Syllabus-2023-2024

BCA

Title of the Course	Environmental Science
Course Code	BCA-104[T]

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					2	0	2	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Student must have knowledge about Language proficiency.			**Co-Requisite/s**	Knowledge of English language			
Course Outcomes & Bloom's Level	**CO1-** To remember various concept of environmental education and ecosystem and also about its functions and knowledge about the conservation of biodiversity and its importance.**(BL1-Remember)** **CO2-** To understand about natural resource, its importance and environmental impacts of human activities on natural resource.**(BL2-Understand)** **CO3-** To implement various concepts and methods from ecological and physical sciences and their application in environmental problem solving.**(BL3-Apply)** **CO4-** To gain the knowledge about the different types of pollutions and their control technologies.**(BL4-Analyze)** **CO5-** To Acquire values and attitudes towards understanding complex environmental- economic social challenges, and participating actively in solving current environmental problems and preventing the future ones.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✕ Entrepreneurship ✕ Employability ✕ Professsonal Ethics ✕ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG4(Quality education) SDG6(Clean water and sanitation) SDG7(Affordable and clean energy) SDG10(Reduced inequalities) SDG12(Responsible consuption and production) SDG13(Climate action) SDG14(Life below water) SDG15(Life on land)				

Part B

Modules	Contents	Pedagogy	Hours
Module 1	Environmental Education, Ecosystem & Ecology Environmental Education- Definition, scope, importance, Need for Public Awareness, Multidisciplinary nature of Environmental Science, Environment – Definition and its segments, (Lithosphere, Hydrosphere, Atmosphere and Biosphere) Ecology and Ecosystem: Basic concepts, Type & Components, Energy Flow, Food chain, food web, Ecological Pyramids & Biodiversity (importance, threats & conservation).	Classroom Lecture, PPts, Videoes	7
Module 2	Natural Resources Management & Energy Resources Natural Resources – Classification, Water Resources (availability, quality, water budget), Mineral Resources (distribution, availability and future perspectives), and Forest Resources and its management. Energy Resources- Classification, - Conventional (Mineral Oil, Coal and Gas), Non-Conventional (Solar, Geothermal, Wind, Nuclear, Hydrogen, Biomass Energy.	Classroom Lecture, PPts,	8
Module 3	Environmental Pollution and Control Air pollution - Causes, Effects & Control methodologies. Water pollution – sources & effects, characteristics and treatment of waste water, Soil - Formation of soil, elementary and mineral composition, effects and abatements. Noise Pollution and Hazards	Classroom Lecture, PPts, Videoes	6
Module 4	Environmental Issues and Legislations Population Growth & Explosion, Global warming, Acid Rain, Ozone Layer depletion, Photochemical smog. Environmental legislations in India – Air Act, Water Act, Environment Protection Act & Wild life Act.	Classroom Lecture, PPts, Videos	7
Module 5	Ethics, Solid waste Management & EIA Ethics (types & theories) and moral values, NGOs and their role in environmental preservations, Effectiveness of various religions in environmental conservation Solid waste - impacts on Society & management strategies. Environmental Impact Assessment – Methods & Process in India	Classroom Lecture, PPts, Videos	6

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	To measure the intensity of Light at different locations in the ITM University campus by using Light Meter.	Experiments	BL4-Analyze	4
2	To measure the intensity of Noise at different places in the ITM University campus by using Sound Meter.	Experiments	BL4-Analyze	4
3	To analyze the grassland ecosystem and calculate the Important Value Index (IVI) by quadrate method.	Field work	BL2-Understand	4
4	To determine the TDS and Conductivity of the given water samples.	Experiments	BL4-Analyze	4
5	To determine the pH of given water and soil samples.	Experiments	BL4-Analyze	4
6	To determine the turbidity of given water samples.	Experiments	BL4-Analyze	4
7	To determine the strength of calcium ion in the given water sample	Experiments	BL4-Analyze	4
8	To find out the amount of Dissolved Oxygen (DO) in the given sample of water.	Experiments	BL4-Analyze	4

