3rd Semester

<table>
<tr><th colspan="7">DEPARTMENT OF ENVIRONMENTAL ENGINEERING</th></tr>
<tr><th colspan="2">Course Code: 26MTEV31I</th><th colspan="5">Course Title: Internship / Industrial Training</th></tr>
<tr><th colspan="2">Total Credits: 4</th><th colspan="2">SDGs addressed: All SDGs</th><th colspan="2">Course Category: SDA</th><th>Course Type: Internship</th></tr>
<tr><td rowspan="6">Teaching Learning Process</td><td colspan="2"></td><td>Total Contact Hours/semester</td><td colspan="4">Assessment Weightage and Marks</td></tr>
<tr><td colspan="2">Lecture</td><td rowspan="5">8 weeks commencing from intervening vacation of II and III Semester</td><td></td><td>CIE</td><td>SEE</td><td>Total</td></tr>
<tr><td colspan="2">Tutorial</td><td>Weightage %</td><td>100</td><td>-</td><td>100</td></tr>
<tr><td colspan="2">Practical</td><td>Maximum Marks</td><td>100</td><td>-</td><td>100</td></tr>
<tr><td colspan="2">Self-learning and Term work</td><td rowspan="2">Minimum Marks</td><td rowspan="2">50</td><td rowspan="2">-</td><td rowspan="2">50</td></tr>
<tr><td colspan="2">Total</td></tr>
</table>

Course Objective: Development of practical experience and technical expertise in Environmental Engineering techniques and technologies for professional development.

Course Outcomes (COs): At the end of the course students will be able to,

CO	Course Outcomes	Highest Level of Cognitive Domain
CO1	Apply the knowledge and technical skills acquired during the M.Tech. Environmental Engineering program to address real-world environmental engineering problems.	L3
CO2	Evaluate industrial practices, operational procedures, and applicable standards in the context of environmental engineering and regulatory compliance.	L5
CO3	Evaluate professional practices involving communication, teamwork, problem-solving, time management, and networking to enhance professional competence and opportunities for future employment or collaboration.	L5

L1 – Remember, L2 – Understand, L3 – Apply, L4 – Analyze, L5 – Evaluate, L6 – Create

Guidelines:

- The internship / industrial training is a course having 4 credits.
- Each student shall be associated with a faculty member serving as internal guide to supervise the internship.
- Students conducting an internship in an industry or an organization will be associated with an external guide from industry or organization (along with institute guide) with the approval of the Head of the Department.
- The student will work with the internship guide (both institute and industry) towards the identification of the problem through a systematic literature review and finalize the objectives and scope of work.
- Students are expected to come out with detailed specifications, methodology, resources required, critical issues and any other issues related to design, and implementation of the project should be provided in consultation with guides.
- The student should submit the proposal within ten working days from the commencement of the semester to the Head of Department after due approval from the guide.
- The student is expected to exert on design, development and testing of the proposed work as per the schedule.
- The students should present an interim progress review as per the department calendar of events.
- Completed internship / industrial training documentation should be in the form of a report and the report should be submitted to the department at the end of the semester.
- The report should include Abstract, Content sheets, Introduction chapter with objectives, literature review chapter, materials and methodology chapter, results and discussion chapter, summary and conclusion followed by reference list and appendix if any.
- The student should make a final presentation at the end of the semester (CIE) as per the department Calendar of events.

Course Articulation Matrix:

COURSE OUTCOMES ↓	PROGRAM OUTCOMES					
	PO1	**PO2**	**PO3**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	3
CO2	3	3	3	3	3	3
CO3	3	3	3	3	3	3

High – 3, Medium – 2, Low – 1

DEPARTMENT OF ENVIRONMENTAL ENGINEERING			
Course Code: 26MTEV32P	**Course Title: Project Work (Phase-I)**		
Total Credits: 6	**SDGs addressed: All SDGs**	**Course Category: PWC**	**Course Type: PROJ**

		Total Contact Hours/semester	Assessment Weightage and Marks			
Teaching Learning Process	**Lecture**	**-**		**CIE**	**SEE**	**Total**
	Tutorial	**-**	**Weightage %**	**100**	**-**	**100**
	Practical	**30**	**Maximum Marks**	**100**	**-**	**100**
	Self-learning & Term work	**-**	**Minimum Marks**	**50**	**-**	**50**
	Total	**30**				

Course Objective: Development of practical experience and technical expertise in Environmental Engineering techniques and technologies for professional development.

