MAR BASELIOS COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

Department of Civil Engineering

List of Institute Electives for 2023 curriculum

Institute Elective I						
Slot	**Category**	**Course Code**	**Courses**	**L-T-P-J**	**Hours**	**Credit**
E	IEC	23IEL31A	Green Building and Energy Management	3-0-0-0	3	3
E	IEC	23IEL31B	Engineering Project Management	3-0-0-0	3	3
E	IEC	23IEL31C	Disaster Mitigation and Management	3-0-0-0	3	3
E	IEC	23IEL31D	Environmental Impact Assessment and Life Cycle Analysis	3-0-0-0	3	3

Institute Elective II						
Slot	**Category**	**Course Code**	**Courses**	**L-T-P-J**	**Hours**	**Credit**
E	IEC	23IEL42A	Global Climate Change	3-0-0-0	3	3
E	IEC	23IEL42B	Environmental Health and Safety	3-0-0-0	3	3
E	IEC	23IEL42C	Application of Remote Sensing and GIS	3-0-0-0	3	3
E	IEC	23IEL42D	Circular Economy for Sustainable Development	3-0-0-0	3	3

INSTITUTE ELECTIVE I

Course Code	Course Name	Category	L	T	P	J	Credit	Year of introduction
23IEL31A	GREEN BUILDING AND ENERGY MANAGEMENT	IEC	3	0	0	0	3	2023

i) COURSE OVERVIEW

Goal of this course is to expose the students to the principles and practices of green building design, construction and operation, with a focus on energy management and sustainability.

ii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO1	Explain the principles, benefits, and key certifications of green buildings and sustainable design.	Understand	
CO2	Describe sustainable construction materials, waste management, and energy-efficient building systems.	Understand	
CO3	Apply energy management strategies, renewable energy technologies, and smart building techniques.	Apply	
CO4	Discuss building performance assessment methods, energy audits, BIM, and sustainability policies.	Understand	

iii) SYLLABUS

Introduction to Green building - benefits, and history, sustainability and major certifications like LEED, IGBC, and GRIHA.

Eco-friendly materials - water-saving methods, effective waste management in sustainable construction.

Energy-efficient MEP systems - smart technologies, and renewable energy sources like solar, wind, and geothermal.

Passive/active design - water and energy conservation, indoor quality, site planning, and energy audits.

Building performance tools - BIM, LCA - policies, incentives, and real-world green building case studies and trends.

iv) a) TEXTBOOKS

1. Kibert, C. J., Sustainable Construction: Green Building Design and Delivery, 5th edition, Wiley, ISBN: 9781119706455, 2022.
2. Ching, F. D. K., & Shapiro, I. M., Green Building Illustrated, 2nd edition, Wiley, ISBN: 9781119584459, 2020.

3. Capehart, B. L., Turner, W. C., & Kennedy, W. J., Guide to Energy Management, 8th edition, CRC Press, ISBN: 9780367333427, 2020.

b) REFERENCES

1. Yang, P., Renewable Energy: Challenges and Solutions, Springer, ISBN: 9783031421034, 2024.
2. Uherova Hasbani, K., Sustainable Energy Management: Policies and Technologies, Springer, ISBN: 9783030613782, 2021.
3. Kubba, S., Handbook of Green Building Design and Construction: LEED, BREEAM, and Green Globes, 2nd edition, Butterworth-Heinemann, ISBN: 9780128104439, 2016.
4. Sayigh, A., Sustainability, Energy, and Architecture: Case Studies in Realizing Green Buildings, Elsevier, ISBN: 9780123972705, 2016.
5. Lechner, N., Heating, Cooling, Lighting: Sustainable Design Methods for Architects, 4th Ed., Wiley, ISBN: 9781118582425, 2014.
6. Wilson, A., The Building Green Guide to Insulation Products and Practices, Building Green, Inc., ISBN: 9781934429257, 2013.
7. Balcomb, J. D., Passive Solar Buildings, MIT Press, ISBN: 9780262518844, 2013.
8. Yudelson, J., The Green Building Revolution, Island Press, ISBN: 9781597261791, 2008.