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	

Part E

Books	Chauhan, B. S. (2008b). Environmental Studies. Firewall Media. Cunningham, W., & Cunningham, M. (2014). Ebook: Environmental Science: A Global Concern. McGraw Hill.
Articles	
References Books	Peavy, H. S., Rowe, D. R., & Tchobanoglous, G. (1985b). Environmental Engineering. McGraw-Hill Publishing Company. Masters, G. M., & Ela, W. (2008). Introduction to Environmental Engineering and Science. Pearson.
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	2	-	-	-	2	-	-	1	-	1
CO2	2	2	1	2	2	2	-	-	-	2	-	-	1	-	3
CO3	2	1	1	-	1	-	-	-	-	2	-	-	3	2	3
CO4	3	2	-	2	1	-	-	-	-	2	-	-	2	3	3
CO5	3	2	-	2	1	-	-	-	-	2	-	-	2	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-CivilEngineering

Title of the Course	Wastewater Treatment and Recycling
Course Code	CEE0707[T]

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					3	1	0	4
Course Type	Theory only							
Course Category	Discipline Electives							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Integrated waste management issues, collection, recovery, reuse, recycling, energy-from-waste, and landfilling**(BL3-Apply)** **CO2-** Analyze & compute the challenges of waste management for smart cities**(BL4-Analyze)** **CO3-** Understand the C&D Waste and E-Waste Management**(BL2-Understand)** **CO4-** Design the generation rates and waste composition material**(BL5-Evaluate)** **CO5-** Perform the role of MSW management within the various initiatives of the Govt. of India including: Swachh Bharat Mission, Smart Cities as well as Make in India**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG4(Quality education) SDG6(Clean water and sanitation) SDG9(Industry Innovation and Infrastructure) SDG11(Sustainable cities and economies)				

Part B

Modules	Contents	Pedagogy	Hours
1	Important terminologies in waste water treatments systems: Sludge, aerobic treatments, anerobic treatments, bioengineering, biosolids, clarifiers, sewers, wetland, retention time, disinfection, influent, effluent, scum, anaerobic digestion, trickling filter, root zone treatment technology	Lectures with problem based learning, experimental learning, case study,	8
2	Sewage and waste water treatments systems: A. Primary treatment methods B. Secondary treatment methods and C. Tertiary treatment methods	Lectures with problem based learning, experimental learning, case study,	8
3	Biotechnological application of hazardous waste management and management of Resources: Use of microbial systems, Waste water treatment using root zone treatment by plants. Reclamation of wasteland: biomass production for Biogas	Lectures with problem based learning, experimental learning, case study,	7
4	Sludge disposal: Sources and effects of sludge on the environment. Methods of sludge disposal	Lectures with problem based learning, experimental learning, case study,	8
5	Wastewater Recycling: Scope and demands; Types and stages of recycling; Recycling requirements; Designated reuse criteria; centralized vs decentralized recycling systems	Lectures with problem based learning, experimental learning, case study,	9

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Development of Natural Filters for clean water	PBL	BL5-Evaluate	15 hrs
2	Development of Biogas chamber model	PBL	BL5-Evaluate	15 hrs

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	12	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Biotreatment Systems, Volume II ; D.L. Wise Biodegradation and Bioremediation. Academic Press; 2nd edn. Martin Alexander
Articles	https://www.researchgate.net/publication/375376650_The_Treatment_of_Wastewater_Recycling_and_Reuse_-Past_Present_and_in_the_Future
References Books	Gabriel Bitton (Author). Wastewater Microbiology, 2nd Edition. Wiley-Liss; 2nd edition (February 16, 1999).
MOOC Courses	https://onlinecourses.nptel.ac.in/noc21_ce49/preview
Videos	https://www.youtube.com/watch?v=fHRxhuMQQnE

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	-	-	2	3	-	-	-	2	2	3	3	3
CO2	3	2	2	-	-	-	3	-	-	-	2	3	2	2	2
CO3	2	2	2	-	-	2	3	-	-	-	3	2	2	2	2
CO4	2	2	3	-	-	1	3	-	-	-	2	3	2	2	2
CO5	3	2	2	-	-	2	3	-	-	-	2	3	3	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-CivilEngineering

Title of the Course	Sustainable Construction Methods
Course Code	CEE0708[T]

