately; 3 – Substantially

Course Code: 3110322

Course Name: Theory of Structure - I

L	T	P	Credit
2	1	0	3

Course Objective:

To understand the behavior of the structure, different methods for the analysis of indeterminate structure, principle of virtual work and energy methods.

Syllabus:

Unit-I

Deflection of beams: Energy Methods, Castigliano's theorem, method of real work, Principle of virtual work, method of virtual work for beam displacements.

Unit-II

Virtual work and Energy Principles: Principles of Virtual work applied to deformable bodies. Maxwell's Reciprocal theorems, Energy theorems, Application to pin jointed frames only.

Unit – III

Indeterminate Structures –I: Static and Kinematics indeterminacy, Analysis of Fixed and continuous beams by Theorem of three moments, Effect of sinking and rotation of supports.

Unit-IV

Indeterminate Structures – II: Analysis of beams and analysis of frames (with and without sway) by slope Deflection method.

Unit-V

Moment Distribution Method: Moment distribution method for analysis of beams and analysis of frames (without sway) Three hinged arches of different shapes, Eddy's Theorem. Two Hinged and Fixed Arches.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Determine the deflection of beam using energy methods and the principle of virtual work.

CO 2: Explain various methods & principles for analysis of structures.

CO 3: Apply various methods & principles for structural analysis.

CO 4: Analyse various structures using various methods, principles & theorems.

CO 5: Evaluate different methods of structural analysis.

Text Books:

1. Basic Structural Analysis, Reddy C. S., Tata McGraw Hill Publishing Company, 2017
2. Theory of Structures, S. Ramamrutham, R. Narayanan, Dhanpat Rai Publications, 9th edition, 2014
3. Theory of Structures, B.C. Punmia, Laxmi Publications, 2017

Reference Books:

1. Structural Analysis – A Unified classical and matrix Approach, Ghali A & Neville M, Chapman

and Hall, New York, 6th edition, 2009

2. Intermediate structural analysis, Wang C.K., McGraw Hill, New York, 1984
3. Structural Analysis, Aslam Kassimali, C. L. Publisher, 2014
4. Structural Analysis, R. C. Hibbler, Pearson Publication, 2017

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1		2		1						2		2
CO2	1			2		1		1				1		1
CO3	2	2		2	2			1				2		2
CO4	2	3	1	3	1	2	1	1				2		2
CO5	2	2	1	3	1	2						2		2

1 - Slightly; 2 - Moderately; 3 – Substantially

Course Code: 3110323**Course Name: Geotechnical Engineering**

L	T	P	Credit
2	1	2	4

Course Objective:

To familiarize students with the significance of geological investigations for civil engineering projects, and fundamental soil properties and classifications. It also aims to develop an understanding of the relationships between physical and mechanical properties of soils, the role of water in soil behavior, shear parameters, stress changes due to foundation loads, and the principles of soil mechanics for stability analysis of slopes and settlement calculations.

Syllabus:**Unit-I Engineering geology & soil properties**

Introduction to geology, mineralogy, petrology – Three-fold classification of rocks and their characteristic features. Structural geology - Types and classification of structures (Joints, Unconformities, Folds and faults) and their effect on civil engineering projects.

Introduction – Types of soils, their formation & deposition, basic definitions and relationships - Three phase system. Index properties of soil and their determination. Relationship between volume weight, void ratio-moisture content, moisture content-specific gravity, and unit weight- air voids etc.

Plasticity Characteristics of soil & indices and their determination, use of consistency limits, Classification of soil based on particle size and consistency limits, unified soil classification systems, Indian standard soil classification system, general characteristics of soil in different groups.

Unit-II Soil Water and Consolidation:

Permeability of soil: Darcy law and its validity, Determination of permeability in laboratory and in field using various methods like constant head method, pumping tests etc. factors affecting permeability of soil, Seepage analysis – introduction, stream & potential functions, flow nets, uses of a flow net, Introduction to effective, neutral and total stresses, effect of water table, fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition.

Consolidation – Introduction, Compressibility and consolidation, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, interpretation of consolidation test results, Terzaghi's Theory of consolidation, final settlement of soil deposits, Determination of consolidation settlement and secondary consolidation.

Unit-III Stress Distribution in Soils:

Stresses in soil – Introduction, stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area, influence factors, isobars, Boussinesq's equation, westergaard's analysis. Newmark's influence chart. Contact pressure under rigid & flexible area, computation of displacements from elastic theory.

Unit – IV Shear Strength of Soils:

Mohr Circle and its characteristics, principal planes, relation between major and minor principal stresses. Mohr-Coulomb's theory, types of shear tests, direct shear test, merits of direct shear test, Triaxial compression test, test behaviour of UU, CU and CD tests, pore-pressure measurements, computation of effective shear strength parameters, unconfined compression test, vane shear test, critical void ratio, Liquefaction.



Unit – V Stability of Slopes:

Introduction, Types of slopes and their failure mechanisms, factor of safety, analysis of Infinite and finite slopes, wedge failure, Swedish circle method, friction circle method, stability numbers and charts. Effect of ground water. Selection of shear strength parameters in slope stability analysis. Stability of Earth dams.

Course Outcomes:

Upon completion of the course, the students will be able to:

- CO1: Evaluate** different properties of rocks & soil and its classification.
- CO2: Examine** the flow and shear parameters & their effects on various types of soil.
- CO3: Determine** the stress distribution & shear failure by various methods.
- CO4: Evaluate** the shear strength parameter of soil by various methods.
- CO5: Analyse** the stability of slopes using various methods.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2		2		2	2					2	1	2
CO2	2	2		2	1	2	2					2		2
CO3	2	3	1	2	2	2	2	1				2	1	2
CO4	2	3	1	3	2	2	2	1				2	1	2
CO5	2	2	1	3	2	2	1					2		2

1 - Slightly; 2 - Moderately; 3 – Substantially

Text Books:

1. Soil Mech. & Found. Engg., Dr. K.R. Arora, Std. Publishers Delhi, 7th Edition, 2014
2. Soil Mech. & Foundation, Dr. B.C. Punmia, Laxmi Publications, Delhi, 16th Edition, 2017
3. Basic & Applied Soil Mechanics, Gopal Ranjan, New Age International Publishers, 2016
4. Parbin Singh., “Engineering and General Geology”, S. K. Kataria and Sons, 2009

Reference Books:

1. Modern Geotech Engg. Dr. Aram Singh, IBT Publishers, Delhi, 8th Edition, 2016
2. Geotech Engg., C. Venkatramaiah, New Age International Publishers, 16th Edition, 2018
3. Soil Testing for Engg., T.W. Lambe, John Wiley & Sons. Inc. 1969
4. Bangar, K.M, Principles of Engineering Geology, Standard Publishers Distributors, 1995, New Delhi

List of Experiment’s:

1. Moisture Content Determination. Oven Drying Method.
2. Grain Size Analysis – Mechanical Method.
3. Grain Size Analysis – Hydrometer Method.
4. Liquid Limit, Plastic Limit, Shrinkage Limit Tests.
5. In-Place Density tests – Core Cutter Method, Sand Replacement Method.
6. Specific Gravity Tests.
7. Permeability Tests, Variable Head Method.
8. Compaction Test.
9. Unconfined Compression Test.
10. Direct Shear Test.
11. Triaxial Shear Test (UU)
12. Vane Shear Test.
13. Plate Load Test (Demonstration)



14. Consolidation Test.

Upon completion of practical course, the students will be able to:

CO 1: Check physical properties of soil.

CO 2: Check strength properties of soil.

CO 3: Differentiate the flow properties and stresses of soil.

CO 4: Check shear strength of soil.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1		3	2	2	2	2	2	3		2		1
CO2	2	2		3	2	2	2	2	2	3		2		2
CO3	2	2		3	2	2		2	2	3		2		1
CO4	2	2		3	2	2		2	2	3		2		2

1 - Slightly; 2 - Moderately; 3 – Substantially



Course Code: 3110324

Course Name: Transportation Engineering

L	T	P	Credit
2	1	2	4

Course Objective:

To provide comprehensive knowledge on the planning and geometric design of roads and highways, pavement materials and design, construction processes and methods, and traffic characteristics and intersection design.

Syllabus:

Unit – I Highway Development and Planning

Highway Development in India — Necessity for Highway Planning – Different Road Development Plans; Classification of Roads. Road Network Patterns — Highway Alignment-Factors affecting Alignment- Engineering Surveys.

Unit – II Highway Geometric Design

Importance of Geometric Design – Design controls and Criteria – Highway Cross Section Elements – Sight Distance Elements – Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance – Design of Horizontal Alignment – Design of Super elevation and Extra widening – Design of Transition Curves – Design of Vertical alignment - Gradients-Vertical curves.

Unit – III Traffic Studies

Spot Speed Studies and Volume Studies, Speed and Delay Studies purpose, causes of delay, methods of conducting speed and delay studies, Origin and destination Studies (O & D): Various methods, collection and interpretation of data, Traffic Capacity Studies: Volume, density, basic practical and possible capacities, level of service, Parking Studies: Methods of parking studies, design of intersections at grade & grade separated.

Unit -IV

Highway Construction Materials: Aggregates and their types, physical and engineering properties, Fillers, Bitumen, Characteristics, Emulsions and cutbacks, Basic tests on all materials.

Design of Flexible & Rigid Pavements: Introduction, flexible pavement, factors affecting design and performance, stress in flexible pavement, design of flexible pavement as per IRC, rigid pavements – components & functions, factors affecting design & performance of CC pavements, stress in rigid pavement, type of joints, dowel bar, tie bar and its functionalities.

Unit – V Evaluation and Maintenance of Pavements

Pavement distress in flexible and rigid pavements, Pavement evaluation, structural evaluation, evaluation by deflection measurements, Strengthening of pavements, Types of maintenance, Importance of highway drainage, Surface and sub-surface drainage arrangements.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the principles of highway planning & their geometrical design.

CO 2: Evaluate physical properties of suitable highway engineering materials with drainage provisions.

CO 3: Apply the concepts of traffic engineering in transportation planning.

CO 4: Design pavements as per regulations.

CO 5: Formulate the layers of pavement along with provisions of its drainage & maintenance.

Text Books:

1. Highway Engineering, S.K. Khanna & C.E.G. Justo, Nemchand Pub., 10th edition, 2018
2. Highway Engineering, Gurucharan Singh, Standard Publishers, 5th edition, 2006
3. Principles & Practices of Highway Engineering, L R Kadiyali, N B Lal, Khanna Publishers, 2016

Reference Books:

1. Principles of Pavement Design, E.J. Yoder & M.W. Witzech, Wiley India, 2nd edition, 2011
2. Highway Engineering, O' Flaherty, Butterworth-Heinemann, 4th edition, 2002
3. Principles of Practice of Highway Engg., Sharma & Sharma, Asia Publishing House, 1965
4. Analysis and Design of Pavements, Haung, Pearson, 2nd edition, 2004

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		1			1	1					1		1
CO2	2			1		1	1					2		1
CO3	2	2	1	2		2	2	2				2	3	2
CO4	2			2	2	2	2					2		2
CO5	2	1		2	2	2	2	2	2	2	2	2		2

1 - Slightly; 2 - Moderately; 3 – Substantially

List of Experiments:

1. Aggregate Crushing Value Test
2. Determination of Aggregate Impact Value
3. Determination of Los Angeles Abrasion Value
4. Determination of flakiness index and elongation index of aggregates.
5. Determination of California Bearing Ratio Value
6. Determination of Penetration Value of Bitumen
7. Determination of Viscosity of Bituminous Material
8. Determination of Softening Point of Bituminous Material
9. Determination of Ductility of the Bitumen
10. Determination of Flash Point and Fire Point of Bituminous Material
11. Determination of Bitumen Content by Centrifuge Extractor
12. Determination of Stripping Value of Road Aggregate
13. Determination of Marshall Stability Value for Bitumen.



Course Outcomes:

Upon completion of the practical course, the students will be able to:

CO 1: Select suitable aggregate material by testing the physical properties.

CO 2: Determine properties of bitumen and its grade.

CO 3: Determine CBR value of material for subgrade and subsequent layers of pavement.

CO 4: Design job mix formula for bituminous surface using Marshal Stability test

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1		3	2	2	2	2	2	3		2		1
CO2	2	2		3	2	2	2	2	2	3		2		2
CO3	2	2		3	2	2		2	2	3		2		1
CO4	2	2		3	2	2		2	2	3		2		2
CO5	2	1		3	2	2	2	2	2	3		2		1

1 - Slightly; 2 - Moderately; 3 – Substantially

Course Code: 3110325**Course Name: Self Learning / Presentation**

L	T	P	Credit
0	0	2	1

Course Objective:

To encourage students to engage with civil engineering literature, enhance their presentation and communication skills, promote lifelong learning, and develop the soft skills necessary for effective topic presentation

Syllabus:

1. Any relevant topic related to civil engineering from within or beyond the syllabus through Swayam / NPTEL /MOOC.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Analyze contemporary issues in civil engineering & its allied areas through literature survey.

CO2: Distinguish state of art & relevance of the topic in national & international arena.

CO3: Demonstrate good oral & written communication skills.

CO4: Develop poster and power point presentations for effective communication.

CO5: Display lifelong learning.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1		2	1	2	2	1	2	2	1	2	1	2
CO2	1			2	1	2	2	1	2	2	1	2		1
CO3									3	3		2		
CO4									3	3		2		
CO5	2	2	2	2	2	2	2	2	2	2	1	3	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Course Code: 3110326

Course Name: Skill Internship Project

L	T	P	Credit
0	0	4	2

Course Objective:

To encourage students to engage with various civil engineering topics, acquire strong oral and written communication skills, and promote the habit of lifelong learning.

Syllabus:

Each candidate shall have to undergo 15 days in-house summer internship at the institute after the completion of their 2nd Semester exams (in summer vacations). Candidate can choose from various modules which are offered by the institute and after successful completion of internship they have to submit detailed report.

Course Outcomes:

Upon completion of the course, the students will be able to:

- CO1: Observe** various activities in field.
- CO2: Examine** the utility of general and specific equipments for construction.
- CO3: Differentiate** the construction projects individually and in team.
- CO4: Develop** the writing and communication skills for various engineering problems.
- CO5: Adapt** lifelong learning for benefit of society.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				1		2	2	2	1	1	2	2	1	2
CO2	1			2	2	2			2	1		2		2
CO3	2	2	1	2	2	2	2	2	2	1	1	2	2	2
CO4									3	3		2		
CO5	2	2	2	2	2	2	2	2	2	2	1	3	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Course Code: 1000005**Course Name: Project Management and Financing**

L	T	P	Credit
2	0	0	GRADE

Course Objective:

To provide knowledge about project attributes and planning essentials, develop project networks, make rational decisions for project completion, utilize resources effectively, and understand the basics of project finances and management.

Syllabus**Unit I:****Project Planning:**

Introduction to Project Management, Difference between Project and Production, Attributes of a Project: Time, Cost, Quality and Safety. Stakeholders of a Project, Project life cycle. Project Planning: Types of Project Plans and feasibility.

Unit-II:

Project Network logic: Project Networking and work flows, Activity duration and methods of estimating activity duration – One time estimate three time estimates, Duration estimation procedure. Use of Bar Charts, Mile stone charts and networks, Network representation schemes: Activity on Arrow and Activity on Node Networks (A-o-A & A-o-N), Logic behind developing project network and simple network calculations, Critical paths and floats.