v) COURSE PLAN

Module	Contents	No. of hours
I	Introduction to Green Building and Sustainable Design - Definition and principles of green buildings, history and evolution, benefits (environmental, economic, health), key certifications (LEED, BREEAM, WELL, IGBC, GRIHA). Introduction to sustainability concepts - climate-responsive design, green building rating systems - their application in real-world projects.	**9**
II	Sustainable Construction Materials and Waste Management - Low-impact and eco-friendly materials - Recycled and locally sourced materials, Green insulation solutions, Green certifications for materials (Cradle to Cradle, FSC), Rainwater harvesting, greywater recycling, and smart water sensors, Wastewater treatment & solid waste management in green buildings.	**9**
III	Building Systems for Energy Efficiency and Renewable Energy - Overview of mechanical, electrical, and plumbing (MEP) systems in buildings, advanced Heating, Ventilation, and Air Conditioning (HVAC) technologies, energy-efficient lighting and control systems, smart building technologies and automation. Renewable energy systems for buildings - solar photovoltaic (PV) and thermal systems, wind energy integration, geothermal heat pumps, biomass energy systems, energy storage solutions, and smart grid integration.	**9**

IV	Sustainable Design Principles and Energy Management - Energy efficiency principles and strategies - passive and active design techniques, water conservation methods, indoor environmental quality improvement strategies. Site selection and planning considerations for optimizing energy use and sustainability - importance of energy management- energy consumption patterns in buildings - energy audits.	**9**
V	Building Performance Assessment, Policies, and Case Studies - Energy auditing techniques and tools, Building Information Modelling (BIM) for sustainable building design and operation, Life Cycle Assessment (LCA) to measure environmental impact, financial incentives and government regulations for sustainable buildings, case studies of successful green buildings, emerging trends and innovations in green building technology.	**9**
	Total hours	**45**

vi) ASSESSMENT PATTERN

Continuous Assessment: End Semester Examination – 40: 60

Continuous Assessment		
Attendance	:	5 marks
Assignments	:	15 marks
Assessment through Tests	:	20 marks
Total Continuous Assessment	:	**40 marks**
End Semester Examination	:	**60 marks**
TOTAL	:	**100 marks**

vii) CONTINUOUS ASSESSMENT TEST

No. of tests	:	02
Maximum Marks	:	30
Test Duration	:	1 ½ hours
Topics	:	2 ½ modules

viii) END SEMESTER EXAMINATION

Maximum Marks	:	60
Exam Duration	:	3 hours

Course Code	Course Name	Category	L	T	P	J	Credit	Year of introduction
23IEL31B	ENGINEERING PROJECT MANAGEMENT	IEC	3	0	0	0	3	2023

i) COURSE OVERVIEW

This course is designed to equip professionals with the skills and insights necessary to excel in complex project environments. The course introduces students to importance of project management as it affects strategy and business success. It introduces the concept of slack and of crashing and acquaints the complexities of scheduling multi-project programs.

ii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO 1	Explain the fundamental concepts of project management, project life cycle, scope, and the role of the project manager.	Understand
CO 2	Develop project networks using various techniques, perform scheduling using forward and backward pass methods to identify critical paths and slack times.	Apply
CO3	Identify the role of Project Management in instructional technology and project development using appraisal techniques, cost estimation, and social cost-benefit analysis.	Apply
CO 4	Apply network flow concepts to project scheduling and optimize resource allocation in complex project scheduling scenarios	Apply

iii) SYLLABUS

Foundations and Environment of Project Management, Project Life Cycle & Selection Methods, Project Proposal & Scope Definition, Work Breakdown Structure (WBS), PMBOK Framework

Project Network Development, Forward and Backward Pass Computations, Critical Path Algorithm, Total & Free Slack, Three Time Estimates (PERT), Mean, Variance of Activity Times, Event-Oriented Critical Path Algorithm, Schedule Date Probability (PERT Analysis)

Generation and Screening of Project Ideas, Project Rating Index, Cost Estimation, Social Cost-Benefit Analysis (UNIDO Method), Economic Pricing, Income Distribution Impact, Merit/Demerit Goods, Little-Mirrlees Approach

Flow Network for Critical Path, Time-Cost Trade Off, Chance-Constrained Linear Programming in PERT