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					3	1	0	4
Course Type	Theory only							
Course Category	Discipline Electives							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Student will be able to Classify the sustainable construction materials **(BL2-Understand)** **CO2-** Student will be able to Apply cutting-edge construction technologies**(BL3-Apply)** **CO3-** Student will be able to Evaluate different sustainable construction methods**(BL5-Evaluate)** **CO4-** Student will be able to Apply different rating systems of construction/buildings as a professional**(BL3-Apply)** **CO5-** Student will be able to Apply life cycle approach to optimize the performance of green construction materials **(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG11(Sustainable cities and economies)				

Part B

Modules	Contents	Pedagogy	Hours
1	Types of foundations and construction methods. Basics of Formwork and Staging. Common building construction methods (conventional walls and slabs; conventional framed structure with blockwork walls). Modular construction methods for repetitive works	Lectures with problem based learning, experimental learning, case study, field trips	8
2	Precast concrete construction methods. Basics of Slip forming for tall structures. Basic construction methods for steel structures. Basics of construction methods for Bridges	Lectures with problem based learning, experimental learning, case study, field trips	8
3	dentification of cutting-edge sustainable construction materials, technologies, and project management strategies for use in the construction industry and evaluation of their potential to reduce the negative environmental impacts of construction activity	Lectures with problem based learning, experimental learning, case study, field trips	8
4	Study and evaluation of current LEED and GRIHA rating for construction system. Detailed case study and analysis of highly successful recent "green construction projects". Guidance to students for the LEED Green Associate professional licensing examination	Lectures with problem based learning, experimental learning, case study, field trips	8
5	Environmental impact of materials; life-cycle assessment; material selection to optimize performance; design, evaluation, and production of green construction materials	Lectures with problem based learning, experimental learning, case study, field trips	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	12	40	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Rebecca L. Henn; Andrew J. Hoffman (2013), Constructing Green the Social Structures of Sustainability (Urban and Industrial Environments), MIT Press
Articles	https://www.researchgate.net/publication/358582436_A_Study_on_Sustainable_Construction_Practices_and_Management
References Books	Kim S. Elliott, Precast Concrete Structures – 12 June 2019, CRC Press Taylor and Francis
MOOC Courses	https://archive.nptel.ac.in/courses/105/102/105102195/
Videos	https://www.youtube.com/watch?v=LdHMjhaBWxw

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	1	2	3	-	-	-	1	2	2	2	2
CO2	3	3	2	-	1	1	1	-	-	-	1	2	2	3	2
CO3	2	2	2	-	-	2	2	-	-	-	2	2	2	2	3
CO4	2	2	2	-	1	2	1	-	-	-	1	1	3	3	3
CO5	3	3	2	-	1	1	2	-	-	-	1	2	3	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-CivilEngineering

Title of the Course	Building Environment & Services
Course Code	CEE0808[T]

Part A

Year	4th	**Semester**	8th	**Credits**	L	T	P	C
					3	1	0	4
Course Type	Theory only							
Course Category	Discipline Electives							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Students will learn the importance of durability of civil engineering structures**(BL2-Understand)** **CO2-** Students will be able to detect the defects in foundation, masonry, plastering, Painting, flooring, doors and windows**(BL3-Apply)** **CO3-** Students will be able to provide preventive and remedial measures for Defects**(BL4-Analyze)** **CO4-** Students will be able to locate and place different components like Lifts, electrical panels etc.**(BL4-Analyze)** **CO5-** Students will learn the importance of Need for retrofitting and restoration **(BL2-Understand)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG9(Industry Innovation and Infrastructure) SDG11(Sustainable cities and economies)				