Unit-III:**Decision making through networks: CPM, PERT & PDM:**

Use of network in Decision Making: Importance of critical path, Monitoring the progress and updating the project plan. Use of floats in Resource smoothing, Introduction to Precedence Diagramming Method (PDM), Different lag and lead relations in terms of SS(Start to Start), SF(Start to Finish), Finish to Start(FS), and Finish to Finish(FF) and composite relations.

Unit-IV:

Project Cost Control: Breakeven analysis in planning stage, Direct and indirect cost, slope of direct cost curve, Total project cost and optimum duration, contracting the network for cost optimization. Escalation & Variation in prices.

Unit-V:**Projects Financing:**

Introduction to project financing; Role of governments in financing projects, Funder and Concessionaire: Economic multiplier effects of Projects; Means of financing-public finance and private finance, Granting authority: World Bank Group, IMF,ADB, Micro and Small Enterprises Funding Scheme (MSME), Elementary understanding of Procurement of infrastructure projects through Public Private Partnership (PPP) route, Build Operate Transfer (BOT), Build Operate Own & Transfer (BOOT); Stakeholders' perspectives, Lifecycle of PPP projects, Micro & Macro economics concepts and its application in Project Financing.

Course Outcomes

Upon completion of the course, the students will be able to:

CO 1: Know the attributes of project and its different phases.

CO 2: Develop the project network based on work breakdown structure and estimation of activity durations

CO 3: Analyze the project network and make **decide** the various alternates.

CO 4: Evaluate the optimum cost of project for assigned deadlines.

CO 5: Understand the different options to arrange the finances to complete it within stipulated time

Recommended Text-Books:

1. Project Management Scheduling PERT and CPM by Dr. B.C. Punmia, K.K. Khandelawal
2. PERT & CPM Principles and Applications by L.S. Srinath, Affiliated EWP Pvt. Ltd.
3. Project Planning and Control by Albert Lester, Fourth Edition Elsevier Butterworth-Heinemann.

Recommended Reference Books:

1. A Management Guide to PERT/CPM With GERT/PDM/DCPM and Other networks by Jerome D. Wiest, Ferdinand K. Levy, Prentice Hall.
2. Project Management with CPM and PERT by Joseph J. Moder, Cecil R. Phillips, Van Nostrand Reinhold Company

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	2	1						2		1
CO2	3	3	2	2	2	2	1				1	2		1
CO3	3	3		3	3	2					1	2		1
CO4	3	3		2	2	2					1	2		1
CO5	2	1		1	1	1					1	2		1

1 - Slightly; 2 - Moderately; 3 – Substantially



Course Code: 3110421
Course Name: Fluid Mechanics – II

L	T	P	Credit
2	1	0	3

Course Objectives:

To develop a comprehensive understanding of fluid flow patterns, including laminar and turbulent flows, boundary layer theory, drag and lift estimation, open channel flow classification and design, critical and non-uniform flow analysis, hydraulic jump characteristics, and the design principles of pumps and turbines for practical engineering applications.

Syllabus:

Unit-I

Turbulent Flow: Laminar and turbulent boundary layers and laminar sub layer, hydro dynamically rough boundaries, velocity distribution in turbulent flow, Resistance of smooth and artificially roughened pipes, Commercial pipes, aging of pipes.

Pipe Flow Problems: Losses due to sudden expansion and contraction, losses in pipe fittings and valves, Concepts of equivalent length, Hydraulic and energy gradient lines, Siphon, Pipes in series, in parallel, Branching of pipes.(Hardy Cross method)

Pipe Network: Water hammer (only quick closure case) transmission of power.

Unit - II Forces on immersed bodies:

Introduction, Force Exerted by a flowing fluid on a stationary body, Expression for Drag & Lift, Drag on a sphere, Terminal velocity of a Body, Drag on a cylinder. Introduction to Development of Lift on a Circular Cylinder and an Airfoil

Unit – III Uniform Flow in open Channels:

Channel geometry and elements of channel section, Velocity distribution, Energy in open channel flow, Specific energy, Types of flow, Critical flow and its computations, Uniform flow and its computations, Chezy's and Manning's formulae, Determination of normal depth and velocity, Normal and critical slopes, Economical sections.

Unit - IV Gradually varied flow

Basic assumptions and dynamic equations of gradually varied flow, characteristics analysis and computations of flow profiles, rapidly varied flow-hydraulic jump in rectangular channels and its basic characteristics, Surges in open channels.

Unit - V Introduction to Fluid Machinery: Turbines & Pumps

Turbines: Classifications, definitions, Similarity laws, Specific speed and unit quantities, Pelton turbine – their construction and settings, Speed regulation, Dimensions of various elements. Action of jet, Torque, Power and efficiency for ideal case, Characteristics curves. Reaction turbines construction & setting, Draft tube theory, Runaway speed, Simple theory of design and characteristic curves, Cavitation.

Pumps: Principle of working & criteria for selection of different types of pump, viz. Centrifugal, Reciprocating.



Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Differentiate different types of fluid flow & fluid machinery.

CO 2: Describe principles of analysis of fluid flow problem.

CO 3: Explain basic principles for measurement of different forces acting on fluid body.

CO 4: Analyze pipe flow, open channel flow problems & various characteristics of hydraulic machines.

CO 5: Design open & closed conduit systems.

Text Books:

1. Fluid Mechanics, Modi & Seth, Standard Book house, Delhi, 21st edition, 2017
2. Open Chanel Flow, K. Subramanya, Tata McGraw Hill, New Delhi, 5th edition, 2019

Reference Books:

1. Open Channel Flow, Rangaraju, Tata Mc Graw Hill Publishing Comp. Ltd., New Delhi, 1stedition,2001
2. Fluid Mechanics, A.K. Jain, Khanna Publishers, Delhi,1988
3. Fluid Mechanics, Hydraulics & Hydraulic Mechanics, K.R. Arora, Standard Publishers, 2009
4. Open Channel Hydraulics, Chow V.T., McGraw Hill, New York, 57th edition, 2009

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	-	-	-	-	-	-	-	-	2	-	-
CO2	3	3	-	1	-	-	-	-	-	-	-	2	-	-
CO3	2	2	-	1	-	-	-	1	-	-	-	2	-	-
CO4	3	3	-	2	-	1	1	-	-	-	-	3	-	-
CO5	3	2	3	2	1	1	1	1	-	-	-	3	-	-

1 - Slightly; 2 - Moderately; 3 – Substantially



Course Code: 3110422

Course Name: Theory of Structure - II

L	T	P	Credit
2	1	0	3

Course Objectives:

To develop an understanding of the analysis of beams and frames using Moment Distribution Method, Kani's method, Approximate method and Matrix Method; influence line diagram for determinate beam, trusses and Three Hinged Arches; Plastic analysis of beams and frames

Syllabus:

Unit – I

Moment distribution method in analysis of frames with sway, Analysis of box frames, analysis of beams and frames by Kani's methods.

Unit – II

Analysis of tall frames, Calculation of various loads including wind and earthquake loads, Introduction to Code provisions for lateral loads. Approximate analysis of multistorey frames for vertical and lateral loads.

Unit – III

Matrix Method of Structural Analysis: Force method and displacement method.

Unit-IV

Rolling Load and Influence Lines

Maximum SF & BM curves for various types of Rolling loads, EUDL, Influence Lines for determinate structural beams, Trusses, Three Hinged Arches.

Unit-V

Plastic analysis of beams & frames

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain various methods for analysis of structures and frames.

CO 2: Analyse various loads on framed structures using codal provisions.

CO 3: Analyse different type of structures for various load conditions by different methods.

CO 4: Draw influence line diagrams for statically determinate & indeterminate structure.

CO 5: Analyse beams & frames using plastic analysis.

Text Books:

1. Intermediate structural analysis, Wang C.K., McGraw Hill, New York, 1984
2. Basic Structural Analysis, Reddy C. S., Tata McGraw Hill Publishing Company, 2017
3. Theory of Structures, S. Ramamrutham, R. Narayanan, Dhanpat Rai Publications, 9th edition, 2014



Reference Books:

1. Elementary Structural Analysis, Norris C.H., Wilbur J.B. McGraw Hill International
2. Structural Analysis, Aslam Kassimali, C. L. Publisher, 2014
3. Structural Analysis, R. C. Hibbler, Pearson Publication, 2017
4. Indeterminate Structural Analysis, Kinney Sterling J., Addison Wesley
5. Matrix Methods of Framed Structures, Weaver W & Gere J. M., CBS Publishers, Delhi

Course Articulation Matrix

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
C01	3	1	1	-	-	1	-	-	-	-	-	2	-	1
C02	3	3	3	3	-	1	-	-	-	-	-	2	-	1
C03	3	3	3	3	-	1	-	-	-	-	-	2	-	1
C04	3	3	3	3	-	1	-	-	-	-	-	2	-	1
C05	3	3	3	3	-	1	-	-	-	-	-	2	-	1

1 - Slightly; 2 - Moderately; 3 – Substantially



Course Code: 3110423

Course Name: Water Supply Engineering

L	T	P	Credit
2	1	2	4

To develop a comprehensive understanding of drinking water supply systems, water quantity and quality standards, mechanism of water conveyance, concepts and design of water treatment and distribution systems.

Syllabus:

Unit-I

Water demand (types variation, factors affecting it), Design period, population forecasting methods, estimation of water requirement of cities, Sources of Water, Source selection, underground water quality & quantity, characteristics of water (laboratory method & effects), water borne diseases, standards for drinking water.

Unit-II

Water treatment flow diagram, design, construction, working of (Aerators, screens, plain sedimentation tank, tube settlers), coagulants & coagulation, flocculation, feeding and mixing of coagulants, optimum dose of coagulants, design & working of clarifloculator, filtration (Theory & types), Design, operation & construction of slow sands & Rapid sand gravity filters, pressure filters.

Unit-III

Disinfectants (types) & disinfection method of disinfection, chlorine & chlorine compounds, types of chlorination, Hardness (Causes & types), various methods of softening, Recarbonation, calculation of chemical requirements, Removal of colour, odor, Taste, Iron & manganese, algae removal, fluoridation / defluoridation, desalination, latest treatment techniques.

Unit-IV

Intake structures (location, types & design), conduits for transporting water, forces on conduits, types of pressure pipe, joints, corrosion of pipe (causes & control), pipe appurtenances (design), pumping of water (numerical problems), types of pumps, Economical diameter of rising main (numerical), pumping stations.

Unit-V

Requirement of good distribution system, layout of distribution, methods of distribution, Distribution reservoir and calculation of its capacity, fixing size of pipe, Analysis of pipe networks (Hardy cross method, Equivalent pipe method), appurtenances used in distribution networks, water supply & plumbing system in building, Rural water supply.

Courses Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the concepts of water supply engineering.

CO 2: Apply suitable water treatment technique.

CO 3: Analyze a given water supply scheme.

CO 4: Design a water supply and distribution system based upon the needs of society.



Course Articulation Matrix

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
C01	2	-	-	-	-	-	2	-	-	-	-	2	2	-
C02	2	2	3	-	-	-	3	-	-	-	-	3	3	-
C03	2	2	2	-	-	-	2	-	-	-	-	2	3	-
C04	2	2	3	2	2	-	2	-	-	-	-	3	3	-

1 - Slightly; 2 - Moderately; 3 – Substantially

Text Books:

1. Water Supply Engg., B. C. Punmia, Laxmi Publication (P) Ltd. New Delhi, 2016
2. Water Supply Engg., S. K. Garg, Khanna Publishers New Delhi, 2017

Reference Books:

1. Water Supply & Sanitary Engg., G.S. Birdie, Dhanpat Rai Publishing Company, 2014
2. Water & Waste Water Technology, Mark J Hammer, Prentice Hall of India, 6th edition, 2008
3. Environmental Engineering, Peavy, Rowe & Tchobanoglous, McGraw Hill Publication, 2017
4. Manual of Water Supply and Treatment by CPHEEO, GOI, 2009

List of Experiments:

1. Determination of pH of a given water sample.
2. Determination of Total Solids, Dissolved Solids and Suspended Solids of water sample.
3. Determination of Chloride concentration in water sample.
4. Determination of turbidity of water sample using turbidity meter.
5. Determination of acidity of the water sample.
6. Determination of alkalinity of the water sample.
7. Determination of Hardness of the water sample.
8. Determination of D.O concentration of a given water sample.
9. Determination of optimum dose of coagulants required for the treatment of a given water sample.
10. Determination of MPN of the given water sample.
11. Determination of Sulphate of a given water sample.
12. Determination of Nitrate of a given water sample.

List of Skill Based Mini Project

1. Estimation of drinking water requirement for various locations including new upcoming localities in and around Gwalior city.
2. Design of water supply & distribution layout system for various new upcoming localities in and around Gwalior city.
3. Study of existing water supply & distribution scheme available for Gwalior city and suggest improvement in it.
4. Study of existing water supply sources and determination of water quality of those sources.
5. Determination of water quality characteristics of various localities in and around Gwalior city.



6. Draw a water quality map for various localities in and around Gwalior city.
7. Comparative analysis of water quality between Municipal Corporation supplied water in city & R.O. treated water.
8. Study of new water treatment plant in the city.
9. Design of water treatment system for new upcoming localities in and around Gwalior city.
10. Performance evaluation of existing water treatment plants in city.

Upon completion of the course, the students will be able to:

CO 1: Follow sampling procedure & other guidelines for sampling & analysis of water samples.

CO 2: Check various water quality parameters.

CO 3: Improve the water quality by suggesting suitable corrective measures.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	3	-	2	-	2	2	2	-	2	2	-
CO2	-	2	-	3	-	3	2	2	2	2	-	2	2	-
CO3	-	-	2	-	-	-	2	-	-	2	-	2	-	-

1 - Slightly; 2 - Moderately; 3 – Substantially



Course Code: 3110424

Course Name: Water Resources Engineering

L	T	P	Credit
2	1	0	3

Course Objectives:

To develop a comprehensive understanding of water resources management, including crop water requirements, irrigation systems, reservoir planning, and canal design using Khosla's, Bligh's, Lacey's, and Kennedy's theories; to analyze components of the hydrological cycle, such as rainfall, infiltration, and evaporation; to study hydrometry, groundwater hydrology, runoff estimation, rainfall analysis, hydrographs, and flood estimation methods for effective water resource planning and management.

Syllabus:

Unit – I

Hydrology: Definition, Hydrological Cycle, Precipitation, Evaporation, Infiltration, Runoff, Estimation of Runoff, Empirical Formulae, Rainfall-Runoff relationships, Hydrometry, Methods of Stream Gauging, Rating Curves, Ground Water: Elements of Ground water Hydrology, Well Hydraulics, Equations of Ground Water flow, Solutions and applications.

Unit - II

Hydrographs & Hyetographs, Hydrographs analysis, Unit Hydrographs, Methods of constructing, Unit Hydrographs, S-curve Hydrograph, Synthetic unit Hydrograph, Flood and its estimation by different methods.

Unit-III Irrigation Water Requirement and Soil Water Crop Relationship:

Irrigation, Definition, Necessity, Advantages and disadvantages, Type and methods, Irrigation development.

Soil: Types and their occurrence, Suitability for irrigation purposes, Wilting, Coefficient and field capacity, Optimum water supply, Consumptive use and its determination. Irrigation methods - surface and subsurface, Sprinkler and drip irrigation.