Course Outcomes (COs): At the end of the course students will be able to,

CO	Course Outcomes	Highest Level of Cognitive Domain
CO1	Identify and define a research problem or project topic related to Environmental Engineering	L3
CO2	Conduct a literature review and analyze relevant research and information related to the project topic	L4
CO3	Develop a project plan, including objectives, methods and timeline	L3

L1 – Remember, L2 – Understand, L3 – Apply, L4 – Analyze, L5 – Evaluate, L6 – Create

Guidelines:

- The Project Work (Phase – 1) is a course having 6 credits.
- Each student shall be associated with a faculty member serving as internal guide to supervise the project work.
- If the student is conducting the project work in an industry or an organization an external guide is to be chosen from industry or organization (along with internal guide) with the approval of the Head of the Department.
- The student will work with the project guide /supervisor towards the identification of the problem through a systematic literature review and finalize the objectives and scope of work.
- Students are expected to come up with detail specifications, methodology, resources required, critical issues and any other issues related to design, and implementation of the project should be provided in consultation with Guide.
- The student should submit the proposal within ten working days from the commencement of the semester to the Head of Department after due approval from the guide.
- The student is expected to exert on design, development and testing of the proposed work as per the schedule.
- The students should present an interim progress review as per the department calendar of events.
- Completed Project Work documentation should be in the form of a report, and the report should be submitted to the department at the end of the semester.
- The report should include- Abstract, Content sheets, Introduction chapter with objectives, literature review chapter, materials and methodology chapter, results and discussion chapter, summary and conclusion followed by reference list and appendix if any.
- The student should make a final presentation (CIE) at the end of the semester as per the department Calendar of events.

Course Articulation Matrix:

COURSE OUTCOMES ↓	PROGRAM OUTCOMES					
	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3
CO2	3	3	3	3	3	3
CO3	3	3	3	3	3	3

High – 3, Medium – 2, Low – 1

4th Semester

<table>
<tr><th colspan="8">DEPARTMENT OF ENVIRONMENTAL ENGINEERING</th></tr>
<tr><td colspan="2">Course Code: 26MTEV41M</td><td colspan="6">Course Title: Open Elective/ SWAYAM/ NPTEL/ MOOCs (Online Course of 12 Weeks)</td></tr>
<tr><td colspan="2">Total Credits: 3</td><td colspan="3">SDGs addressed: 4, 6, 7, 9, 11, 12, 13, 15, 17</td><td colspan="3">Course Category: SWAYAM/ MOOCs/ NPTEL</td><td>Course Type: Theory</td></tr>
<tr><td rowspan="6">Teaching Learning Process</td><td></td><td>Total Contact Hours/semester</td><td colspan="5">Assessment Weightage and Marks</td></tr>
<tr><td>Lecture</td><td>-</td><td colspan="3"></td><td>CIE</td><td>SEE</td><td>Total</td></tr>
<tr><td>Tutorial</td><td>-</td><td colspan="3">Weightage, %</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Practical</td><td>-</td><td colspan="3">Maximum Marks</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Self-learning and Term work</td><td rowspan="2">-</td><td colspan="3" rowspan="2">Minimum Marks</td><td rowspan="2">-</td><td rowspan="2">-</td><td rowspan="2">-</td></tr>
<tr><td>Total</td><td>-</td></tr>
</table>

#SWAYAM/NPTEL (Online Course) can be taken during 1st, 2nd, or 3rd Semesters. To qualify as a 3-credit equivalent, SWAYAM/NPTEL course must total a minimum of 12 weeks in duration, which may be fulfilled through a single 12-week course or an equivalent combination of courses (e.g., one 8-week course and one 4-week course, three 4-week courses, or any other combination aggregating to at least 12 weeks). In case a student fails to complete SWAYAM/PTEL course by the end of 3rd semester, he/she shall choose a course from the pool of open elective courses offered by the University.