Part B

Modules	Contents	Pedagogy	Hours
1	Durability of civil engineering structures: – Importance of durability – Factors affecting durability of buildings – life expectancy of different classes of buildings. Environmental factors that affect the durability of structures – Effect of natural agents (Air, sun, rain, frost and biological agents such as vegetation & insects) – Environmental pollution – Effect of pollution of air, water and soil – Location effect (Marine, Industrial area etc.) – Usage aspects (Structures subjected to dynamical loading & abrasive condition) - Preventive and remedial measures. Role of maintenance in durability and serviceability of buildings: – Necessity of maintenance – Economic aspects of maintenance. Different types of maintenance – Preventive maintenance – Remedial maintenance – Routine maintenance – Pre-monsoon maintenance - Special maintenance – Planning aspects of maintenance	Lectures with Presentation, Video Lectures	8
2	Cracks in buildings – Defects in foundation, masonry, plastering, Painting, flooring, doors and windows, concrete (RCC and PCC) and wooden roof - Corrosion of reinforcement and steel structures – structural damage due to fire - Causes – Preventive and remedial measures Cracks in buildings – Causes - Preventive and remedial measures	Lectures with Presentation, Practical visits to detect cracks and defects in a building	8
3	Causes - Preventive and remedial measures for Defects in foundation, masonry wooden roof concrete (RCC and PCC) Corrosion of reinforcement and steel structures flooring doors and Painting Defects due to fire, Stair case, water supply system, sewage and sullage system, in drainage system and electrical system Building Services Introduction to other building services	Lectures with Presentation, Practical visits to detect cracks and defects in a building	8
4	Lift – Location – RTT – Number of lifts – lift well and shaft – Machine room. Air conditioning system: Types of A/C – Capacity determination – Requirements for an A/C room. Electrical installations: Panel board & Buss bar, rising mains – distribution boards – MCB – ELCB – DP - TP and change over switch switches - Telephone and TV connectivity – Requirements of domestic gas pipeline	Lectures with Presentation, Case Study on different lift locations	8
5	Retrofitting and restoration of building – Need for retrofitting and restoration – Common retrofitting works carried out – Shoring and underpinning – Different methods of retrofitting and restoration – Challenges in retrofitting and restoration works. Deterioration of monumental and historical buildings – Common causes – Preventive measures – Restoration works – Conservation of world heritages	Lectures with Presentation, Practical visits to provide solutions for cracks and defects in a building	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Plan and draw in detail ventilation and air-conditioning for a given building	PBL	BL3-Apply	15
2	Plan movement facilities: Lifts, escalators, ramps etc. for a given public building	PBL	BL3-Apply	15

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	S. Champion :Failures and repair of concrete structures ; John Wiley & Sons
Articles	Philip.H.Perkins: Concrete Structures-repair water proofing and protection; Elsevier Science Ltd
References Books	B.S.Nayak : A book on Maintenance Engineering ; Khanna Publishers
MOOC Courses	https://nptel.ac.in/courses/105107156
Videos	https://www.youtube.com/watch?v=9hfKdUGWQjQ&t=2s

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	1	2	-	-	-	2	2	2	3	3
CO2	3	2	3	2	1	1	2	-	-	-	2	2	2	2	2
CO3	3	2	3	2	-	-	1	-	-	-	2	2	2	3	3
CO4	3	3	3	1	1	-	2	-	-	-	1	2	2	2	2
CO5	3	3	2	2	1	1	2	-	-	-	2	2	2	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-CivilEngineering

Title of the Course	Energy Efficient and Green Building
Course Code	CEE0811[T}

Part A

Year	4th	**Semester**	8th	**Credits**	L	T	P	C
					3	1	0	4
Course Type	Theory only							
Course Category	Discipline Electives							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Understand the concept of Green Buildings**(BL2-Understand)** **CO2-** Analyze & compute the energy flow in buildings**(BL4-Analyze)** **CO3-** Understand the energy efficient buildings**(BL2-Understand)** **CO4-** Design the building as per LEED India Rating System**(BL4-Analyze)** **CO5-** Design an Eco-friendly captive power generation**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG9(Industry Innovation and Infrastructure) SDG11(Sustainable cities and economies)				