Duty of water, factors affecting duty and methods to improve duty, Suitability of water for irrigation, Crops and crop seasons, Principal crops and their water requirement, Crop ratio and crop rotation, Intensity of irrigation, Water logging-causes, effects & its prevention.

Unit – IV Reservoir Planning and Canal Irrigation

Types of reservoir, Reservoir planning, Estimation of storage capacity by mass curve analyses, Economical height of dam, Reservoir sedimentation, Canal systems, Planning and layout of canal systems, Regime concept and tractive force method of channel design, Channel losses, Design of unlined and lined canals, Kennedy's and Lacey's silt theories, Typical canal section, Water-logging: Causes and effects, Remedial measures, Salinity, Land reclamation and Drainage.

Unit – V Diversion works and Canal Regulation Structures

Elements of diversion works, Type of weirs and barrages, Weir design for surface and sub-surface



flow, Bligh's, Lane's and Khosla's theories, Silt excluders and Silt ejectors.
Canal regulation structure like Head & Cross regulations, falls, Escapes, Outlets, Their Need, Functions sketches.

Course Outcomes:

Upon completion of the course, the students will be able to:

- CO 1: Apply** the concept of hydrology for measurement & forecasting of rainfall & runoff.
- CO 2: Analyse** runoff hydrograph by various methods.
- CO 3: Analyse** various requirements for an efficient irrigation project.
- CO 4: Design** different components of irrigation system using different theories.
- CO 5: Plan** an efficient, economical & safe irrigation system.

Text Books:

1. Engineering. Hydrology, K. Subramanya, Tata McGraw Hill Publ. Co. 4th edition, 2013
2. Hydrology & Water Resources Engineering, S. K. Garg, Khanna Publishers, 2016
3. Irrigation Engineering & Hydraulic Structures, Santosh Kumar Garg, Khanna Publishers, 2017
4. Irrigation, Water Power & Water Resources Engg., K.R. Arora, Standard Publishers Distributors, 2010

Reference Books:

1. Engineering. Hydrology, J. NEMEC, Prentice Hall, 1972
2. Hydrology for Engineers, Linsley, Kohler, Paulnus, Tata Mc Graw Hill, 2014
3. Engineering Hydrology, H. M. Raghunath, New Age International Publishers, 5th edition, 2015.
4. Irrigation, Water Resources & Water Power, Dr. P.N. Modi, Standard Book House, 9th edition, 2014
5. Irrigation Engineering by Varshney & Gupta, Vol I & II, Nemchand Publishers, 2007.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	1	1	-	-	-	-	2	-	2
CO2	3	3	-	2	-	-	-	-	-	-	-	3	-	-
CO3	2	2	1	-	-	1	1	-	-	-	-	2	-	-
CO4	2	2	3	2	-	1	1	1	-	-	-	3	-	2
CO5	2	2	-	-	-	1	1	1	-	-	1	3	-	2

1 - Slightly; 2 - Moderately; 3 – Substantially



Course Code: 3110425
Course Name: Civil Drawing Lab

L	T	P	Credit
0	0	2	1

Course Objectives:

To develop proficiency in civil engineering drawing by preparing plans, elevations, and sections of building components, creating detailed sketches of elements like doors and windows, and utilizing software tools such as AutoCAD for accurate and efficient drafting.

Syllabus:

List of Experiments:

1. One drawing sheet containing Foundations and Footing using AutoCAD
2. One drawing sheet containing Doors, Windows, Ventilators using AutoCAD
3. One drawing sheet containing Lintels, Trusses and Arches etc. using AutoCAD
4. One drawing sheet containing detailed planning of one room residential building
5. One drawing sheet containing detailed planning of multi rooms residential building
6. Drawing sheets one each of residential building using AutoCAD
7. One Drawing sheet of Institutional building using AutoCAD
8. One Drawing sheet of Commercial building using AutoCAD
9. One Drawing sheet of Hospital building using AutoCAD
10. Sketches of various building components i.e. floors, roof & roof covering
11. Sketches of various building components i.e. staircase

List of Skill Based Mini Project

1. To design an institution building of given area using AutoCAD with all the required components
2. To design an Residential building of given area using AutoCAD with all the required components
3. To design an Multistorey building of given area using AutoCAD with all the required components
4. To design an Hospital building of given area using AutoCAD with all the required components

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Attempt to draw different components of a building.

CO2: Produce plan, elevation & section of various components of a residential and institutional building.

CO3: Use AutoCAD software in civil engineering drawing.

CO4: Prepare drawing sheets of various types of buildings like residential, institutional, commercial etc



Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	1	2	-	-	-	2	2	-	3	-	-
CO2	2	-	-	1	2	-	-	-	2	2	-	3	-	-
CO3	2	-	-	2	3	-	-	-	2	2	-	3	-	-
CO4	2	-	-	2	3	-	-	-	2	2	-	3	-	-

1 - Slightly; 2 - Moderately; 3 – Substantially



Course Code: 3110426
Course Name: Cyber Security

L	T	P	Credit
2	0	0	2

Course Objectives: To analyze cyber-attacks, types of cybercrimes, cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks.

Course Contents:

Unit 1: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

Unit 2: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics

Unit 3: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Organizational security Policies and Measures in Mobile Computing Era, Laptops.

Unit 4: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

Unit 5: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Datalinking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc

Course Outcomes

At the end of this course, students will be able to:

CO 1: Analyze cyber-attacks, types of cybercrimes and cyber laws

CO2: Interpret and forensically investigate security incidents

CO3: Apply policies and procedures to manage Privacy issues

CO4: Design and develop secure software modules



TEXT BOOKS:

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley.
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

REFERENCES:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa (john) Wu, J. David Irwin, CRC Press T&F Group.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				1	1	1	1	1		1	1	1	1	1
CO2				1	1		1			1	1	2	2	2
CO3				1		1	1			1	1	2	2	2
CO4				1	1	1			2	2	2	3	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially



Course Code: 1000001

Course Name: Indian Constitution and Traditional Knowledge

L	T	P	Credit
2	0	0	Grade

Course Objectives:

- The course aims to provide students with the continuous, comprehensive and cumulative understanding of Indian Knowledge Tradition (Philosophy, Language, Art) and its modern interpretation and analysis.
- It intends to connect the students' modern advanced knowledge system with the roots of Indian Knowledge Tradition for their development and better understanding of the essentials of thought process, intellection and inference.
- To impart the knowledge of the Yogic Science and an insight into Sanskrit Literature which will promote interest among students in discerning the significance of health and wisdom with an Indian perspective.
- The objective of the syllabus is to familiarize students with the essential features and basic principles of the constitution of India.
- It will acquaint them with the concept of government, its organs and various types.
- It will provide students with a comprehensive and clear understanding of the basic fundamental rights and duties.

Unit-1

- Introduction to Basic Structure of Indian Knowledge System
- Homogeneity of modern science and Indian Knowledge Tradition
- Yoga: Promoting positive health and personality
- Case Studies

Unit-2

- Indian Philosophy or Darshanas: [Jainism](#), [Buddhism](#), [Yoga](#), Śaiva and [Vedanta](#)
- Indian Linguistic Tradition: Panini's Ashtadhyayi
- Indian Art: Mauryan art, Buddhist art, Gupta art, Muslim Art & Culture Contemporary art
- Case Studies

Unit 3 Introduction to Political Science

- Nature and scope of political science
- Definition, elements and theories of origin of State (Social Contract and Evolutionary)
- Meaning and features of Civil Society
- Indian Political Thought: Raja Ram Mohan Roy, Swami Vivekanand, Gandhi, Ambedkar

Unit 4 Concept of Government and Its Organs

- Government: Definition and its characteristics
- Types and meaning of Legislature: Composition, Function and Role of the Parliament (Lok Sabha and Rajya Sabha)
- The Powers, Position and Role of the President, Prime Minister and the Cabinet
- The Powers, Position and Role of the Governor and the Chief Minister; Composition and the role of Supreme Court, Judicial Review and Judicial Activism

Unit 5 Salient features of Indian Constitution

- Preamble, Conventions, Sovereignty of the Constitution and the Rule of Law
- Parliamentary Democracy, Federalism, Secularism and Socialism
- Fundamental Rights, Directive Principles of State Policies and Fundamental Duties



- Election Commission and Electoral Reforms

Basic Readings:

1. O.P. Gauba, *Political Theory*, Macmillan, (latest edition).
2. D.D. Basu, *Introduction to the Constitution of India*, (Latest Edition).
3. N.G. Jayal & Pratap Bhanu Mehta, *The Oxford Companion of Politics in India*, 2000.
4. W.H. Morris-Jones, *The Government and Politics of India*.
5. Swami Jitamanand, *Holistic Science and Vedam*, Bhartiya Vidyabhawan
6. V. Shivramakrishnan (Ed.), *Cultural Heritage of India*, Bhartiya Vidyabhawan, Mumbai Fifth Edition, 2014.
7. Yoga sutra of Patanjali, Ramakrishnan Mission, Kolkata.
8. Panini Shiksha, Motilal Banarsidas
9. VN Jh, *Language, Thought and Reality*
10. Krishna Chaitanya. *Arts of India*, Abhinav Publications, 1987.
11. SC Chaterjee and DM Datta, *An Introduction to Indian Philosophy*, university of Calcutta, 1984
12. A L Basham, *The Wonder That was India*

Course Outcomes:

1. Gain knowledge about the Indian tradition and Indian constitution.
2. Recognize the basic concepts of ethics and morality pertaining to Indian culture and tradition.
3. Employ the knowledge of the constitutional norms as laid in the constitution and abide by the practices stated therein.
4. Connect itself with traditional Indian philosophy with their everyday conduct and practices.
5. Appraise the utility and significance of tradition and its working in the light of more radical thought of the modern times.
6. Create a better society and living standards for themselves as well as for the generations for the others to come.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				1	1	1	1	1		1	1	1		
CO2				1	1		1			1	1	2		
CO3				1		1	1			1	1	2		
CO4				1	1	1			2	2	2	3		

1 - Slightly; 2 - Moderately; 3 – Substantially

ANNEXURE – IV

SYLLABUS FOR COURSES TO BE OFFERED IN V SEMESTER (2023-2024 ADMITTED BATCH)

Course Code: 3110511

Course Name: Waste Water Engineering

L	T	P	Credit
2	1	0	3

Course Objective:

To provide comprehensive knowledge on sewerage systems, sewage composition, disposal standards, and various sewage treatment techniques, including advanced processes.

Syllabus:

Unit – I

Sewerage schemes & sewerage system and their importance, collection & conveyance of sewage, Estimation of sewage & storm water quantity, fluctuation in sewage flow, Flow through sewer, Design of sewer, Construction & maintenance of sewer, testing of sewer, Sewer appurtenances.

Unit – II

Characteristics and analysis of wastewater (Physical, chemical & biological parameters). Oxygen demand i.e. BOD & COD, TOC, TOD, ThOD, relative Stability, Population equivalent, Natural methods of waste water disposal i.e. by land treatment & by dilution, Self-purification capacity of stream, Oxygen sag analysis (numerical problems).

Unit-III

Unit operations for waste water treatment, Preliminary treatment such as screens, grit chamber, floatation tank, sedimentation etc. and chemical clarification, Role of micro-organism in biological treatment, Sewage filtration – theory & design. Trickling filter its design & constructions, modifications in trickling filter.

Unit-IV

Methods of Biological Treatment (Theory & Design) – Activated Sludge Process, Oxidation ditch, Stabilization Ponds, Aerated Lagoon, Anaerobic Lagoons, Septic Tank & Imhoff tank, Rotating Biological contactor Sources & treatment of sludge, sludge thickening and digestion, sludge drying beds, sludge disposal.

Unit-V

Advanced Waste Water treatment – Need of advanced treatment, Diatomaceous earth filters, Ultra filtration, Adsorption by activated carbon, Phosphorus removal, Nitrogen removal, Sewage treatment plants using MBBR and SBR technology.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the concepts of waste water engineering.

CO 2: Determine the requirements for safe disposal of sewage.

CO 3: Apply suitable techniques for sewage treatment & disposal based upon the available data.

CO 4: Analyse a given sewerage system.

CO 5: Design sewage system for safe disposal of sewage

Text Books:

1. Waste Water Engg., B. C. Punmia, Laxmi Publication (P) Ltd. New Delhi, 2016
2. Sewage Disposal and Air Pollution Engineering, S. K. Garg, Khanna Publishers, 2017

Reference Books:

1. Water Supply & Sanitary Engg., G.S. Birdie, Dhanpat Rai Publishing Company, 2014
2. Environmental Engg., Rowe, Peavy & Tchobanogolous Tata McGraw Hill Publication, 2017
3. Water & Waste Water Technology, Mark J Hammer, Prentice Hall of India, 6th edition 2008
4. Waste Water Engineering, Metcalf & Eddy, Mc Graw Hill Book Company New Delhi, 4th edition 2005
5. CPHEEO Manual on Sewage & Sewage Treatment System, GOI, 2013

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2					2	2					2	2	1
CO2	2	2		2		3	3	2				2	3	2
CO3	2	2		3		3	3					2	2	2
CO4	3	3	2	3	1	3	3		1	2		3	3	2
CO5	3	3	3	2	2	3	3	2	1	2	1	3	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially



Course Code: 3110512

Course Name: Estimating Costing & Contracting

L	T	P	Credit
2	1	0	3

Course Objective:

To develop skills to calculate quantities for various civil works such as buildings and culverts, compute earthwork, understand detailed specifications and perform rate analysis, learn different estimation methods, comprehend valuation processes and rent fixation, and grasp contracting procedures.

Syllabus:

Unit I Introduction of Estimating:

Purpose and importance of estimates, principles of estimating, methods of taking out quantities of items of work. Mode of measurement, measurement sheet and abstract sheet, bill of quantities. Types of estimate, plinth area rate, cubical content rate, preliminary, original, revised and supplementary estimates for different projects.

Unit II: Details of Items:

Specifications of materials and works: Types of Specifications, General specifications for Class A, B & C type of building, Detailed specifications of important items of work.

Rate Analysis: Task for average artisan, various factors involved in the rate of item, material and labour requirement for various trades, preparation for rates of important items of work, current schedule of rates (C.S.R)

Unit III: Estimates

Preparing detailed estimates of various types of buildings, R.C.C Works, Culverts, earth work calculations for roads and Canals, contingencies and work charge establishment, use of computational tools for preparing estimates.

Unit IV: Valuation

Purposes, depreciation, sinking fund, scrap value, year's purchase, gross and net income, dual rate of interest, methods of valuation, rent fixation of buildings

Unit V: Contracting

Contract, Types of engineering contract, essentials documents of engineering Contract, Conditions of contract, Earnest Money Deposit, Security Deposit, Responsibility of Engineer, Contractor & Client.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the fundamentals of quantity estimation, costing & contracting.

CO 2: Apply methods to estimate area, volume & cost.

CO 3: Evaluate mathematical & numerical models for rate & quantity estimation.

CO 4: Determine rates & value.

CO 5: Classify different rates of items, contracts & measurement techniques.