Resource Allocation & Levelling Techniques, Complexity with Limited Resources, Demand Levelling for Key Resources, Heuristic Programs for Resource Allocation, Project Crashing (Time-Cost Optimization)

iv) a) TEXTBOOKS

1. J. R. Meredith and S. J. Mantel, *Project Management: A Managerial Approach*, 8th ed. Hoboken, NJ, USA: John Wiley & Sons Inc., 2012, ISBN: 978-1-118-09473-8.
2. P. I. Parameshwar, *Engineering Project Management with Case Studies*. New Delhi, India: Vikas Publishing, 2005, ISBN: 978-81-259-1874-5.
3. P. Chandra, *Projects: Planning, Implementation and Control,* 8th ed. New Delhi, India: Tata McGraw Hill, 2017, ISBN: 978-93-5260-724-0.

b) REFERENCES

1. Project Management Institute (PMI), *A Guide to the Project Management Body of Knowledge (PMBOK Guide)*, 5th ed. Newtown Square, PA, USA: Project Management Institute, 1996, ISBN: 978-1-93389-051-7.
2. C. F. Gray and E. W. Larson, *Project Management: The Managerial Process*, 8th ed. New York, NY, USA: McGraw-Hill Education, 2020, ISBN: 978-1-260-23886-0.
3. L. S. Srinath, *PERT & CPM: Principles and Applications*. New Delhi, India: East-West Press, 2001, ISBN: 978-81-7678-136-7.

v) COURSE PLAN

Module	Contents	No. of hours
	Foundations of Project Management, Project Life Cycle, Project Environment, Project Selection, Project Proposal, Project Scope, Work Breakdown Structure. Project Management Body of Knowledge (PMBOK), Role of Project manager, SWOT Analysis in Project Management, Project Organisation and Structure	**8**
II	Development of project network, dummy activities, activity on node networks, cyclic network, forward pass and backward pass computations, algorithm for critical path, total slacks, free slacks and their interpretations. Three time estimates for activities, estimation of mean and variance of activity times, event oriented algorithm for critical path, probability of meeting a schedule date.	**10**
III	Analysis and appraisal generation of project ideas, scouting for project ideas, preliminary screening, project rating index, and cost of project. Social cost-benefit analysis, UNIDO approach, the net benefit in terms of economic prices, measurement of impact on distribution, savings impact and its value, income distribution impact, adjustment for merit and demerit, goods little Mirrless approach.	**9**

IV	A flow network interpretation for determination of critical paths, Time-Cost Trade off, Chance constrained linear programming for probabilistic durations of activities in PERT network	**9**
V	Resource allocation and levelling, Complexity of project scheduling with limited resources, levelling the demands on key resources, a simple heuristic program for resource allocation, project crashing	**9**
	Total	**45 hours**

vi) ASSESSMENT PATTERN

Continuous Assessment: End Semester Examination – 40: 60

Continuous Assessment		
Attendance	:	5 marks
Assignments	:	15 marks
Assessment through Tests	:	20 marks
Total Continuous Assessment	:	**40 marks**
End Semester Examination	:	**60 marks**
TOTAL	:	**100 marks**

vii) CONTINUOUS ASSESSMENT TEST

No. of tests	:	02
Maximum Marks	:	30
Test Duration	:	1 ½ hours
Topics	:	2 ½ modules

viii) END SEMESTER EXAMINATION

Maximum Marks	:	60
Exam Duration	:	3 hours

Course Code	Course Name	Category	L	T	P	J	Credit	Year of Introduction
23IEL31C	DISASTER MITIGATION AND MANAGEMENT	IEC	3	0	0	0	3	2023

PRE-REQUISITE: Nil

i) COURSE OVERVIEW

The goal of this course is to expose the students to the fundamental concepts of disaster mitigation and management. The course details the various phases of disaster management cycle and the measures to mitigate disaster risks.

ii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO 1	Explain the fundamental concepts and terminology related to disaster management.	Understand
CO 2	Explain hazard and vulnerability types and methodologies for disaster risk assessment	Understand
CO 3	Identify the core elements and phases of disaster management cycle and the various measures to mitigate disaster risks	Apply
CO 4	Explain the legislations and best practices for disaster mitigation and management at national and international level	Understand

iii) SYLLABUS

Interaction between various Earth Systems and their role in disasters, climate change and its impact on disasters, Key concepts and Terminology related to disaster management

Types of hazards and vulnerability assessments, Disaster risk assessment

Phases of disaster management cycle, Measures for disaster risk reduction- prevention, mitigation, preparedness, disaster response, relief, Participatory stakeholder engagement, Disaster communication, Capacity building.