Course ID	Discipline	Course Name	Duration
noc26-ar18	Architecture and Planning	Low-Cost Building Materials and Techniques	12 Weeks
noc26-ar31	Architecture and Planning	Sustainable Architecture	12 Weeks
noc26-ar33	Architecture and Planning, Civil Engineering	Building Materials as a Cornerstone to Sustainability	12 Weeks
noc26-ar34	Architecture and Planning, Civil Engineering	Architectural Approaches to Decarbonization of Buildings	12 Weeks
noc26-bt56	Energy, Climate And Sustainability	Biodiversity for Sustainability	12 Weeks
noc26-bt88	Biotechnology and Bioengineering	Environmental Biotechnology	12 Weeks
noc26-bt89	Biotechnology and Bioengineering	Industrial Biotechnology	12 Weeks
noc26-ce105	Earth Sciences	Groundwater Engineering	12 Weeks
noc26-ce117	Civil Engineering	Environmental Geomechanics	12 Weeks
noc26-ce121	Civil Engineering/ Geology/ Engineering Geology/ Environmental Engineering/Environmental Science/ Geography/ Management	Sustainable Groundwater Management	12 Weeks
noc26-ce125	Climate and Environmental Science and Technology	An Introduction to Climate Dynamics, Variability and Monitoring	12 Weeks
noc26-ce126	Environmental Engineering, Civil Engineering	Indoor Air Pollution: Sources, Effects, Monitoring, Control and Modeling	12 Weeks
noc26-ce142	Civil Engineering	Integrated Waste Management for a Smart City	12 Weeks
noc26-ce160	Civil Engineering/Earth Sciences	Remote Sensing for Natural Hazard Studies	12 Weeks

noc26-ce162	Civil Engineering	Sustainable Materials and Green Buildings	12 Weeks
noc26-ch56	Chemical Engineering	Analysis and Modeling in Chemical Engineering	12 Weeks
noc26-ch73	Chemical Engineering	Basic Environmental Engineering and Pollution Abatement	12 Weeks
noc26-ch77	Chemical Engineering	Polymers: Concepts, Properties, Uses and Sustainability	12 Weeks
noc26-cs128	Computer Science and Engineering	Mathematical Foundations for Machine Learning	12 Weeks
noc26-cs129	Computer Science and Engineering	Artificial Intelligence: Concepts and Techniques	12 Weeks
noc26-cs132	Computer Science and Engineering	Artificial Intelligence: Search Methods for Problem solving	12 Weeks
noc26-cs133	Computer Science and Engineering	Introduction to Machine Learning	12 Weeks
noc26-ec14	Economic Sciences	Environmental & Resource Economics	12 Weeks
noc26-ge80	Energy, Multidisciplinary	Hydrogen Energy: Technology and Economics	12 Weeks
noc26-ge81	Any Engineering, Science and Management Disciplines	Carbon Accounting and Sustainable Designs in Product Lifecycle Management	12 Weeks
noc26-ge91	Multidisciplinary	Solar Energy Engineering and Technology	12 Weeks
noc26-hs215	Humanities and Social Sciences	Ecology and Society	12 Weeks
noc26-me141	Mechanical Engineering, Chemical Engineering	Sustainable Energy Technology	12 Weeks
noc26-me171	Mechanical Engineering	Energy Conservation and Waste Heat Recovery	12 Weeks
noc26-mm75	Materials Science and Engineering	Nanomaterials and their Properties	12 Weeks
noc26-mm87	Metallurgy/Material-science/Tribology	Corrosion/Environmental Degradation/Surface Engineering	12 Weeks

DEPARTMENT OF ENVIRONMENTAL ENGINEERING						
Course Code: 26MTEV42P		**Course Title: Project Work (Phase-II)**				
Total Credits: 15		**SDGs addressed: All SDGs**		**Course Category: PWC**		**Course Type: PROJ**
Teaching Learning Process		**Total Contact Hours/semester**	**Assessment Weightage and Marks**			
	Lecture	**-**		**CIE**	**SEE**	**Total**
	Tutorial	**-**	**Weightage %**	**40**	**60**	**100**
	Practical	**450**	**Maximum Marks**	**100**	**200**	**300**
	Self-learning and Term work	**-**	**Minimum Marks**	**50**	**80**	**135**
	Total	**450**				

Course Objective: Development of practical experience and technical expertise in Environmental Engineering techniques and technologies for professional development.