Text Books:

1. Estimating & costing in civil engineering, B.N. Dutta, UBS Publishers, 28th revised edition 2016
2. Estimating & Costing, S.C. Rangwala, Charotar Publishing House, 17th edition 2017

Reference Books:

1. Estimating & Costing for Civil Engg., G.S. Birdie, Dhanpat Rai Publications, 6th edition 2014
2. Estimating & Costing specification & valuation in civil engineering, M. Chakraborti, 2006

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2			1		2	1	2			2	1		2
CO2	2			1	1	2	1	2			2	2		2
CO3	2	2	1	2	2	2	2	2	2	2	3	3		3
CO4	2	3		2	1	2	2		2	2	3	3		3
CO5	2	3		2		2	2	2	2	2	1	3		3

1 - Slightly; 2 - Moderately; 3 – Substantially

Course Code: 3110513**Course Name: Structural Design & Drawing (RCC)**

L	T	P	Credit
2	1	0	3

Course Objective:

To understand various design philosophies; learn design of RC elements such as beams, slabs, columns, footings and staircase using Indian Standard provisions.

Syllabus:**Unit-I**

Design principles: Materials; Introduction to IS 456; Design philosophies: Working stress, Ultimate load and Limit state design

Singly reinforced beam sections: Analysis and design of singly reinforced rectangular beams: Lintel, Cantilever, Simply supported beams; Design for deflection.

Unit-II Design of Beams:

Design for Shear; Design for bond; Doubly-reinforced and Flanged sections; Design of Continuous beams

Unit-III Design of Slabs:

Slabs spanning in one direction: Cantilever, Simply supported and Continuous slabs; Slabs spanning in two directions; Circular slabs.

Unit-IV Columns & Footing:

Design of short columns subjected to axial loads, axial load and bending moments (section with no tension); Design of long columns; Introduction to IS 13920; Design of isolated and combined footings.

Unit-V Staircases:

Design of Staircases with waist slab: straight flight, dog legged, and open well staircase with different support conditions; Design of Tread-riser (without waist slab) staircase.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Apply the concepts of different design philosophies for analysis and design of singly reinforced concrete beams using relevant IS Codes.

CO2: Analyze and design singly, doubly and flanged sections for flexure, shear and bond using relevant IS Codes

CO3: Design one way, two way and circular slabs using relevant IS Codes.

CO4: Analyze and design compression members and design footings using relevant IS codes.

CO5: Design different type of staircase using relevant IS codes

Text Books:

1. Reinforced Concrete Limit State Design, A.K. Jain, Nem Chand Pub., 7th edition, 2012
2. Reinforced Concrete, Pillai & Menon, Tata McGraw Hill, New Delhi, 3rd edition, 2017
3. Limit State Design, P.C. Varghese, Prentice Hall of India, New Delhi, 2nd edition, 2008
4. RCC Design, Neelam Sharma, Katson Publishers, 2014



Reference Books:

1. Reinforced Cement Concrete, P. Dayaratnam, Medtech Publishers, 5th edition, 2017.
2. Reinforced Concrete Design, S.N. Sinha, Tata McGraw Hill, 3rd edition, 2017
3. Plain and Reinforced Concrete, O.P. Jain and Jai Krishna, Nem Chand Pub., 8th edition, 2008
4. Reinforced Cement Concrete, Winter & Nelson, McGraw Hill, 11th edition, 1991

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	2		2				2	3	1
CO2	3	3	2	2	1	2		2				2	3	1
CO3	3	3	2	2	2	2		2	1	2		3	3	2
CO4	3	3	3	2	2	2		3	1	2		3	3	2
CO5	3	3	3	2	2	2	2	3	1	2		3	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Course Code: 3110514**Course Name: Railway, Airport & Tunnel Engineering**

L	T	P	Credit
3	0	0	3

Course Objective:

To expose the students to Railway survey, planning & requirements of geometrical elements for ideal railway track, design, construction and maintenance, and planning, design principles & construction methodology of Airports and Tunnel.

Syllabus:**Unit-I Introduction to Railway Engineering**

Tractive resistance & Permanent way, Principles of Transportation, Transportation by Road, Railways, Airways, Waterways, their importance and limitations. Route surveys and alignment, railway track, development and gauges. Hauling capacity and tractive effort.

- (i) Rails- types, welding of rails, wear & tear of rails, rail creep ultrasonic Testing of Rails.
- (ii) Rail fastenings- types – Fishplates, spikes bearing plates, chairs, keys, check and guard rails, Elastic Rail Clips (ERC), Vossloh fastening.
- (iii) Sleepers, types & comparison, requirement of a good sleeper, sleeper density, Turnouts.
- (iv) Ballast –Requirement of good ballast, various materials used as ballast, quantity of ballast, Ballast Cleaning.

Different methods of plate laying, material trains, calculation of materials required, relaying of track.

Unit-II

Track alignment, Geometrical Design, Gradient & grade compensation, Super Elevation, Equilibrium, Cant and Cant deficiency, relationship of super elevation, gauge, speed & radius of curves, speed on curves, Limits of super elevation, Cant deficiency, Negative super elevation, curves, transition curves, necessity of points and crossing. Turnouts, Points of switches, Types of switches, crossing, calculation of turnouts, sleepers at points & crossing, Types of Track junctions. Types, locations, general equipments, layouts, marshalling yards. Definition, layout details, designs of simple turnouts.

Stations and Yards: Site selection for a Railway stations, Requirements of railway stations, junction station & terminals, location, layout & details, Types of signals in stations and yards, principles of signaling and inter-locking, Modern development in railways, Modernization of track for high speed, Maintenance of track, Track drainage.

Unit – III Airport Planning, Runway & Taxiway

Airport site selection. air craft characteristic and their effects on runway alignments, wind rose diagrams, basic runway length and corrections, classification of airports. Geometrical elements: taxi ways and runways, pattern of runway capacity.

Unit – IV Airport, Obstructions, Lightning & Traffic control

Zoning regulations, approach area, approach surface-imaginary, conical, horizontal. Rotating beacon, boundary lights, approach lights, runway and taxiway lighting etc. instrumental landing system, precision approach radar.

Unit-V Tunnels

Selection of route, Engineering surveys, alignment, shape and size of tunnel, bridge action, pressure relief phenomenon, Tunnel approaches, Shafts, pilot shafts , Construction of tunnels in soft soil, hard soil and rock, Different types of lining, methods of lining, Mucking operation, Drainage and ventilation, Examples of existing important tunnels in India and abroad.

Course Outcomes:

Upon completion of the course, the students will be able to:

- CO 1:** Explain various elements of railway tracks, signaling , yards, bridges & tunnels.
- CO 2:** Illustrate various gauges, signals, fasteners, turnouts, crossing & their defects etc.
- CO 3:** Explain the elements of airport planning, & tunnels.
- CO 4:** Design runway & taxiway system as per regulations.
- CO 5:** Apply construction methods of railway tunnels.

Text Books:

1. Airport Planning & Design, S. K. Khanna & M. G. Arora, Nem chand Publishers, 6th edition, 1999
2. Railway Engineering, Arora & Saxena, Dhanpat Rai & Sons, 2010

Reference Books:

1. Airport Planning, Froesch, Charles, Andesite Press, 2017
2. The Planning & Design of Airports, Horonjeff Robert, MHE, 5th edition, 2010
3. Railway Engineering, S.C. Rangwala, Charotar Publication House, Anand, 2012
4. Railway Tack, K.F. Antia, New Book Company, 5th edition, 1960

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1		1	2	1	1				1	1	1	1
CO2	2			1		1	1				1	2	2	1
CO3	2	2		2		2	2	2	1		1	2	1	2
CO4	2	2	3	2	2	2	2		1	2	2	2	2	2
CO5	2	1		2	2	2	2	2	2	2	2	2	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Course Code: 3110515
Course Name: Minor Project – I

L	T	P	Credit
0	0	4	2

Course Objective:

To familiarize students with a thorough understanding and practical experience in addressing civil engineering problems, utilizing both conventional methods and software, innovating and implementing technological solutions, functioning professionally with social responsibility, collaborating effectively with peers, and preparing professional reports with proficient data presentation and computer graphics skills.

Syllabus:

Each candidate shall work on an approved project of a public building or any other civil engineering work and shall submit design and a set of drawings.

OR

Shall submit a detailed report of experimental work / software package on any specific problem of importance.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Recognize various engineering problems and techniques to solve them.

CO 2: Reproduce the solution of the problems upon the need of society.

CO 3: Cooperate to work within group.

CO 4: Develop the writing and communication skills for various engineering problems.

CO 5: Display lifelong learning.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	2	2	2	2	3	3	1	3		2
CO2	3	3	3	3	3	3	3		3	3	3	3	3	2
CO3				2	2				3	2		2		
CO4									3	3		2		
CO5	2	2	2	2	2	2	2	2	2	2	1	3	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Course Code: 3110516**Course Name: Self Learning / Presentation**

L	T	P	Credit
0	0	2	1

Course Objective:

To encourage students to read and understand various civil engineering topics from articles and literature, present these topics to supplement classroom knowledge, develop strong oral and written communication skills, promote lifelong learning, and cultivate soft skills for effective presentations.

Syllabus:

1. Any relevant topic related to civil engineering from within or beyond the syllabus through Swayam / NPTEL/MOOC.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Analyze contemporary issues in civil engineering & its allied areas through literature survey.

CO 2: Distinguish state of art & relevance of the topic in national & international arena.

CO 3: Demonstrate good oral & written communication skills.

CO 4: Develop poster and power point presentations for effective communication.

CO 5: Display lifelong learning.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1		2	1	2	2	1	2	2	1	2	1	2
CO2	1			2	1	2	2	1	2	2	1	2		1
CO3								2	3	3		2		
CO4								2	3	3		2		
CO5	2	2	2	2	2	2	2	2	2	2	1	3	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially



Course Code: 3110517

Course Name: Summer Internship Project – II

L T P Credit
0 0 4 2

Course Objective:

To develop students' oral and written communication skills, promote lifelong learning, and cultivate soft skills for effective topic presentations to listeners.

Syllabus:

Each candidate shall have to undergo 15 days in house summer internship related to soft skills at the institute after the completion of their 4th Semester exams (in summer vacations) and after successful completion of internship they have to submit detailed report.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Develop the writing and communication skills for various engineering problems.

CO 2: Adapt lifelong learning for benefit of society.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									3	3		2		
CO2	2	2	2	2	2	2	2	2	2	2	1	3	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially



Course Code: 3110520
Course Name: Data Science

L	T	P	Credit
3	0	2	4

COURSE OBJECTIVE:

The objective of a data science course is to equip students with the skills to analyze and interpret complex data sets using statistical and computational techniques. This includes learning to extract actionable insights, build predictive models, and communicate findings effectively.

Syllabus

Unit 1

Need for data science, benefits and uses, facets of data, data science process, Introduction of basics python tool, Setting working Directory, Creating and saving a script file, File execution, removing variables from environment, clearing environment, Commenting script files, Variable creation, Data types and associated operations, Arithmetic and logical operators.

Unit 2

Control structures, loop, Functions, data structures: Lists, Arrays, Tuples, Dictionary, Sets, NumPy library, Data Collection: Getting to know your data, Types of Data, Data collection strategies, Data Pre-processing, Feature engineering, Exploratory Data Analytics.

Unit 3

Descriptive Statistics, Mean, Standard Deviation, Skewness and Kurtosis, inferential statistics: hypothesis testing, probability: probability theory, conditional probability, Pandas library, dataframe and dataframe related operations, Reading files.

Unit 4

Data Cleaning and Preparation, Handling Missing Data, Data Transformations using pandas and sklearn library, Removing Duplicates, Replacing Values, Detecting Outliers. Data visualization on different dataset using matplotlib and seaborn libraries, Scatter plot, Line plot, Bar plot, Histogram, Box plot, Pair plot.

Unit 5

Supervised learning: Regression, classification, Linear regression, logistic regression, decision tree, tree creation with entropy and information gain, ID3 algorithm, random forest, naïve bayes theorem, K-nearest neighbor and ensemble methods for solving real world problems, Unsupervised learning: Clustering, Reinforcement learning.

BOOKS AND REFERENCES

1. Mastering python for data science, Samir Madhavan
2. Introduction to linear algebra - by Gilbert Strang
3. Applied statistics and probability for engineers – by Douglas Montgomery
4. Pattern Recognition and Machine Learning, Christopher M. Bishop

COURSE OUTCOMES:

After completing the course, the student will be able to:

CO1: Define different Data Science techniques.

CO2: Illustrate various tools used for Data Science technique.

CO3: Apply data visualization techniques to solve real world problems.

CO4: Build exploratory data analysis for Data Science methods.

CO5: Apply Data Science techniques for solving real world problems.

CO6. Evaluate the performance of algorithms in data science.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2		1	1	1						2		
CO2	2	2		1	1	1		1				2		
CO3	2	2	1	2	2	1	1	1	2	3		2		2
CO4	2	2	1	2	2	1	1	1	2	1	2	2		3
CO5	2	2	2	2	2	1	1	2	2	2	2	2		3
CO6	2	2		2	2	1	1		2	1		2		3

1 - Slightly; 2 - Moderately; 3 – Substantially

List of Experiments

1. Perform creation, indexing, slicing, concatenation and repetition operations on Python built – in data types: Strings, List, tuples, dictionary, set
2. Solve problems using decision and looping statements.
3. Apply python built-in data types: Strings, List, tuples, dictionary, set and their methods to solve any given problem.
4. Handle numerical operations using math and random number functions
5. Manipulation of NumPy arrays – Indexing, Slicing, Reshaping, Joining and Splitting.
6. Computation on NumPy arrays using universal functions and mathematical methods.
7. Import a CSV file and perform various statistical and comparison operations on rows/columns.
8. Create Pandas series and data-frame from various inputs.
9. Import any CSV file to Pandas data-frame and perform the following –
 - Visualize the first and last 10 records
 - Get the shape, index and column details
 - Select / Delete the rows / columns based on conditions
 - Perform ranking and sorting operations
 - Do required statistical operations on given columns
 - Find the count and uniqueness of the given categorical values
 - Rename single / multiple files
10. Import any CSV file to Pandas data-frame and perform the following –
 - Handle missing data by detecting and dropping / filling missing values.
 - Transform data using different methods
 - Detect and filter outliers
 - Perform vectorized string operations on Pandas series
 - Visualize data using line plots, bar pots, histograms, density plots and scatter plots
11. Use the scikit-learn package in python to implement the regression model and its related methods



List of Skill Based Mini Project:

1. Write a python Program to predictive maintenance of Infrastructure.
2. Write a python Program for Traffic Flow Optimization.
3. Implement python programming for Water Distribution System Optimization.\
4. Implementation of Decision Tree method for Environmental Impact Assessment
5. Write a Program for Material Quality Prediction using MLR.
6. Write a python Program for Structural Health Monitoring.
7. Implement python programming for Sewer Distribution System Optimization.



Course Code: 1000006

Course Name: Disaster Management

L	T	P
2	-	-

Course Objective:

To understand the basic concepts, definitions, and terminologies in disaster management, the types and categories of disasters, the challenges posed by disasters, and the key skills needed to manage their impact.

Syllabus:

Unit 1: Introduction to disaster management, concepts and definitions: disaster, vulnerability, risk severity, frequency and details, capacity impact, prevention, mitigation.

Unit 2: Disasters – Disasters classification, demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends, hazard and vulnerability profile of India.

Unit 3: Disaster Impacts – Disaster impact (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues, impact of natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides etc.), impact of manmade disasters (industrial pollution, artificial flooding in urban areas, urban disasters, transportation accidents etc.).

Unit 4: Disaster Risk Reduction (DRR)- Disaster management cycle- its phases; prevention, mitigation, preparedness, relief and recovery; structural and non- structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response. Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders: Policies and legislation for disaster management. DRR programmes in India and the activities of National Disaster Management Authority.