Common disaster types in India, Legislations in India on Disaster Management- National Disaster Management Policy- Institutional arrangements for disaster management in India, The Sendai Framework for Disaster risk reduction.

iv) a) TEXTBOOKS

1) Coppola, D.P., Introduction to International Disaster Management, Elsevier Science (B/H), London, 2020. ISBN : 9780128173688.
2) Srivastava, H.N., Gupta, G.D., Management of Natural Disasters in developing countries, Daya Publishers, 2007. ISBN-13: 9789389569438

3) Subramanian, R., Disaster Management, Vikas Publishing House, 2018. ISBN-13: 9789352718702
4) Sulphey, M.M., Disaster Management, PHI Learning, 2016. ISBN-13: 9788120352209

b) REFERENCES

1) NDMA, National Policy on Disaster Management, Ministry of Home Affairs, Government of India,2009.
2) National Disaster Management Division, Disaster Management in India - A Status Report, Ministry of Home Affairs, Government of India, New Delhi,2004.
3) National Disaster Management Plan, NDMA, Ministry of Home Affairs, Government of India, 2019.
4) Disaster Management Training Manual, UNDP, 2016
5) United Nations Office for Disaster Risk Reduction, Sendai Framework for Disaster Risk Reduction 2015-2030, 2015

v) COURSE PLAN

Module	Contents	No. of hours
I	Interaction between various Earth Systems (Lithosphere, Atmosphere, Hydrosphere, Biosphere) and their role in disasters, Climate change and its impact on disasters. Definition and meaning of key terms in Disaster mitigation and management – disaster, hazard, exposure, vulnerability, risk, risk assessment, risk mapping, capacity, resilience, disaster risk reduction, disaster risk management, early warning systems, disaster preparedness, disaster prevention, disaster mitigation, disaster response, damage assessment, crisis counselling, needs assessment	**9**
II	Hazards- types- hazard mapping, Vulnerability types and their assessment- Physical, social, economic and environmental vulnerability. GIS and Remote Sensing applications in disaster risk mapping. Core elements of disaster risk assessment, Process of risk assessment, Methodologies for risk assessment.	**9**
III	Disaster management phases- prevention, mitigation, preparedness, response, relief. Role of Artificial Intelligence and IOT in Disaster Early Warning Systems. Case studies on successful disaster response models.	**9**
IV	Participatory stakeholder engagement, Disaster communication-methods, barriers, Crisis counselling. Capacity building- Structural measures, non-structural measures Capacity assessment. Disaster simulation exercises and role-playing activities.	**9**

V	Common disaster types in India. Disaster legislations in India- National disaster management policy, Institutional arrangements for disaster management in India. The Sendai Framework for Disaster risk reduction and targets- priorities for action, guiding principles.	**9**
	Total hours	**45**

vi) ASSESSMENT PATTERN

Continuous Assessment: End Semester Examination – 40: 60

Continuous Assessment		
Attendance	:	5 marks
Assignments	:	15 marks
Assessment through Tests	:	20 marks
Total Continuous Assessment	:	**40 marks**
End Semester Examination	:	**60 marks**
TOTAL	:	**100 marks**

vii) CONTINUOUS ASSESSMENT TEST

No. of tests	:	02
Maximum Marks	:	30
Test Duration	:	1 ½ hours
Topics	:	2 ½ modules

viii) END SEMESTER EXAMINATION

Maximum Marks	:	60
Exam Duration	:	3 hours

Course Code	Course Name	Category	L	T	P	J	Credit	Year of Introduction
23IEL31D	ENVIRONMENTAL IMPACT ASSESSMENT AND LIFE CYCLE ANALYSIS	IEC	3	0	0	0	3	2023