Course Outcomes (COs): At the end of the course students will be able to,

CO	Course Outcomes	Highest Level of Cognitive Domain
CO1	Apply knowledge and skills learned in the M.Tech. Environmental Engineering program for the project work.	L3
CO2	Analyze and interpret data and information related to the project topic and present findings in a clear and concise manner.	L4
CO3	Independently work and communicate effectively with the project supervisor and develop research and critical thinking skills.	L6

L1 – Remember, L2 – Understand, L3 – Apply, L4 – Analyze, L5 – Evaluate, L6 – Create

Guidelines:

- The Project Work (Phase –II) is a course having 15 credits.
- Each student shall be associated with a faculty member serving as internal guide to supervise the project.
- If the student is conducting the project work in an industry or an organization an external guide is to be chosen from industry or organization (along with internal guide) with the approval of the Head of the Department.
- The student will work with the project guide /supervisor towards the identification of the problem through a systematic literature review and finalize the objectives and scope of work.
- Students are expected to come up with detail specifications, methodology, resources required, critical issues and any other issues related to design, and implementation of the project should be provided in consultation with Guide.
- The student should submit the proposal within ten working days from the commencement of the semester to the Head of Department after due approval from the guide.
- The student is expected to exert on design, development and testing of the proposed work as per the schedule.
- The students should present an interim progress review as per the department calendar of events.
- Completed Project Work documentation should be in the form of a report, and the report should be submitted to the department at the end of the semester.
- The report should include Abstract, Content sheets, Introduction chapter with objectives, liter- ature review chapter, materials and methodology chapter, results and discussion chapter, sum- mary and conclusion followed by reference list and appendix if any.
- The student should make an interim presentation (CIE) during the semester as per the department calendar of events.
- The student should make final presentation (SEE) at the end of the semester as per the university calendar of events.

Course Articulation Matrix:

COURSE OUTCOMES ↓	PROGRAM OUTCOMES					
	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	2
CO2	3	3	3	3	3	3
CO3	2	3	3	2	3	3

High – 3, Medium – 2, Low – 1

DEPARTMENT OF ENVIRONMENTAL ENGINEERING						
Course Code: 26MTEV411		**Course Title: Disaster Management**				
Total Credits: 03		**SDGs addressed: 11, 13, 15, 17**		**Course Category: Open Elective**		**Course Type: Theory**
Teaching Learning Process		**Total Contact Hours/semester**	**Assessment Weightage and Marks**			
	Lecture	**45**		**CIE**	**SEE**	**Total**
	Tutorial	**-**	**Weightage %**	**40**	**60**	**100**
	Practical	**-**	**Maximum Marks**	**40**	**60**	**100**
	Self-learning and Term work	**45**	**Minimum Marks**	**20**	**25**	**45***
	Total	**90**				

Note: *For passing the student must score a Minimum of 45 Marks (CIE+SEE: 20 + 25 or 21 + 24)

Course Objective: The course imparts a thorough understanding of natural and manmade disasters, impact and vulnerability assessment, emergency response, preparedness, mitigative measures. Stresses the role of modern engineering and information technology in disaster management. The course also supplements details on the legal framework along with few case studies.

Course Outcomes (COs): At the end of the course students will be able to,

CO	Course Outcomes	Highest Level of Cognitive Domain
CO1	Explain disasters and list the types of disasters and identify the cause- effect relationships.	L2
CO2	Apply the concept of vulnerability assessment for pre-planning, early warning systems and response plan and prepare on-site and off-site ERPs.	L3
CO3	Recognize the role of IT in creating vulnerability scenarios through simulation exercises using GIS and other related software and prepare Disaster and Environmental Management Plans	L4
CO4	Schedule the Pre-Disaster Planning, Disaster Response Planning, Preparedness	L4
CO5	Consolidate the information on National policy on disaster management along with required legal framework for effective mitigation and extrapolate some recent case studies of disaster and plan the preparedness and mitigation measures	L5

L1 – Remember, L2 – Understand, L3 – Apply, L4 – Analyze, L5 – Evaluate, L6 - Create

Course Syllabus:

Unit No.	Content	Lecture Hours	Tutorial Hours
1	**Introduction:** Disasters, causes and impacts, scope of disaster management, disaster Managers- professionals and specialists active in various phases of disasters, Risk management, preparedness, operational functions of disaster management, Resource management, impact reduction. **Disasters:** Natural disasters - Drought, Floods, Earth Quake, Volcanoes, Land Slides, Cyclones, Tsunami; Manmade - Air accidents, Rail and Road accidents, Industrial, Chemical, Biological (Bio-Terrorism) nuclear Disasters, accidental oil spills and other types of Disasters. **Self-learning and Term work**	**09**	**06**