Unit 5: Disasters, Environment and Development – Factors affecting vulnerability such as impact of development projects and environmental modifications (including of dams, land use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

Course Outcomes:

After successful completion of the course, the students will be able to

- CO1: Identify** disaster prevention and mitigation approaches.
- CO2: Classify** global and national disasters, their trends and profiles.
- CO3: Determine** the impacts of various disasters.
- CO4: Apply** Disaster Risk Reduction in management.
- CO5: Infer** the linkage between disasters, environment and development.

Text Books:

1. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
2. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation



3. Srivastava H.H. & Gupta G.D., Management of Natural Disasters in developing countries, DayaPublishers Delhi, 2006.

Reference Books:

1. <http://ndma.gov.in> (Home page of National Disaster Management Authority)
2. <http://www.ndmindia.nic.in> / (National Disaster Management in India)
3. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
4. National Disaster Management Policy, 2009, GOI.
5. Inter Agency Standing Committee (IASC) (Feb. 2007), IASC Guidelines on Mental Health and Psychosocial Support in Emergency Setting. Geneva: IASC

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1				1	1					2		1
CO2	2	1		2		1						2		2
CO3	2	2		3	2	2	2	2	2	3		2		2
CO4	2	1	2	2	2	2	2	2	2	2	2	2	1	2
CO5	2			2		3	2	2			1	2		2

1 - Slightly; 2 - Moderately; 3 – Substantially



DEPARTMENT OF CIVIL ENGINEERING
Scheme of Evaluation

B. Tech. V Semester (Civil Engineering)

For batches admitted in academic session 2023 – 24 onwards

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching (Offline/ Online)	Mode of Exam
				Theory Slot				Practical Slot				L	T	P			
				End Term Evaluation		Continuous Evaluation		End Sem Exam	Continuous Evaluation								
				End Sem Exam	Proficiency in subject /course	Mid Sem	Quiz/ Assignment		Lab Work & Sessional	Skill Based Mini Project							
1.	3110520	MC	Data Science	50	10	20	20	40	30	30	200	3	0	2	4	Blended	MCQ
2.	3110511	DC	Wastewater Engineering (DC - 10)	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP
3.	3110512	DC	Estimating Costing & Contracting (DC - 11)	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP
4.	3110513	DC	Structural Design & Drawing (RCC) (DC - 12)	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP
5.	3110514	DC	Railway, Airport and Tunnel Engineering (DC - 13)	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP
6.	3110515	DLC	Minor Project – I (DLC – 3)**	-	-	-	-	40	60	-	100	-	-	4	2	Offline	SO
7.	3110516	DLC	Self-learning /Presentation (SWAYAM/NPTEL/ MOOC)*	-	-	-	-	-	40	-	40	-	-	2	1	Online + Mentoring	SO
8.	200XXX	CLC	Novel Engaging Course (Informal Learning)	-	-	-	-	50	-	-	50	-	-	2	1	Interactive	SO
9.	3110517	DLC	Soft Skill Internship (Institute Level) (Evaluation)	-	-	-	-	60	-	-	60	-	-	4	2	Offline	SO
Total				250	50	100	100	230	100	20	850	11	4	14	22	-	-
10.	1000006	MAC	Disaster Management	50	10	20	20	-	-	-	100	2	-	-	Grade	Blended	MCQ
Additional Courses for obtaining Honours or Minor Specialization				Permitted to opt for <u>maximum 02 additional courses</u> for the award of Honours or Minor Specialization													

*compulsory registration for one online course using SWAYAM/NPTEL/ MOOC, evaluation through attendance, assignments and presentation

*Proficiency in course/subject – includes the weightage towards ability/ skill/ competence /knowledge level /expertise attained /attendance etc. in that particular course/subject

MCQ – Multiple Choice Questions, PP – Pen paper Mode, A+O – Assignment + Oral, SO – Submission + Oral

Note: Students of 2020-21 admitted batch needs to appear and complete an additional MAC course of 30 Hrs. duration on Project Management & Financing. / other modules related to futuristic technologies (Drones/ Robotics etc.)

** The Minor Project-I may be evaluated by an internal committee for awarding sessional marks.

Mode of Teaching						Mode of Examination					Total Credits
Theory			Lab / SIP	Seminar	NEC	Theory			Lab	SIP/SLP/NEC	
Offline	Online	Blended	Offline	Online Mentoring	Interactive	PP	A+O	MCQ	SO	SO	
-	-	15	5	1	1	12	-	3	4	3	22
-	-	68%	23%	4.5%	4.5%	54%	-	14%	18%	14%	Credits %



ANNEXURE – IV

SYLLABUS FOR COURSES TO BE OFFERED IN V SEMESTER (2023-2024 ADMITTED BATCH)

Course Code: 3110511

Course Name: Waste Water Engineering

L	T	P	Credit
2	1	0	3

Course Objective:

To provide comprehensive knowledge on sewerage systems, sewage composition, disposal standards, and various sewage treatment techniques, including advanced processes.

Syllabus:

Unit – I

Sewerage schemes & sewerage system and their importance, collection & conveyance of sewage, Estimation of sewage & storm water quantity, fluctuation in sewage flow, Flow through sewer, Design of sewer, Construction & maintenance of sewer, testing of sewer, Sewer appurtenances.

Unit – II

Characteristics and analysis of wastewater (Physical, chemical & biological parameters). Oxygen demand i.e. BOD & COD, TOC, TOD, ThOD, relative Stability, Population equivalent, Natural methods of waste water disposal i.e. by land treatment & by dilution, Self-purification capacity of stream, Oxygen sag analysis (numerical problems).

Unit-III

Unit operations for waste water treatment, Preliminary treatment such as screens, grit chamber, floatation tank, sedimentation etc. and chemical clarification, Role of micro-organism in biological treatment, Sewage filtration – theory & design. Trickling filter its design & constructions, modifications in trickling filter.

Unit-IV

Methods of Biological Treatment (Theory & Design) – Activated Sludge Process, Oxidation ditch, Stabilization Ponds, Aerated Lagoon, Anaerobic Lagoons, Septic Tank & Imhoff tank, Rotating Biological contactor Sources & treatment of sludge, sludge thickening and digestion, sludge drying beds, sludge disposal.

Unit-V

Advanced Waste Water treatment – Need of advanced treatment, Diatomaceous earth filters, Ultra filtration, Adsorption by activated carbon, Phosphorus removal, Nitrogen removal, Sewage treatment plants using MBBR and SBR technology.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the concepts of waste water engineering.

CO 2: Determine the requirements for safe disposal of sewage.

CO 3: Apply suitable techniques for sewage treatment & disposal based upon the available data.

CO 4: Analyse a given sewerage system.

CO 5: Design sewage system for safe disposal of sewage

Text Books:

1. Waste Water Engg., B. C. Punmia, Laxmi Publication (P) Ltd. New Delhi, 2016
2. Sewage Disposal and Air Pollution Engineering, S. K. Garg, Khanna Publishers, 2017

Reference Books:

1. Water Supply & Sanitary Engg., G.S. Birdie, Dhanpat Rai Publishing Company, 2014
2. Environmental Engg., Rowe, Peavy & Tchobanogolous Tata McGraw Hill Publication, 2017
3. Water & Waste Water Technology, Mark J Hammer, Prentice Hall of India, 6th edition 2008
4. Waste Water Engineering, Metcalf & Eddy, Mc Graw Hill Book Company New Delhi, 4th edition 2005
5. CPHEEO Manual on Sewage & Sewage Treatment System, GOI, 2013

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2					2	2					2	2	1
CO2	2	2		2		3	3	2				2	3	2
CO3	2	2		3		3	3					2	2	2
CO4	3	3	2	3	1	3	3		1	2		3	3	2
CO5	3	3	3	2	2	3	3	2	1	2	1	3	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially



Course Code: 3110512

Course Name: Estimating Costing & Contracting

L	T	P	Credit
2	1	0	3

Course Objective:

To develop skills to calculate quantities for various civil works such as buildings and culverts, compute earthwork, understand detailed specifications and perform rate analysis, learn different estimation methods, comprehend valuation processes and rent fixation, and grasp contracting procedures.

Syllabus:

Unit I Introduction of Estimating:

Purpose and importance of estimates, principles of estimating, methods of taking out quantities of items of work. Mode of measurement, measurement sheet and abstract sheet, bill of quantities. Types of estimate, plinth area rate, cubical content rate, preliminary, original, revised and supplementary estimates for different projects.

Unit II: Details of Items:

Specifications of materials and works: Types of Specifications, General specifications for Class A, B & C type of building, Detailed specifications of important items of work.

Rate Analysis: Task for average artisan, various factors involved in the rate of item, material and labour requirement for various trades, preparation for rates of important items of work, current schedule of rates (C.S.R)

Unit III: Estimates

Preparing detailed estimates of various types of buildings, R.C.C Works, Culverts, earth work calculations for roads and Canals, contingencies and work charge establishment, use of computational tools for preparing estimates.

Unit IV: Valuation

Purposes, depreciation, sinking fund, scrap value, year's purchase, gross and net income, dual rate of interest, methods of valuation, rent fixation of buildings

Unit V: Contracting

Contract, Types of engineering contract, essentials documents of engineering Contract, Conditions of contract, Earnest Money Deposit, Security Deposit, Responsibility of Engineer, Contractor & Client.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the fundamentals of quantity estimation, costing & contracting.

CO 2: Apply methods to estimate area, volume & cost.

CO 3: Evaluate mathematical & numerical models for rate & quantity estimation.

CO 4: Determine rates & value.

CO 5: Classify different rates of items, contracts & measurement techniques.



Text Books:

1. Estimating & costing in civil engineering, B.N. Dutta, UBS Publishers, 28th revised edition 2016
2. Estimating & Costing, S.C. Rangwala, Charotar Publishing House, 17th edition 2017

Reference Books:

1. Estimating & Costing for Civil Engg., G.S. Birdie, Dhanpat Rai Publications, 6th edition 2014
2. Estimating & Costing specification & valuation in civil engineering, M. Chakraborti, 2006

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2			1		2	1	2			2	1		2
CO2	2			1	1	2	1	2			2	2		2
CO3	2	2	1	2	2	2	2	2	2	2	3	3		3
CO4	2	3		2	1	2	2		2	2	3	3		3
CO5	2	3		2		2	2	2	2	2	1	3		3

1 - Slightly; 2 - Moderately; 3 – Substantially

Course Code: 3110513**Course Name: Structural Design & Drawing (RCC)**

L	T	P	Credit
2	1	0	3

Course Objective:

To understand various design philosophies; learn design of RC elements such as beams, slabs, columns, footings and staircase using Indian Standard provisions.

Syllabus:**Unit-I**

Design principles: Materials; Introduction to IS 456; Design philosophies: Working stress, Ultimate load and Limit state design

Singly reinforced beam sections: Analysis and design of singly reinforced rectangular beams: Lintel, Cantilever, Simply supported beams; Design for deflection.

Unit-II Design of Beams:

Design for Shear; Design for bond; Doubly-reinforced and Flanged sections; Design of Continuous beams

Unit-III Design of Slabs:

Slabs spanning in one direction: Cantilever, Simply supported and Continuous slabs; Slabs spanning in two directions; Circular slabs.

Unit-IV Columns & Footing:

Design of short columns subjected to axial loads, axial load and bending moments (section with no tension); Design of long columns; Introduction to IS 13920; Design of isolated and combined footings.

Unit-V Staircases:

Design of Staircases with waist slab: straight flight, dog legged, and open well staircase with different support conditions; Design of Tread-riser (without waist slab) staircase.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Apply the concepts of different design philosophies for analysis and design of singly reinforced concrete beams using relevant IS Codes.

CO2: Analyze and design singly, doubly and flanged sections for flexure, shear and bond using relevant IS Codes

CO3: Design one way, two way and circular slabs using relevant IS Codes.

CO4: Analyze and design compression members and design footings using relevant IS codes.

CO5: Design different type of staircase using relevant IS codes

Text Books:

1. Reinforced Concrete Limit State Design, A.K. Jain, Nem Chand Pub., 7th edition, 2012
2. Reinforced Concrete, Pillai & Menon, Tata McGraw Hill, New Delhi, 3rd edition, 2017
3. Limit State Design, P.C. Varghese, Prentice Hall of India, New Delhi, 2nd edition, 2008
4. RCC Design, Neelam Sharma, Katson Publishers, 2014



Reference Books:

1. Reinforced Cement Concrete, P. Dayaratnam, Medtech Publishers, 5th edition, 2017.
2. Reinforced Concrete Design, S.N. Sinha, Tata McGraw Hill, 3rd edition, 2017
3. Plain and Reinforced Concrete, O.P. Jain and Jai Krishna, Nem Chand Pub., 8th edition, 2008
4. Reinforced Cement Concrete, Winter & Nelson, McGraw Hill, 11th edition, 1991

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	2		2				2	3	1
CO2	3	3	2	2	1	2		2				2	3	1
CO3	3	3	2	2	2	2		2	1	2		3	3	2
CO4	3	3	3	2	2	2		3	1	2		3	3	2
CO5	3	3	3	2	2	2	2	3	1	2		3	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Course Code: 3110514**Course Name: Railway, Airport & Tunnel Engineering**

L	T	P	Credit
3	0	0	3

Course Objective:

To expose the students to Railway survey, planning & requirements of geometrical elements for ideal railway track, design, construction and maintenance, and planning, design principles & construction methodology of Airports and Tunnel.

Syllabus:**Unit-I Introduction to Railway Engineering**

Tractive resistance & Permanent way, Principles of Transportation, Transportation by Road, Railways, Airways, Waterways, their importance and limitations. Route surveys and alignment, railway track, development and gauges. Hauling capacity and tractive effort.

- (i) Rails- types, welding of rails, wear & tear of rails, rail creep ultrasonic Testing of Rails.
- (ii) Rail fastenings- types – Fishplates, spikes bearing plates, chairs, keys, check and guard rails, Elastic Rail Clips (ERC), Vossloh fastening.
- (iii) Sleepers, types & comparison, requirement of a good sleeper, sleeper density, Turnouts.
- (iv) Ballast –Requirement of good ballast, various materials used as ballast, quantity of ballast, Ballast Cleaning.

Different methods of plate laying, material trains, calculation of materials required, relaying of track.

Unit-II

Track alignment, Geometrical Design, Gradient & grade compensation, Super Elevation, Equilibrium, Cant and Cant deficiency, relationship of super elevation, gauge, speed & radius of curves, speed on curves, Limits of super elevation, Cant deficiency, Negative super elevation, curves, transition curves, necessity of points and crossing. Turnouts, Points of switches, Types of switches, crossing, calculation of turnouts, sleepers at points & crossing, Types of Track junctions. Types, locations, general equipments, layouts, marshalling yards. Definition, layout details, designs of simple turnouts.

Stations and Yards: Site selection for a Railway stations, Requirements of railway stations, junction station & terminals, location, layout & details, Types of signals in stations and yards, principles of signaling and inter-locking, Modern development in railways, Modernization of track for high speed, Maintenance of track, Track drainage.

Unit – III Airport Planning, Runway & Taxiway

Airport site selection. air craft characteristic and their effects on runway alignments, wind rose diagrams, basic runway length and corrections, classification of airports. Geometrical elements: taxi ways and runways, pattern of runway capacity.