PRE-REQUISITE: Nil

i) COURSE OVERVIEW

This course introduces students to Environmental Impact Assessment (EIA) and Life Cycle Analysis (LCA) as key tools for assessing environmental impacts from developmental projects, industries and products**.** Students will learn about environmental regulations and EIA methodologies along with LCA principles and applications in environmental management and circular economy. The course will also cover environmental management plans, audits, and case studies on real-world applications**.**

ii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO 1	Explain the fundamental concepts and importance of Environmental Impact Assessment (EIA) and Life Cycle Analysis(LCA)	Understand
CO 2	Discuss the various environmental legislations and EIA clearance procedure in India	Understand
CO 3	Apply various EIA and LCA methodologies for impact assessment and decision making	Apply
CO 4	Prepare impact assessment and audit reports and LCA frameworks for real-world applications	Apply

iii) SYLLABUS

Introduction to EIA and Environmental Legislations, Environmental clearance process in India, Types of EIA, EIA methodologies, Life cycle analysis- fundamentals and applications, Environmental Management Plan (EMP), Environment Audit, ISO 14001 standards , EIA & LCA case studies - highway project, hydro-electric power plant, airport project, quarry mining project, solid waste management project.

iv) a) TEXTBOOKS

1) Canter, L. W., Environmental Impact Assessment, McGraw Hill Inc., New York, 1996. ISBN-10: 0071141030
2) Curran, M. A., Life Cycle Assessment Handbook: A Guide for Environmental Sustainability, Wiley, 2012. ISBN-13: 978-1118099728
3) Marriott, B.B., Environmental Impact Assessment: A Practical Guide, McGraw Hill Professional, 1997. ISBN-13: 978-0070404106

b) REFERENCES

1) Glasson, J. and Therivel, R., Introduction to Environmental Impact Assessment, Routledge Publications, Fifth edition, 2019. ISBN-13: 978-1138600751
2) Lawrence, D. P., Environmental Impact Assessment (Practical Solutions to Recurrent Problems), Wiley International, New Jersey, 2003. ISBN-13: 978-0471457220
3) Ministry of Environment and Forests, Govt. of India, EIA Notification, 2006.
4) Guinée, J. B. (Ed.), Handbook on Life Cycle Assessment: Operational Guide to the ISO Standards, Springer, 2002. ISBN-13: 978-1402002281

v) COURSE PLAN

Module	Contents	No. of hours
I	Definition and need for EIA, Evolution of EIA- Global and Indian Scenario, Environmental legislations in India- The Environmental (Protection) Act 1986, Environmental standards for water, air and noise quality, EIA Notification 2006 and draft amendments 2024, Environmental clearance process in India- screening- scoping- public participation-stakeholder involvement- public hearings, Appraisal- Form1- Categorisation of projects- Generic structure of EIA report- Terms of Reference (ToR),Single Window Clearance.	**9**
II	Types of EIA- Strategic-Regional- Sectoral- Project level, Rapid EIA and comprehensive EIA, EIA Methodologies- Ad hoc-Checklist-Matrix-Network-Overlay methods, Impact prediction and assessment (water , air, noise, ecology), Socio-economic and cultural impacts	**10**
III	Introduction to Life Cycle Analysis (LCA) – Definition—Need-importance –applications in environmental management and sustainability, Phases of LCA- Goal & Scope Definition- Life Cycle Inventory (LCI)- Life Cycle Impact Assessment (LCIA)- Interpretation of LCA results, LCA Methodologies-Process-based, Input-Output, Hybrid Approaches, LCA and circular economy-role of LCA in sustainable product design-circular economy principles and lifecycle thinking	**10**
IV	Environmental Management Plan (EMP)- purpose and importance of EMP- Content of an EMP- Environmental monitoring programs, Environment Audit- need, types and benefits-Environmental audit procedures, ISO 14001 standards for Environmental Management- importance, salient features - stages in implementation- benefits- corporate environmental	**8**

	responsibility	
V	Case studies on EIA and LCA applications- Highway Projects- Hydro-Electric Power Plants, Airport Projects, Quarry Mining projects, Solid waste management Projects. Comparison of EIA and LCA approaches in decision making	**8**
	Total hours	**45**

vi) ASSESSMENT PATTERN

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vii) CONTINUOUS ASSESSMENT TEST

No. of tests	:	02
Maximum Marks	:	30
Test Duration	:	1 ½ hours
Topics	:	2 ½ modules

viii) END SEMESTER EXAMINATION

Maximum Marks	:	60
Exam Duration	:	3 hours