	• Incident Response System (IRS) • International frameworks (Sendai Framework and SDGs)		
2	**Vulnerability Assessment and Disaster Preparedness:** Vulnerability assessment(VA). Importance and advantages, Process of VA, Steps in VA, Report, Prioritization, Emergency Response Plan (ERP). **Self-learning and Term work** • Methods and tools for vulnerability assessment • Vulnerability assessment of a selected community or institution • Vulnerability assessment methods	**09**	**06**
3	**Information Technology in Disaster Management**: Application of GIS and Remote sensing for Disaster Management, Simulation studies. Use of Unmanned aerial vehicles (UAVs) in disaster management and monitoring. **Self-learning and Term work** • Artificial Intelligence (AI) and IoT in disaster management • Case study on GIS applications in disaster management	**08**	**06**
4	**Pre disaster Planning:** Earthquakes, cyclones, epidemics outbreak, drought and famine. Disaster resistant constructions, rehabilitation and reconstruction. Coping mechanism and relief assistance, disaster management continuum, Early warning and management, Global Disaster alerting and coordination system (GDACS), Flood forecasting, flood control systems. **Self-learning and Term work** • Drought and famine management strategies • Field visit to a disaster management or flood control agency	**09**	**06**
5	**Disaster Response Planning, Preparedness and Mitigation**: Earthquake, Cyclone, Landslide, Flood preparedness and response. NDMA act 2005, National Disaster Management Policy, Disaster Management Plans (DMP), Guidelines. **Case studies:** Natural, Industrial, Nuclear, Biological, Accidental Oil Spills, Recent case studies **Self-learning and Term work** • Emergency Operations Centre (EOC) • Recent case studies on natural and man-made disasters	**10**	**06**

Text Books:

- National Research Council 2007. Improving Disaster Management: The Role of IT in Mitiga- tion, Preparedness, Response, and Recovery. Washington, DC: The National Academies Press. https://doi.org/10.17226/11824
- National Research Council 2007. Successful Response Starts with a Map: Improving Geospa- tial Support for Disaster Management. Washington, DC: The National Academies Press. https://doi.org/10.17226/11793

Reference Books:

- Trim, P.R.J. (2004), "An integrative approach to disaster management and planning", Disaster Prevention and Management,Vol.13No.3,pp.218-225. https://doi.org/10.1108/09653560410541812
- National Research Council 2006. Facing Hazards and Disasters: Understanding Human Dimen- sions. Washington, DC: The National Academies Press. https://doi.org/10.17226/11671
- National Research Council 2007. Tools and Methods for Estimating Populations at Risk from Natural Disasters and Complex Humanitarian Crises. Washington, DC: The National Acad- emies Press. https://doi.org/10.17226/11895.

- National Research Council 2006. The Indian Ocean Tsunami Disaster: Implications for U.S. and Global Disaster Reduction and Preparedness: Summary of the June 21, 2005 Workshop of the Disasters Roundtable. Washington, DC: The National Academies Press. https://doi.org/10.17226/11619.
- WCDR Session Report UNEP, (2005), "Environmental Management and Disaster Prepared- ness" Building a multi-stakeholder partnership.

Journals/Magazines:

- Technical articles from peer reviewed journals of Science Direct, acs.org, Springer, Taylor and Francis and patented materials.

Web/Digital resources:

- **https://nidm.gov.in/research.asp**
- http://www.adrc.or.jp/top_gen.asp
- http://www.cdc.gov

SWAYAM/NPTEL:

- NPTEL 8 weeks course on "Natural Hazards" by Prof. Javed N. Malik, IIT Kanpur
- Short Term Training Programs by NIDM, GOI

Self-Learning Exercises:

- Case Study projects
- Mini Projects
- Any others

Course Articulation Matrix:

COURSE OUTCOMES↓	PROGRAM OUTCOMES					
	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	-	1	-	-	3
CO2	3	3	-	2	2	-
CO3	3	3	-	2	2	1
CO4	3	3	-	2	-	2
CO5	3	3	-	2	-	-

High – 3, Medium – 2, Low – 1

DEPARTMENT OF ENVIRONMENTAL ENGINEERING			
Course Code: 26MTEV412	**Course Title: Waste Management**		
Total Credits: 03	**SDGs addressed: 12, 13, 16**	**Course Category: Open Elective**	**Course Type: Theory**

Teaching Learning Process		**Total Contact Hours/semester**	**Assessment Weightage and Marks**			
	Lecture	**45**		**CIE**	**SEE**	**Total**
	Tutorial	**-**	**Weightage %**	**40**	**60**	**100**
	Practical	**-**	**Maximum Marks**	**40**	**60**	**100**
	Self-learning & Term work	**45**	**Minimum Marks**	**20**	**25**	**45***
	Total	**90**				

Note: *For passing the student must score a Minimum of 45 Marks (CIE+SEE: 20 + 25 or 21 + 24)

COURSE OBJECTIVE: The course provides knowledge of engineering principles and practices of municipal, biomedical and e-waste management including treatment and disposal options.