Unit – IV Airport, Obstructions, Lightning & Traffic control

Zoning regulations, approach area, approach surface-imaginary, conical, horizontal. Rotating beacon, boundary lights, approach lights, runway and taxiway lighting etc. instrumental landing system, precision approach radar.

Unit-V Tunnels

Selection of route, Engineering surveys, alignment, shape and size of tunnel, bridge action, pressure relief phenomenon, Tunnel approaches, Shafts, pilot shafts , Construction of tunnels in soft soil, hard soil and rock, Different types of lining, methods of lining, Mucking operation, Drainage and ventilation, Examples of existing important tunnels in India and abroad.

Course Outcomes:

Upon completion of the course, the students will be able to:

- CO 1:** Explain various elements of railway tracks, signaling , yards, bridges & tunnels.
- CO 2:** Illustrate various gauges, signals, fasteners, turnouts, crossing & their defects etc.
- CO 3:** Explain the elements of airport planning, & tunnels.
- CO 4:** Design runway & taxiway system as per regulations.
- CO 5:** Apply construction methods of railway tunnels.

Text Books:

1. Airport Planning & Design, S. K. Khanna & M. G. Arora, Nem chand Publishers, 6th edition, 1999
2. Railway Engineering, Arora & Saxena, Dhanpat Rai & Sons, 2010

Reference Books:

1. Airport Planning, Froesch, Charles, Andesite Press, 2017
2. The Planning & Design of Airports, Horonjeff Robert, MHE, 5th edition, 2010
3. Railway Engineering, S.C. Rangwala, Charotar Publication House, Anand, 2012
4. Railway Tack, K.F. Antia, New Book Company, 5th edition, 1960

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1		1	2	1	1				1	1	1	1
CO2	2			1		1	1				1	2	2	1
CO3	2	2		2		2	2	2	1		1	2	1	2
CO4	2	2	3	2	2	2	2		1	2	2	2	2	2
CO5	2	1		2	2	2	2	2	2	2	2	2	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Course Code: 3110515
Course Name: Minor Project – I

L	T	P	Credit
0	0	4	2

Course Objective:

To familiarize students with a thorough understanding and practical experience in addressing civil engineering problems, utilizing both conventional methods and software, innovating and implementing technological solutions, functioning professionally with social responsibility, collaborating effectively with peers, and preparing professional reports with proficient data presentation and computer graphics skills.

Syllabus:

Each candidate shall work on an approved project of a public building or any other civil engineering work and shall submit design and a set of drawings.

OR

Shall submit a detailed report of experimental work / software package on any specific problem of importance.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Recognize various engineering problems and techniques to solve them.

CO 2: Reproduce the solution of the problems upon the need of society.

CO 3: Cooperate to work within group.

CO 4: Develop the writing and communication skills for various engineering problems.

CO 5: Display lifelong learning.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	2	2	2	2	3	3	1	3		2
CO2	3	3	3	3	3	3	3		3	3	3	3	3	2
CO3				2	2				3	2		2		
CO4									3	3		2		
CO5	2	2	2	2	2	2	2	2	2	2	1	3	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Course Code: 3110516**Course Name: Self Learning / Presentation**

L	T	P	Credit
0	0	2	1

Course Objective:

To encourage students to read and understand various civil engineering topics from articles and literature, present these topics to supplement classroom knowledge, develop strong oral and written communication skills, promote lifelong learning, and cultivate soft skills for effective presentations.

Syllabus:

1. Any relevant topic related to civil engineering from within or beyond the syllabus through Swayam / NPTEL/MOOC.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Analyze contemporary issues in civil engineering & its allied areas through literature survey.

CO 2: Distinguish state of art & relevance of the topic in national & international arena.

CO 3: Demonstrate good oral & written communication skills.

CO 4: Develop poster and power point presentations for effective communication.

CO 5: Display lifelong learning.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1		2	1	2	2	1	2	2	1	2	1	2
CO2	1			2	1	2	2	1	2	2	1	2		1
CO3								2	3	3		2		
CO4								2	3	3		2		
CO5	2	2	2	2	2	2	2	2	2	2	1	3	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially



Course Code: 3110517

Course Name: Summer Internship Project – II

L	T	P	Credit
0	0	4	2

Course Objective:

To develop students' oral and written communication skills, promote lifelong learning, and cultivate soft skills for effective topic presentations to listeners.

Syllabus:

Each candidate shall have to undergo 15 days in house summer internship related to soft skills at the institute after the completion of their 4th Semester exams (in summer vacations) and after successful completion of internship they have to submit detailed report.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Develop the writing and communication skills for various engineering problems.

CO 2: Adapt lifelong learning for benefit of society.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									3	3		2		
CO2	2	2	2	2	2	2	2	2	2	2	1	3	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially



Course Code: 3110520

Course Name: Data Science

L	T	P	Credit
3	0	2	4

COURSE OBJECTIVE:

The objective of a data science course is to equip students with the skills to analyze and interpret complex data sets using statistical and computational techniques. This includes learning to extract actionable insights, build predictive models, and communicate findings effectively.

Syllabus

Unit 1

Need for data science, benefits and uses, facets of data, data science process, Introduction of basics python tool, Setting working Directory, Creating and saving a script file, File execution, removing variables from environment, clearing environment, Commenting script files, Variable creation, Data types and associated operations, Arithmetic and logical operators.

Unit 2

Control structures, loop, Functions, data structures: Lists, Arrays, Tuples, Dictionary, Sets, NumPy library, Data Collection: Getting to know your data, Types of Data, Data collection strategies, Data Pre-processing, Feature engineering, Exploratory Data Analytics.

Unit 3

Descriptive Statistics, Mean, Standard Deviation, Skewness and Kurtosis, inferential statistics: hypothesis testing, probability: probability theory, conditional probability, Pandas library, dataframe and dataframe related operations, Reading files.

Unit 4

Data Cleaning and Preparation, Handling Missing Data, Data Transformations using pandas and sklearn library, Removing Duplicates, Replacing Values, Detecting Outliers. Data visualization on different dataset using matplotlib and seaborn libraries, Scatter plot, Line plot, Bar plot, Histogram, Box plot, Pair plot.

Unit 5

Supervised learning: Regression, classification, Linear regression, logistic regression, decision tree, tree creation with entropy and information gain, ID3 algorithm, random forest, naïve bayes theorem, K-nearest neighbor and ensemble methods for solving real world problems, Unsupervised learning: Clustering, Reinforcement learning.

BOOKS AND REFERENCES

1. Mastering python for data science, Samir Madhavan
2. Introduction to linear algebra - by Gilbert Strang
3. Applied statistics and probability for engineers – by Douglas Montgomery
4. Pattern Recognition and Machine Learning, Christopher M. Bishop

COURSE OUTCOMES:

After completing the course, the student will be able to:

CO1: Define different Data Science techniques.

CO2: Illustrate various tools used for Data Science technique.

CO3: Apply data visualization techniques to solve real world problems.

CO4: Build exploratory data analysis for Data Science methods.

CO5: Apply Data Science techniques for solving real world problems.

CO6. Evaluate the performance of algorithms in data science.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2		1	1	1						2		
CO2	2	2		1	1	1		1				2		
CO3	2	2	1	2	2	1	1	1	2	3		2		2
CO4	2	2	1	2	2	1	1	1	2	1	2	2		3
CO5	2	2	2	2	2	1	1	2	2	2	2	2		3
CO6	2	2		2	2	1	1		2	1		2		3

1 - Slightly; 2 - Moderately; 3 – Substantially

List of Experiments

1. Perform creation, indexing, slicing, concatenation and repetition operations on Python built – in data types: Strings, List, tuples, dictionary, set
2. Solve problems using decision and looping statements.
3. Apply python built-in data types: Strings, List, tuples, dictionary, set and their methods to solve any given problem.
4. Handle numerical operations using math and random number functions
5. Manipulation of NumPy arrays – Indexing, Slicing, Reshaping, Joining and Splitting.
6. Computation on NumPy arrays using universal functions and mathematical methods.
7. Import a CSV file and perform various statistical and comparison operations on rows/columns.
8. Create Pandas series and data-frame from various inputs.
9. Import any CSV file to Pandas data-frame and perform the following –
 - Visualize the first and last 10 records
 - Get the shape, index and column details
 - Select / Delete the rows / columns based on conditions
 - Perform ranking and sorting operations
 - Do required statistical operations on given columns
 - Find the count and uniqueness of the given categorical values
 - Rename single / multiple files
10. Import any CSV file to Pandas data-frame and perform the following –
 - Handle missing data by detecting and dropping / filling missing values.
 - Transform data using different methods
 - Detect and filter outliers
 - Perform vectorized string operations on Pandas series
 - Visualize data using line plots, bar pots, histograms, density plots and scatter plots
11. Use the scikit-learn package in python to implement the regression model and its related methods



List of Skill Based Mini Project:

1. Write a python Program to predictive maintenance of Infrastructure.
2. Write a python Program for Traffic Flow Optimization.
3. Implement python programming for Water Distribution System Optimization.\
4. Implementation of Decision Tree method for Environmental Impact Assessment
5. Write a Program for Material Quality Prediction using MLR.
6. Write a python Program for Structural Health Monitoring.
7. Implement python programming for Sewer Distribution System Optimization.



Course Code: 1000006

Course Name: Disaster Management

L	T	P
2	-	-

Course Objective:

To understand the basic concepts, definitions, and terminologies in disaster management, the types and categories of disasters, the challenges posed by disasters, and the key skills needed to manage their impact.

Syllabus:

Unit 1: Introduction to disaster management, concepts and definitions: disaster, vulnerability, risk severity, frequency and details, capacity impact, prevention, mitigation.

Unit 2: Disasters – Disasters classification, demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends, hazard and vulnerability profile of India.

Unit 3: Disaster Impacts – Disaster impact (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues, impact of natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides etc.), impact of manmade disasters (industrial pollution, artificial flooding in urban areas, urban disasters, transportation accidents etc.).

Unit 4: Disaster Risk Reduction (DRR)- Disaster management cycle- its phases; prevention, mitigation, preparedness, relief and recovery; structural and non- structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response. Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders: Policies and legislation for disaster management. DRR programmes in India and the activities of National Disaster Management Authority.

Unit 5: Disasters, Environment and Development – Factors affecting vulnerability such as impact of development projects and environmental modifications (including of dams, land use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

Course Outcomes:

After successful completion of the course, the students will be able to

- CO1: Identify** disaster prevention and mitigation approaches.
- CO2: Classify** global and national disasters, their trends and profiles.
- CO3: Determine** the impacts of various disasters.
- CO4: Apply** Disaster Risk Reduction in management.
- CO5: Infer** the linkage between disasters, environment and development.

Text Books:

1. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
2. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation



3. Srivastava H.H. & Gupta G.D., Management of Natural Disasters in developing countries, DayaPublishers Delhi, 2006.

Reference Books:

1. <http://ndma.gov.in> (Home page of National Disaster Management Authority)
2. <http://www.ndmindia.nic.in> / (National Disaster Management in India)
3. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
4. National Disaster Management Policy, 2009, GOI.
5. Inter Agency Standing Committee (IASC) (Feb. 2007), IASC Guidelines on Mental Health and Psychosocial Support in Emergency Setting. Geneva: IASC

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1				1	1					2		1
CO2	2	1		2		1						2		2
CO3	2	2		3	2	2	2	2	2	3		2		2
CO4	2	1	2	2	2	2	2	2	2	2	2	2	1	2
CO5	2			2		3	2	2			1	2		2

1 - Slightly; 2 - Moderately; 3 – Substantially

Scheme of Evaluation
B. Tech. VI Semester (Civil Engineering)

For batches admitted in academic session 2023 – 24

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted									Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	Mode of Exam	Duration of Exam
				Theory Slot				Practical Slot			MOOCS			L	T	P				
				End Sem.		Mid Sem	Quiz/Assignment	End Sem	Lab Work & Sessional	Skill Based Mini Project	Assessment	Exam								
				End Term Evaluation	Proficiency in subject/course															
1.	3110620	MC	Artificial Intelligence & Machine Learning	50	10	20	20	40	30	30	-	-	200	2	1	2	4	Blended	MCQ	1.5 Hrs
2.	3110621	DC	Solid & Hazardous Waste management	50	10	20	20	-	-	-	-	-	100	3	-	-	3	Blended	MCQ	1.5 Hrs
3.	3110622	DC	Structural Design & Drawing (Steel)	50	10	20	20	-	-	-	-	-	100	3	1	-	4	Blended	PP	2 Hrs
4.	31106XX	DE	Departmental Elective - I (DE-1)*	-	-	-	-	-	-	-	25	75	100	-	-	3	3	Online	MCQ	3 Hrs
5.	910XXX	OC	Open Category Course – I (OC-1)	50	10	20	20	-	-	-	-	-	100	3	-	-	3	Blended	PP	2 Hrs
6.	3110623	DLC	Minor Project – II**	-	-	-	-	40	60	-	-	-	100	-	-	4	2	Offline	SO	-
7.	300XXX	CLC	Novel Engaging Course	-	-	-	-	50	-	-	-	-	50	-	-	2	1	Interactive	SO	-
8.		NSS	#Natural Sciences & Skills	200	40	80	80	120	40	40	-	-	600	1	-	2	2*	-	-	-
Total				400	80	160	160	250	130	70	25	75	1350	15	1	8	22	-	-	-
9.	1000007	MAC	Intellectual Property Rights	50	10	20	20	-	-	-	-	-	100	2	-	-	Grade	Online	MCQ	1.5 Hrs
Skill Enhancement Program/Research Internship/On Job Training for Four weeks duration: Evaluation in VII Semester																				
Additional Course for Honours or minor Specialization									Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization											

#Natural Sciences & Skills: Engineering Physics / Engineering Chemistry / Environmental Science/ Language (“Natural Sciences & Skills” treated as Mandatory Audit Courses from first to fourth semester and cumulative marks converted as a cluster of credits and awarded in the VI semester)

\$ proficiency in course/subject includes the weightage towards ability/skill/competence/knowledge level/ expertise attained etc. in that particular course/subject.

^{SS}MCQ: Multiple Choice Question ^{SS}AO: Assignment + Oral ^{SS}PP: Pen Paper ^{SS}SO: Submission + Oral

*Course run through SWAYAM/NPTEL/ MOOC Learning Based Platform with credit transfer

**The minor project-II may be evaluated by an internal committee for awarding sessional marks.

Mode of Teaching						Mode of Examination					Total Credits
Theory		Lab	MOOC		NEC	Theory		Lab	SIP/SLP/NEC		
Offline	Online	Blended	Offline	Online Mentoring	Interactive	PP	A+O	MCQ	SO	SO	
		13	3	3	1	7	-	9	3	1	22
		65%	15%	15%	5%	35%	-	45%	15%	5%	Credits %

Departmental Elective I (SWAYAM/NPTEL) (DE-1)

- 3110661, Geotechnical Engineering II – Foundation Engineering
- 3110662, Remote Sensing and GIS for Rural Development

Open Category Course – I (OC-1)

- 910XXX, Infrastructure services and maintenance
- 910219, Biomass Conversion Techniques
- 910XXX, Soil Exploration
- 910XXX, Renewable energy resources
- 910XXX, Water Resources and Society



*DE-1 (SWAYAM/NPTEL/ MOOC platform)		**Open Category Course (OC-1) (For students of other branches)	
Course Code	Course Name	Course Code	Course Name
3110661	Geotechnical Engineering II – Foundation Engineering		Infrastructure services and maintenance
3110662	Remote Sensing and GIS for Rural Development		Biomass Conversion Techniques
			Soil Exploration
			Renewable energy resources
			Water Resources and Society

Important Note: The Credit for opting a particular NPTEL course will be given only once throughout the tenure of B.Tech. program

List of courses to be opted for Minor specialization in B. Tech VI Semester

Minor specialization* <i>((To be opted by the students of other Department))</i>		Honour specialization* <i>((To be opted by the students of parent Department))</i>	
Course Code	Course Name	Course Code	Course Name
M11601	Hydraulic Engineering	H110601	. Structural Dynamics
M11602	Water & Wastewater Treatment	H110606	Construction Methods & Equipment Management
		H110607	Soil Structure Interaction
		H110605	Environmental Impact Assessment
		H110608	Applied Environmental Microbiology
		H110609	Biological process design for wastewater treatment

Important Note: The Credit for opting a particular NPTEL course will be given only once throughout the tenure of B.Tech. program



ANNEXURE – II

SYLLABUS FOR COURSES TO BE OFFERED IN VI SEMESTER

Course Code: 3110621

Course Name: Solid & Hazardous Waste Management

L	T	P	Credit
3	0	0	3

Course Objective:

To provide students with the knowledge and skills to manage solid, hazardous, and special waste types, focusing on collection, processing, and disposal, while exploring sustainable practices involved in management of waste.

SYLLABUS

Unit I Introduction:

Introduction to waste and waste management, classification of solid waste, objective of solid waste management, Issues related to solid waste, elements of waste management system. Solid waste sources – Nature and characteristics (physical, chemical & biological) – Quantities and Qualities – Generation rates. Overview of MSW Rule 2016 and implementation of SBM and smart waste management solutions in the country.

Unit II

Collection, storage and disposal of waste:

Implementation of 5R policy in waste management. On-site handling, storage and processing of waste. Collection of waste: collection systems and its analysis, collection vehicles, vehicle routing, route balancing, Transfer station, transportation of wastes. Disposal of waste through landfills – types of landfills, planning & operation of landfills, leachate management & control of gases in landfills, environmental monitoring of landfills.

Unit III

Processing and energy recovery form waste:

Conveying and compacting waste, shredding, material separation, recycling of waste: examples/case study. Biological processing of waste involving composting, Vermicomposting and biomethanation. Concept of Refused derived fuel. Thermal processing of municipal solid waste involving incineration, pyrolysis, gasification.

Unit IV

Hazardous Waste Management:

Introduction to hazardous waste: Definition, types, characterization and composition, source, health effects. Storage and transportation of hazardous waste, labeling of hazardous waste, Physical, Chemical and Biological treatment of hazardous waste, bioremediation of hazardous waste and disposal of waste. Overview of hazardous waste management rules.

Unit V

Other wastes and their management:

Biomedical waste management – sources, types and classification of biomedical wastes, health effects, challenges in waste management and biomedical waste management practices.



E-waste management – sources, types and classification of e-wastes, effects, challenges in waste management and handling of E-waste.

Plastic waste management – types of plastics, sources of plastic waste, impacts of plastic waste, plastic waste management practices.

Course Outcomes:

Upon completion of the course the student will be able to:

CO 1: Explain the principles & concepts of waste management

CO 2: Apply various techniques of handling the waste.

CO 3: Apply various techniques of processing and energy recovery from waste.

CO 4: Apply various techniques to manage hazardous waste.

CO 5: Analyze the challenges and impacts of managing biomedical, e-waste, and plastic waste

Text Books:

1. Text Book of Solid Wastes Management, Iqbal H. Khan and Naved Ahsan, CBS Publishers, 1st edition 2012
2. Integrated Solid Waste Management, Hilary Theisen and Samuel A, Vigil, George Tchobanoglous, McGraw Hill Yew York, 1993

Reference Books:

1. Environmental Engineering, Rowe, Peavy & Tchobanogolous, Tata McGraw Hill Publications, 2017
2. CPHEEO, Manual on Municipal Solid Waste management, Central Public Health and Environmental Engineering organization, Government of India, New Delhi, 2016
3. Solid Waste Engineering, Vesilind P.A., Worrel H. W. and Reinhard, Thomson Learning Inc, 2003
4. Charles A. Wentz, Hazardous Waste Management, McGraw Hill, New York. 1995.
5. David Rimbers, Municipal Solid Waste Management: Pollution Technologies Review, Noyes Data Corporation, London, 1990.
6. Michael D. Lagrega, Philip L. Buckingham, Jeffrey C. Evans. Hazardous Waste Management, McGraw Hill, New York. 1994.

Course Articulation Matrix

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02
CO1	3	2	-	1	-	2	3	1	-	-	-	2	-
CO2	3	2	2	1	2	-	2	-	-	-	-	3	-
CO3	3	2	3	2	2	-	3	-	-	-	1	3	-
CO4	3	3	2	2	2	2	2	2	-	-	1	-	-
CO5	2	3	1	2	-	3	3	2	-	1	-	-	-

1 - Slightly; 2 - Moderately; 3 – Substantial



Course Code: 3110622

Course Name: Structural Design & Drawing (Steel)

L	T	P	Credit
3	1	0	4

Course Objectives:

To comprehensively study the design principles and behavior of steel structural components as per IS 800-2007, including the analysis and design of compression, tension, and flexural members, bolted and welded connections, plate girders, column bases, and both laterally restrained & unrestrained beams and Introduction to plate girders & composite construction, while understanding their performance under gravity loads and using simple and built-up sections.

Syllabus:

Unit-I

Structural properties of steel, Design of structural connections – Bolted and Welded connections, Codal provision.

Unit-II

Design of Tension members. Lug angles & Tension splices. Codal provision.

Unit-III

Design of Compression member - simple and compound, Lacing & Battens. Codal provision.

Unit-IV

Design of Laterally supported and unsupported beams, web buckling and crippling. Codal provision.

Unit-V

Design of bases for steel columns, Introduction to plate girder, Introduction to composite construction. Codal provision.

Course Outcomes:

Upon completion of the course, the students will be able to:

- CO 1: Design** the steel connections using relevant IS codes.
- CO 2: Design** tension members using relevant IS codes.
- CO 3: Design** simple and built up compression member using relevant IS codes.
- CO 4: Design** flexural members using relevant IS codes.
- CO 5: Design** column bases and explain plate girders and composite construction.

Text Books:

1. Limit State Design of Steel Structures, S. K. Duggal, McGraw Hill Publication, 3rd edition, 2017

Reference Books:

1. Design of Steel Structures, S. S. Bhavikatti, International Publishing House, 2014
2. Design of Steel Structures, N. Subramanian, Oxford University Press India, 2008



Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	1	2	2	3	1	2		3	2
CO2	3	3	3	2	1	2	2	3	1	2		3	2
CO3	3	3	3	2	2	2	2	3	1	2		3	2
CO4	3	3	3	2	2	2	2	3	1	2		3	2
CO5	3	3	3	2	2	2	2	2	1	2		3	2

1 - Slightly; 2 - Moderately; 3 – Substantially



Course Code: 3110623
Course Name: Minor Project - II

L	T	P	Credit
0	0	4	2

Course Objectives:

To prepare students to address real-life civil engineering challenges through innovative problem-solving and the application of conventional and software-based methods, while fostering professional expertise, social responsibility, teamwork, leadership, and effective communication. Additionally, students will develop skills in technological innovation, system implementation, professional reporting, data presentation, and the use of computer tools and graphics for engineering solutions.

Syllabus:

Each candidate shall work on an approved project of a public building or any other civil engineering work and shall submit design and a set of drawings.

OR

Shall submit a detailed report of experimental work / software package on any specific problem of importance.

Course Outcomes:

Upon completion of the course, the students will be able to:

- CO 1: Recognize** various engineering problems and techniques to solve them.
- CO 2: Reproduce** the solution of the problems upon the need of society.
- CO 3: Cooperate** to work within group.
- CO 4: Develop** the writing and communication skills for various engineering problems.
- CO 5: Display** lifelong learning.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	3	2	2	2	2	3	3	1		2
CO2	3	3	3	3	3	3	3		3	3	3	3	2
CO3				2	2				3	2			
CO4									3	3			
CO5	2	2	2	2	2	2	2	2	2	2	1	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially



Course Code: 3110620

Course Name: Artificial Intelligence & Machine Learning

L	T	P	Credit
3	0	2	4

COURSE OBJECTIVES:

To equip students with fundamental knowledge of Artificial Intelligence, Neural Networks, and Machine Learning, including basic representation, reasoning paradigms, and the operational techniques used in these fields.

Unit – I:

Introducing Artificial Intelligence: Definition, Goals of AI, Task of AI, Computation, Psychology and Cognitive Science. Perception, Understanding, and Action. Artificial intelligence vs machine learning vs deep learning and other related fields. Applications of Artificial intelligence and Machine Learning in the real world.

Unit – II:

Problem, Problem Space and Search:

Production System, Blind Search: BFS & DFS, Heuristic Search, Hill Climbing, Best First Search

Introduction to Neural Networks:

History, Biological Neuron, Artificial Neural Network, Neural Network Architectures, Classification, & Clustering

Unit – III:

Introduction to Machine Learning: Traditional Programming vs Machine learning. Key Elements of Machine Learning: Representation, process (Data Collection, Data Preparation, Model selection, Model Training, Model Evaluation and Prediction), Evaluation and Optimization. Types of Learning: Supervised, Unsupervised and reinforcement learning. Regression vs classification problems.

Unit – IV:

Supervised Machine Learning: Linear regression: implementation, applications & performance parameters. Decision tree classifier, terminology, classification vs regression trees, tree creation with Gini index and information gain, IDE3 algorithms, applications and performance parameters. Random forest classifier. Case study on regression and classification for solving real world problems.

Unit – V:

Unsupervised Machine Learning: Introduction, types: Partitioning, density based, DBSCAN, distribution model-based, hierarchical, Agglomerative and Divisive, Common Distance measures, K-means clustering algorithm. Case study on clustering for solving real world problems.

RECOMMENDED BOOKS:

1. Artificial Intelligence: A Modern Approach by Stuart J. Russell and Peter Norvig, Prentice Hall.
2. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-Graw Hill.
3. Introduction to AI & Expert System: Dan W. Patterson, PHI.
4. Pattern Recognition and Machine Learning, Christopher M. Bishop
5. Introduction to Machine Learning using Python: Sarah Guido
6. Machine Learning in Action: Peter Harrington

COURSE OUTCOMES: After completing the course, the student will be able to:

- CO1: Define** basic concepts of Artificial Intelligence & Machine Learning.
- CO2:** Illustrate various techniques for search and processing.
- CO3:** Identify various types of machine learning problems and techniques.
- CO4:** Analysis various techniques in Artificial Intelligence, ANN & Machine Learning.
- CO5:** Apply AI and ML techniques to solve real world problems.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	1	1	-	-	-	-	-	-	-	-
CO2	3	2	2	1	2	-	-	-	-	-	-	-	-
CO3	3	3	2	1	2	1	-	1	-	-	-	-	-
CO4	3	3	3	2	2	1	-	1	-	-	-	-	-
CO5	3	3	3	2	3	2	1	1	1	1	2	-	-

1 - Slightly; 2 - Moderately; 3 – Substantially

List of experiments of AIML

1. Predicting Concrete Strength Using Regression
2. Classifying Soil Types Using Decision Tree
3. Predicting Water Quality Using Logistic Regression
4. Traffic Volume Prediction Using Linear Regression
5. Simple Classification of Building Materials Using K-Nearest Neighbors (KNN)
6. Predicting Construction Project Cost Using Linear Regression
7. Machine Learning for Seismic Risk Assessment
8. Classification of Building Energy Efficiency Using Random Forest
9. Predicting Building Foundation Failure Using Decision Tree
10. Simple Clustering of Construction Sites Using K-Means

List of Skill Based Mini Projects:

1. Write a program to predict compressive strength using a dataset with concrete mixture details and strength values to predict the. Evaluate the model using metrics like Mean Absolute Error (MAE) and Root Mean Squared Error (RMSE).
2. Write a program to predict future congestion levels using past traffic data (volume, speed, weather, time). Use regression models like Random Forest or XGBoost for prediction.
3. Write a program to predict energy usage using historical data on temperature, humidity, and occupancy. The goal is to minimize energy consumption by predicting usage patterns and optimizing HVAC systems.
4. Develop a classification model to predict the condition of pavement (e.g., good, fair, poor) using features



like traffic load, weather conditions, and maintenance logs.

5. Develop a model that can predict material costs for future projects, helping in cost estimation and planning using historical cost data to.
6. Use historical geotechnical data to train a regression model that can predict the soil's bearing capacity for different building types.
7. Implement anomaly detection algorithms (e.g., Isolation Forest or auto encoders) on vibration data to identify structural defects such as cracks, deformation, or fatigue.
8. Implement a classification model that determines the suitability of land for construction projects (e.g., residential, commercial) based on geotechnical parameters.



Course Code: 1000007

Course Name: Intellectual Property Rights

L	T	P	Credit
2	0	0	Grade

COURSE OBJECTIVE:

To acquaint learners with the fundamental concepts of Intellectual Property Rights (IPR), develop their expertise in IPR-related issues, and sensitize them to emerging challenges and the rationale behind IPR protection.

Syllabus

UNIT I: Introduction: Introduction to IPRs, Basic concepts and need for Intellectual Property – Meaning and practical aspects of Patents, Copyrights, Geographical Indications, IPR in India and Abroad. Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II: Intellectual Property Rights: The IPR tool kit, Patents, the patenting process, Patent cooperation treaties: International Treaties and conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

Unit III: Fire & Explosion: Intellectual Property Protections: IPR of Living Species, protecting inventions in biotechnology, protections of traditional knowledge, biopiracy and documenting traditional knowledge, Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection. Case studies: The basmati rice issue, revocations of turmeric patent, revocation of neem patent.

Unit IV: Exercising and Enforcing of Intellectual Property Rights: Rights of an IPR owner, licensing agreements, criteria for patent infringement. Case studies of patent infringement, IPR – a contract, unfair competitions and control, provisions in TRIPS.

Unit 5: Role of Patents in Product Development: Commercialization, Recent changes in IPR laws impacting patents and copy rights, intellectual cooperation in the science and allied industry. Patentable and non-patentable research. Case studies

Reference Books:

1. P.B. Ganguli, Intellectual Property Rights: Unleashing the Knowledge Economy. Tata Mc Graw Hill, 2001.
2. Steve Smith, The Quality Revolution. 1st ed., Jaico Publishing House, 2002.
3. Kompal Bansal and Praishit Bansal. Fundamentals of IPR for Engineers, 1st Edition, BS Publications, 2012.
4. Prabhuddha Ganguli. Intellectual Property Rights. 1st Edition, TMH, 2012.
5. R Radha Krishnan & S Balasubramanian. Intellectual Property Rights. 1st Edition, Excel Books, 2012.
6. M Ashok Kumar & Mohd. Iqbal Ali. Intellectual Property Rights. 2nd Edition, Serial Publications, 2011.

7. Vinod V. Scople, Managing Intellectual Property. Prentice Hall of India Pvt Ltd, 2012.
8. Deborah E. Bouchoux. Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets. Cengage Learning, 3rd ed. Edition, 2012.
9. Prabuddha Ganguli. Intellectual Property Rights: Unleashing the Knowledge Economy. McGraw Hill Education, 2011. Edited by Derek Bosworth and Elizabeth Webster.