Course Outcomes (COs): At the end of the course students will be able to,

CO	Course Outcomes	Highest Level of Cognitive Domain
CO1	Identify and have the knowledge of basic engineering principles and practices of waste management of solid waste and their environmental implications.	**L3**
CO2	Explain the proper basic engineering principles of Hazardous waste and of biomedical waste management and their environmental implications.	**L2**
CO3	Explain the basic engineering principles of E- waste management and disposal and their environmental implications,	**L2**
CO4	Expound the necessity and implications of Waste Minimization, Resource Recovery and Lifecycle assessment and the management Concepts.	**L3**
CO5	Identify and relate the relevant regulation of waste management policy adopted in national and international level	**L3**

L1 – Remember, L2 – Understand, L3 – Apply, L4 – Analyze, L5 – Evaluate, L6 – Create

Course Syllabus:

Unit No.	Content	Lecture Hours
1	Solid Waste Management: Introduction, Characteristics and Quantities, Circular economy principles in municipal solid waste management, generation rates, waste Collection, transportation, segregation, processing, treatment and disposal: Case Studies. Smart waste management using IoT, GIS, GPS, and sensor technologies **Self-Learning and Term work** ● Global Best Practices in Solid Waste Management (Japan, Sweden, Germany, Singapore) ● Design a smart waste bin concept ● Design a source segregation awareness campaign	**10**
2	**Hazardous Waste Management:** Hazardous wastes and the environment, Waste management hierarchy, Transportation, Hazardous wastes treatment, storage, and disposal facilities, Source reduction, recycling, disposal, and treatment, major safety	**8**

	operations in the management of hazardous waste. Risk assessment and risk management methodologies. **Biomedical Waste Management:** Introduction, types and categories, Segregation, collection and transportation, disinfection, processing, treatment, and Disposal of biomedical waste: Case Studies. **Self-Learning and Term work** ● Circular Economy Approaches for Hazardous Waste ● Model or prototype demonstrating safe handling and transportation of waste	
3	**Electronic Waste (E-Waste) Management:** Issues and Status in India and Globally E-Waste Management Rules 2016 and Management Challenges Exposure pathway of pollutants emitted from Recycling of E-Waste. E-waste Management: Case Studies. Artificial Intelligence applications in e-waste segregation and recycling **Self-Learning and Term work** ● Extended Producer Responsibility ● Green Electronics and Eco-Design	**9**
4	**Construction and Demolition (C&D) waste management:** Environmental degradation due to indiscriminate disposal of C & D wastes, Quantification & composition of C & D waste generation, Type of C & D wastes products proposed under Rules, Roadmap for C & D waste management, C & D waste processing, Hierarchy in waste management, Importance of recycling C & D Wastes, Sustainable Model' on C & D waste management. Building Information Modelling (BIM) for C&D waste minimization. Environmental Management – noise and dust, impact on soil and water. **Self-Learning and Term work** ● Design a roadmap for implementing C&D waste management ● Awareness campaign on segregation and recycling of construction waste.	**9**
5	Municipal Solid Waste (Management and Handling) Rules, 2000. Hazardous And Other Wastes (Management and Transboundary Movement) Rules, 2015, Bio-medical Waste Management Rules, 2016, C & D Waste Management Rules, 2016 **Current Issues**: Life cycle assessment, Fly ash rules; recycled plastics usage rules; commuter vehicle batteries (management and handling) rules Swachh Bharat Mission and Status in Smart Cities in the Country Construction and Demolition (C&D) **Self-Learning and Term work** ● Analyze waste management practices in a Smart City. ● Prepare and present a technical paper on recent developments in waste management policies and circular economy practices.	**9**

Text Books:

- George Techobanoglous et al, (2014) "Integrated Solid Waste Management‖", Mc Graw - Hill, 2014.
- Techobanoglous Thiesen Ellasen (2014), "Solid Waste Engineering Principles and Management", Mc Graw – Hill.
- Tchobanoglous G., Theisen H., Viquel S.A., "Integrated Solid Waste Management: Engineering, Principles and Management issues", Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
- Wentz C.A., (1995), "Hazardous Waste Management", Mc Graw Hill International Edition.