Course Outcomes:

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

CO1. Imbibe the knowledge of Intellectual Property and its protection through various laws

CO2. Apply the knowledge of IPR for professional development

CO3. Develop a platform for protection and compliance of Intellectual Property Rights & knowledge CO4. Create awareness amidst academia and industry of IPR and Copyright compliance

CO5. Deliver the purpose and function of IPR and patenting.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	-	1	1	2	1	3	-	1	-	-	-
CO2	2	2	2	1	1	3	1	3	-	1	2	-	-
CO3	2	2	3	2	2	3	1	3	1	2	2	-	-
CO4	2	-	-	2	2	2	1	3	1	3	1	-	-
CO5	2	1	2	2	2	3	1	3	-	3	1	-	-

1 - Slightly; 2 - Moderately; 3 – Substantially



ANNEXURE – III

SYLLABUS FOR OPEN CATEGORY COURSES (OCs) TO BE OFFERED IN VI SEMESTER

Course Code: 910150

Course Name: Infrastructure services and maintenance

L	T	P	Credit
3	0	0	3

Course Objectives:

To gain knowledge and understanding of essential building services, including fire-fighting systems, water management, and lift planning and maintenance in high-rise buildings, and to develop skills for the effective maintenance and management of these services.

Syllabus:

Unit I

Introduction: Introduction to primary services in a building, Type of services required to keep facility usable, planning of services. Organization structures of services management. Role and administrative functions of supervisors. Outline of the concept of carbon trading and self-sustainable zero carbon building. Importance

Unit II

Fire Fighting: Standard fire, fire resistance, classification of buildings. Basic requirement of the works for fighting system, various components of the fire-fighting system. Maintenance required of the system, fire fighting in high-rise buildings, commercial/industrial complexes. Public buildings, checklist for fire safety. Provision of NBC.

Unit III

Lifts/Elevators, Escalators: Legal formalities for elevators, various types of lifts, working mechanisms of lift and escalators. Indian standard codes for planning & installations of elevator, inspection & maintenance of lifts.

Unit IV

Plumbing Services Water Supply System: Basics of Plumbing systems. Requirement of Plumbing works, Agency, Activity flow chart for plumbing work. Quality checking of materials. Water supply and distribution system in high-rise building & other complexes, pumps and pumping mechanisms. Operation & maintenance of fittings & fixtures of water supply & sanitary. Do's & Don'ts for water pipe networks.

Unit V:

Maintenance and management of services: Telecommunication network, computer network LAN, Electrical network & appliances. Basics of single phase & three phase electrification, precautions and safety measures during electrification. Indian standard codes for electrical appliances & wiring operations & maintenance of network & appliances. Landscaping &



Horticulture. Building maintenance management, applications of computer in service management. Flowcharts of air conditioning & heating.

Centralised systems, monitoring and working of the equipments, Checklist of inspection, Performance testing. Water proofing. Damp proofing & Termite proofing. Working procedure & stages of work of water proofing for W.C., Bathrooms, Terrace, sloping roof, Basements, tanks. Use of chemicals for water proofing treatment.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Identify various services required in a building.

CO2: Carry out planning of fire-fighting system for a building.

CO3: Develop a management strategy for maintenance of building services in a building.

CO4: Design a sustainable building services plan for a building.

Reference Books:

1. Building services Design and Management by Jackie Partman, Willey Blackwell 2014.
2. Building Services Engineering by David V .Chadderton, Routledge 2013.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	2	2	1	1	-	-	-	-	-	-	1
CO2	2	2	2	2	1	1	-	-	-	-	-	-	1
CO3	3	3	3	3	3	2	1	-	-	-	-	-	2
CO4	3	3	3	3	2	2	-	-	-	-	-	-	2

1 - Slightly; 2 - Moderately; 3 – Substantially



Course Code: 910151

Course Name: Biomass Energy Conversion Techniques

L	T	P	Credit
3	0	0	3

Course Objectives:

To equip students with a comprehensive understanding of biomass resources, conversion methods, ideal properties for energy production, and sustainability issues.

Syllabus:

Unit-I

Biomass as energy source: Introduction, source of biomass, advantages and disadvantages in use of biomass as energy source; **Ideal biomass feedstock:** sources of biomass available for energy use.

Unit-II

Overview of Biomass conversion processes: Chemical conversion process: transesterification; **Biological conversion process:** fermentation; **Thermal conversion process:** torrefaction, pyrolysis, gasification and combustion, **hybrid Conversion processes, Applications of biomass conversion products.**

Unit-III

Biomass Properties for Energy Conversions: Properties for thermal conversions: Physical and thermal related properties of biomass; Properties for Biological Conversions: Properties of biomass for biological conversions, Biomass pretreatment.

Unit-IV

BioEnergy Production: Biodiesel production: Process, ASTM characterization; **Bioethanol Production:** Biomass used, pretreatment process, Pilot scale ethanol production, commercial cellulosic ethanol plants; **Biogas production:** process, first and second generation biogas digesters, design of biogas digester.

Unit-V:

Biomass Sustainability Issues: Introduction, Well- to-Wheel Approach, Biofuel Economics, Sustainability of Biofuels Production

Course Outcomes

Upon completion of the course, the students will be able to:

CO1: Explain the ideal sources of biomass used for energy production.

CO2: Describe the types of techniques used for energy production from biomass.

CO3: Explain properties of biomass used for energy production.

CO4: Explain process used for the production of commonly used biofuels.

CO5: Discuss the economics of various biomass energy conversion processes and compare this with other conventional processes.



List of Books:

1. Sergio C. Capareda Introduction to biomass energy conversions, 2019 CRC Press, Taylor & Francis Group.
2. Basu S. (20130), Biomass gasification, pyrolysis and torrefaction, 2nd Ed., Publisher AP.
3. Sarkar S. (2010); Fuels and Combustion, Third Edition, CRC Press

Course Articulation Matrix

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02
C01	3	2	2	1	-	2	3	-	-	-	1	3	-
C02	3	2	2	1	-	2	3	-	-	-	1	3	-
C03	3	2	2	1	-	2	3	-	-	-	1	3	-
C04	3	2	2	1	-	2	3	-	-	-	1	3	-
C05	3	2	2	1	-	2	3	-	-	-	1	3	-

1 - Slightly; 2 - Moderately; 3 – Substantially



Course Code: 910152

Course Name: Soil Exploration

L	T	P	Credit
3	0	0	3

Course Objective:

To provide students with the ability to understand the need for soil exploration before any construction; plan and execute comprehensive soil exploration programs, analyze field and laboratory data to characterize subsurface conditions, and formulate professional geotechnical reports with actionable design recommendations.

SYLLABUS

Unit-I Introduction, Planning, and Geophysical Methods

Exploration phases, Planning: scope, spacing, depth, Site reconnaissance, Desk study, data collection, Geophysical methods: seismic refraction, electrical resistivity, Soil/rock stratification

Unit-II Direct Methods: Drilling, Excavation, and Sampling

Test pits, trenches, Boring methods: auger, wash, rotary, core; Soil samples: disturbed, undisturbed; Sampling criteria, standard samplers; Groundwater measurement: standpipe piezometers, water level recording

Unit-III In-Situ Testing Methods

Standard Penetration Test (SPT), Cone Penetration Test (CPT), Field Vane Shear Test, Plate Load Test, Advanced tests: Pressuremeter (PMT), Dilatometer (DMT)

Unit-IV Laboratory Interface, Documentation, and Reporting

Field-lab link, Lab tests: index properties, shear strength, consolidation, Sample preservation, Borehole logs, test pit logs, Geotechnical report: format, data presentation, design recommendations (foundation, SBC, settlement)

Unit-V Recent Advancements and Case Studies

Modern techniques: GPR, automated data acquisition, AI interpretation, Case studies: failures, complex projects, advanced exploration use

Books Recommended:

1. Gopal Ranjan and A.S.R. Rao, Basic and Applied Soil Mechanics, New Age International Publishers
2. K.R. Arora, Soil Mechanics and Foundation Engineering, Standard Publishers

Course Outcomes

Upon completion of the course, a student will be able to



CO1: Formulate a comprehensive geotechnical investigation plan, utilizing desk studies, site reconnaissance, and appropriate geophysical methods to characterize subsurface conditions.

CO2: Identify and supervise appropriate direct exploration methods (drilling, test pitting) and execute standardized procedures for collecting high-quality soil and rock samples.

CO3: Interpret data obtained from various in-situ tests to quantitatively determine essential soil engineering parameters.

CO4: Evaluate suitability of sites and provide justified foundation design recommendations.

CO5: Analyze complex, real-world geotechnical case studies to propose practical engineering solutions.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	3	2	1	2	1	2	2	2	2	-
CO2	3	3	3	3	3	1	1	2	3	2	3	2	-
CO3	3	3	3	3	3	-	1	-	1	2	2	2	-
CO4	3	3	3	2	2	2	3	2	2	2	3	3	-
CO5	3	3	3	3	2	3	3	3	3	3	3	2	-

1 - Slightly; 2 - Moderately; 3 – Substantially



Course Code: 910153

Course Name: Renewable energy resources

L	T	P	Credit
3	0	0	3

Course Objective:

To introduce students to renewable energy technologies, their applications, and sustainability benefits, while developing the ability to evaluate their feasibility, environmental impact, and role in future energy planning.

SYLLABUS:

UNIT 1: Introduction to Energy Resources

Classification of energy resources: Renewable vs Non-renewable, Global and Indian energy scenarios, Need for renewable energy and sustainable development, Environmental impacts of conventional energy sources, Energy policies and initiatives in India (National Solar Mission, etc.)

UNIT 2: Solar Energy

Principles of solar radiation, solar geometry, solar thermal systems: flat plate collectors, solar heaters, dryers, cookers solar photovoltaic (PV) systems: components, working, applications, Grid-connected and off-grid systems, Advantages, limitations and recent developments

UNIT 3: Wind and Hydro Energy

Basics of wind energy, wind characteristics, site selection, Wind turbines: types, components and performance, Small vs large wind systems, Hydropower: classification (micro/mini/small hydro), Components of hydroelectric plants, Environmental impacts and suitability

UNIT 4: Biomass & Bioenergy

Biomass resources: classification and availability, Biogas technology: production, digesters, applications, Biofuels: biodiesel, bioethanol—properties and uses, Waste-to-energy concepts (incineration, gasification, pyrolysis), Environmental benefits and challenges

UNIT 5: Other Emerging Renewable Resources

Geothermal energy: principles, applications, Ocean energy: tidal, wave, OTEC, Hydrogen energy and fuel cells, Hybrid renewable energy systems, Role of renewable energy in smart cities and sustainable development

Text Books:

1. Renewable Energy Sources and Emerging Technologies, by Kothari, D.P., Singal, K.C., and Ranjan, R. published by PHI Learning Pvt. Ltd.
2. Non-Conventional Energy Sources, by G.D. Rai, published by Khanna Publishers, Delhi,
3. Renewable Energy Resources, by John Twidell & Tony Weir, published by Taylor & Francis Group



Reference Books:

1. Solar Engineering of Thermal Processes by Duffie & Beckman, published by John Wiley & Sons
2. Wind Energy Explained: Theory, Design and Application by Manwell, McGowan & Rogers, by John Wiley & Sons
3. Renewable Energy: Power for a Sustainable Future by Boyle, Godfrey by Oxford University Press.

Course Outcomes (COs)

CO1: Explain the need, scope and potential of renewable energy resources.

CO2: Describe the working principles and applications of solar energy systems.

CO3: Explain the fundamentals of wind and hydropower systems.

CO4: Analyze various biomass conversion technologies and their environmental benefits.

CO5: Discuss emerging renewable technologies and evaluate their relevance for sustainable development.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	-	-	-	1	-	3	2	-	2	-	1	2
CO2	2	-	1	-	1	-	2	-	-	1	-	1	2
CO3	2	-	1	-	1	-	2	-	-	1	-	1	2
CO4	1	1	-	-	1	-	3	1	-	2	-	1	3
CO5	1	-	-	-	1	-	3	2	-	3	-	1	3

1 - Slightly; 2 - Moderately; 3 – Substantially



Course Code: 910154

Course Name: Water Resources and Society

L	T	P	Credit
3	0	0	3

Course Objective:

To give students from all branches a basic understanding of how water resources support life, society and development, and to create awareness about water-related issues and simple, practical ways to use and manage water in a sustainable manner.

Syllabus:

Unit I: Water on Earth and in India: Introduction to water on Earth; forms of water (rain, rivers, lakes, groundwater, glaciers) and the simple idea of the water cycle. Overview of water resources in India and major river basins. Basics of surface water, groundwater and safe drinking water.

Unit II: Water in Daily Life, Health and Society: Importance of safe water for drinking, cooking, hygiene and sanitation. Link between water and human health (water-borne diseases, handwashing, safe storage). Social aspects of water – who gets water, who collects water, and how water affects women, children and different groups in villages and cities.

Unit III: Water Governance and Indian Programmes: Who manages water – an overview of the role of government, local bodies and communities. Introductory idea of rules and policies related to water in India in very simple language. Brief overview of major schemes such as Jal Jeevan Mission, Namami Gange, Atal Bhujal Yojana and Swachh Bharat Mission, with examples of what they try to achieve.

Unit IV: Water Challenges and Simple Solutions: Common water problems in villages and cities – shortage, pollution, leakage, waterlogging and flooding. Simple household and community-level solutions like boiling and filtering water, fixing leaks, cleaning tanks, rainwater harvesting and protecting ponds and lakes. Short case studies from different parts of India showing successful community efforts.

Unit V: Climate Change, Conservation and Local Projects: How changing climate and weather can affect rainfall, floods and droughts in simple terms. Ways to save water at home, in hostels, on campus and in industry – reduce, reuse and recycle. Group-based mini project: identify a small water-related issue in the campus or local area, collect basic information (photos, simple survey), think of possible solutions and prepare a short report and presentation.

Books Recommended:

1. UNESCO / UN-Water (2024), World Water Development Report 2024: Water for Prosperity and Peace, UNESCO Publishing.
2. K. Subramanya (2024), Engineering Hydrology, 6th Edition, McGraw-Hill Education India.
3. Peter H. Gleick (Ed.) (1993), Water in Crisis: A Guide to the World's Fresh Water Resources, Oxford University Press.



4. Central Ground Water Board (CGWB), Annual Reports and Hydrogeological Basin Studies (2019 onwards).

Course Outcomes

Upon completion of the course, a student will be able to

CO1: Explain in simple language the basic ideas of the water cycle and water resources in India.

CO2: Describe how water is linked with daily life, health and society through simple examples and case studies.

CO3: Summarise in basic terms how water is managed through government programmes and local institutions in India.

CO4: Identify common water-related problems in villages, towns or cities and discuss possible simple solutions.

CO5: Understand Work in a small group to study a local water issue and suggest practical measures for improvement

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	1	-	-	-	2	2	-	-	1	2	-	-
CO2	-	1	-	1	-	2	3	2	1	2	3	-	-
CO3	-	1	-	1	-	3	3	2	1	2	2	-	-
CO4	-	1	1	1	-	2	3	2	1	2	3	1	-
CO5	-	1	1	1	1	2	3	2	3	3	3	-	-

1 - Slightly; 2 - Moderately; 3 – Substantially