- Davis M.L., and Cornwell D.A. (1998)," Introduction to Environmental Engineering", McGraw Hill International Edition.
- Johri R., "E-waste: implications, regulations, and management in India and current global best practices", TERI Press, New Delhi.

Reference Books:
- Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development, Govt. Of. India, New Delhi, 2000.
- Guidelines for Hazardous Waste Management, CPHEEO, Ministry of Urban Development, Govt. Of. India, New Delhi.
- Guidelines for Biomedical Waste Management, CPHEEO, Ministry of Urban Development, Govt. Of. India, New Delhi
- Guidelines for E-waste Management and Handling, CPHEEO, Ministry of Urban Development, Govt. Of. India, New Delhi.

Web/Digital resources:
- http://cpheeo.gov.in/
- https://cpcb.nic.in/openpdffile.php?id=TGF0ZXN0RmlsZS8xNTlfMTQ5NTQ0NjM5N19tZWRpYXBob3RvMTkyLnBkZghttps://cpcb.nic.in/uploads/MSW/SWM_2016.pdf
- https://cpcb.nic.in/displaypdf.php?id=aHdtZC9IV01fUnVsZXNfMjAxNi5wZGY

SWAYAM/NPTEL:
- https://nptel.ac.in/courses/105103205
- https://nptel.ac.in/courses/105106056
- https://nptel.ac.in/courses/105105169

Self-Learning Exercises:
- Case Study Projects
- Mini Projects
- Assignments
- Poster Presentation
- Model Making

Course Articulation:

COURSE OUTCOMES↓	PROGRAM OUTCOMES					
	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	-	3	3	-	3
CO2	3	-	3	3	-	3
CO3	3	3	3	3	-	3
CO4	-	3	3	3	2	-
CO5	-	3	-	3	2	-

High–3,Medium–2,Low-1

DEPARTMENT OF ENVIRONMENTAL ENGINEERING						
Course Code: 26MTEV413		**Course Title: Environmental Impact of Developmental Projects**				
Total Credits: 3		**SDGs addressed: 9, 11, 13**	**Course Category: Open Elective**		**Course Type: Theory**	
Teaching Learning Process		**Total Contact Hours/semester**	**Assessment Weightage and Marks**			
	Lecture	**45**		**CIE**	**SEE**	**Total**
	Tutorial	**-**	**Weightage %**	**40**	**60**	**100**
	Practical	**-**	**Maximum Marks**	**40**	**60**	**100**
	Self-learning and Term work	**45**	**Minimum Marks**	**20**	**25**	**45***
	Total	**90**				

Note: *For passing the student must score a Minimum of 45 Marks (CIE+SEE: 20 + 25 or 21 + 24)

COURSE OBJECTIVES: The course offers knowledge on the need for and importance of impact assessment for sustainable development, tools, and methods for assessing the adverse and positive impacts of infrastructure activities on environmental attributes and public participation with demonstrated case studies.

Course Outcomes (COs): At the end of the course students will be able to,

CO	Course Outcomes	Highest Level of Cognitive Domain
CO1	Explain the concepts and procedures of EIA and related assessment frameworks to evaluate the environmental implications of infrastructure projects and support sustainable decision-making.	L2
CO2	Analyze and apply conventional and advanced Environmental Impact Assessment methodologies, decision-support tools, and geospatial technologies for evaluating environmental impacts and supporting sustainable infrastructure planning.	L2
CO3	Apply the concepts of environmental regulations, clearance procedures, sustainability policies, and environmental governance frameworks to assess infrastructure projects and their compliance with environmental requirements.	L3
CO4	Explicate the need for and importance of public participation, its framework and describe EIA audit procedure.	L2
CO5	Critically evaluate post-EIA management practices, environmental compliance mechanisms, online environmental clearance systems, and sustainability strategies for infrastructure projects through analysis of Category A, B1, and B2 case studies.	L4

L1 – Remember, L2 – Understand, L3 – Apply, L4 – Analyze, L5 – Evaluate, L6 – Create

Course Syllabus:

Unit No.	Course Content	No. of Hours
1	**Introduction -** Definition, Purpose and Scope of EIA, Types of EIA. Evolution of EIA in India and other countries. The EIA process, Chapter contents in EIA, Procedural and methodological Limitations. Environmental Management Plan (EMP). Strategic Environmental Assessment (SEA): Concept and Importance, Carrying Capacity and Cumulative Impact Assessment, Climate Change Considerations in EIA, Environmental, Social and Governance (ESG) Frameworks	9

	Self-Learning and Term work ● Climate Change Risk Assessment in Infrastructure Projects ● Environmental Justice and Social Impact Assessment (SIA)	
2	**Methodologies & Techniques in EIA -** Adhoc, checklist, matrix, overlays, networks, BEES, Cost-Benefit-Analysis (CBA), brainstorming, fuzzy, Delphi technique. Multi-Criteria Decision Analysis (MCDA) in EIA, Artificial Intelligence and Big Data Applications in Environmental Assessment, Geographic Information Systems (GIS) and Remote Sensing Applications. **Self-Learning and Term work** • Develop a checklist and matrix for assessing environmental impacts of a selected project. • Prepare a GIS-based environmental sensitivity map for a selected area.	9
3	**Guidelines and Regulations** – Environmental Protection Act, EIA Notification of 2006 and subsequent amendments, Environmental Clearance practices in India, terms of reference– Standard and additional for EIA/ EMP report for projects/activities, MoEF & CC guidelines on infrastructure projects, ecologically sensitive areas, NABET accreditation for EIA consultants, Role of National Green Tribunal in EIA. Green Financing and Sustainable Infrastructure Policies, Environmental Certifications and Rating Systems, National Action Plan on Climate Change (NAPCC), Environmental Justice and Equity in Infrastructure Development. **Self-Learning and Term work** • Conduct a review of environmental clearance procedures for a selected industrial project. • Public Interest Litigation (PIL) and Landmark Environmental Judgments	10
4	**Environmental Attributes -** Air, water, land, sound, socio economic aspects, biodiversity. Prediction models used in EIA. **Public participation in EIA -** Need, objectives, elements, and framework for public participation – step by step procedure. **Self-Learning and Term work** • Evaluate the environmental and social impacts of a proposed infrastructure project. • Stakeholder Engagement and Conflict Resolution	8
5	Post EIA activities, Environmental Auditing and Compliance Monitoring, Case studies – Category A, B1 and B2. Online clearance system – PARIVESH portal and e-governance in EIA, Climate Change, Carbon Footprint and Sustainable Infrastructure Development. **Self-Learning and Term work** • Conduct an environmental audit of a campus or institution and suggest corrective measures. • Develop a sustainable infrastructure framework incorporating ESG principles and carbon footprint reduction measures.	9

Text Books:

- Anjaneyulu Y and Valli Manickam (2020), 3rd Edition, B S Publications, “Environmental Impact Assessment Methodologies”.
- Raman N S, Gajbhiye A R, Khandeshwar S R (2014), 1st Edition, IK International Publications Pvt. Ltd., “Environmental Impact Assessment”.
- Rau and Wooten, (1981), “Environmental Impact Assessment” Handbook.
- Jain R.K., Urban L.V., Stacey G.S., (1977), “Environmental Impact Analysis – A New Dimension in Decision Making", Van Nostrand Reinhold Co.

References

- Anji Reddy Mareddy and Anil Shah (2017), 1st Edition, B S Publications, “Environmental Impact Assessment - Theory and Practice”. Elsevier Science
- Clark B.C. Bisett and Tomlinsan P, (1985), “Perspective on Environmental Impact Assessment”, Allied Publishers.
- Canter L., (1995), “Environmental Impact Assessment”, McGraw Hill.
- Journals - Science Direct, acs.org.
- EIA notifications and Publications, MoEF & CC, GoI

Web/Digital resources:

- Public hearing: https://kspcb.karnataka.gov.in/node/406

SWAYAM/NPTEL:

- Environmental Impact Assessment, Prof. HarshitSosan Lakra, IIT Roorkee, https://nptel.ac.in/courses/124107160

Course Articulation Matrix:

COURSE OUTCOMES↓	PROGRAM OUTCOMES					
	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	1
CO2	3	2	3	1	-	1
CO3	3	3	3	2	1	1
CO4	1	3	2	-	-	1
CO5	3	3	1	1	-	1

High–3,Medium–2,Low–1