Part B

Modules	Contents	Pedagogy	Hours
1	What is Green Building, Why to go for Green Building, Benefits of Green Buildings, Green Building Materials and Equipment in India, What are key Requisites for Constructing a Green Building, Important Sustainable features for Green Building	Lectures with Presentation and Seminar	8
2	Indian Green Building Council, Green Building Moment in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation; Green Building Opportunities And Benefits: Opportunities of Green Building, Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy Saving Approach in Buildings, LEED India Rating System and Energy Efficiency	Lectures with Microsoft Presentation, Poster Presentations and Interactive Video Lectures	8
3	Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximise System Efficiency, Steps to Reduce Energy Demand and Use Onsite Sources and Sinks, Use of Renewable Energy Sources. Ecofriendly captive power generation for factory, Building requirement	Lectures with Microsoft Presentation, Poster Presentations and Interactive Video Lectures	8
4	Introduction, CII Godrej Green business centre,Design philosophy,Design interventions,Energy modeling, HVAC System design,Chiller selection,pump selection,Selection of cooling towers,Selection of air handing units,Precooling of fresh air,Interior lighting system,Key feature of the building. Eco-friendly captive power generation for factory,Building requirement	Lectures with Microsoft Presentation, Poster Presentations and Interactive Video Lectures	8
5	Handling of non process waste, waste reduction during construction,materials with recycled content,local materials,material reuse,certified wood ,Rapidly renewable building materials and furniture; Indoor Environment Quality And Occupational Health: Air conditioning, Indore air quality, Sick building syndrome, Tobacco smoke control, Minimum fresh air requirements avoid use of asbestos in the building, improved fresh air ventilation, Measure of IAQ, Reasons for poor IAQ, Measures to achieve Acceptable IAQ levels	Lectures with Microsoft Presentation, Poster Presentations and Interactive Video Lectures	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Eco-friendly captive power generation for ITM University any block	PBL	BL4-Analyze	20
2	Preparing Models of Green Buildings	PBL	BL3-Apply	15

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009
Articles	https://www.researchgate.net/publication/322273339_Energy_Consumption_and_Efficiency_in_Green_Buildings#:~:text=The%20study%20consummates%20that%20as,climate%20changes%20over%20greenhouse%20gases.
References Books	Green Building Hand Book by Tomwoolley and Samkimings, 2009
MOOC Courses	https://archive.nptel.ac.in/courses/105/102/105102195/
Videos	https://www.youtube.com/watch?v=LdHMjhaBWxw

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	-	1	2	-	-	-	1	2	2	2	3
CO2	3	2	3	1	1	1	2	-	-	-	1	2	2	3	2
CO3	3	2	3	1	1	1	3	-	-	-	2	2	2	2	3
CO4	3	3	3	2	-	1	2	-	-	-	1	2	3	3	3
CO5	3	2	3	1	-	1	3	-	-	-	1	2	3	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-CivilEngineering

Title of the Course	Airport Engineering
Course Code	CEE0812[T]

Part A

Year	4th	**Semester**	8th	**Credits**	L	T	P	C
					3	1	0	4
Course Type	Theory only							
Course Category	Discipline Electives							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Describe the different components of airport and aircrafts**(BL2-Understand)** **CO2-** Analyse the requirements of an airport layout with respect to international regulations**(BL4-Analyze)** **CO3-** Explain the airport runway design**(BL4-Analyze)** **CO4-** Design Taxiways & Aprons.**(BL3-Apply)** **CO5-** Summarise the concepts of the terminal service facilities**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG9(Industry Innovation and Infrastructure) SDG11(Sustainable cities and economies)				

Part B

Modules	Contents	Pedagogy	Hours
1	AIR TRANSPORTATION Airport terminology, component parts of Aeroplane, Classification and size of airports; Aircraft characteristics. Air traffic control need for ATC, Air traffic control network, Air traffic control aids –enroute aids, landing aids. Airport site location and necessary surveys for site section, airport obstructions.	Lectures with Presentation, Site Visit to Airport	8
2	PLANNING: Airport master plan –FAA recommendations, Regional Planning, ICAO recommendations, Estimation of future airport traffic needs-layout of Air Port	Lectures with Presentation, Site Visit to Airport	8
3	RUNWAYS: Runway orientation – windrose diagram, basic runway length, corrections for elevation, temperature and gradient, runway geometric design, runway pavement design introduction	Lectures with Presentation, Site Visit to Airport	8
4	TAXIWAYS AND APRONS: Loading aprons –holding aprons –Geometric design standards, exit taxiways –optimal location, design, and fillet and separation clearance	Lectures with Presentation, Site Visit to Airport	8
5	OTHER FACILITIES: Lighting, visual airport marking, airport lighting aids. OPERATIONS AND SCHEDULING: Ground transportation facilities; Airport capacity, runway capacity and delays.	Lectures with Presentation, Site Visit to Airport	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Project On Airport Planning and Design	PBL	BL3-Apply	15

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Khanna S.K., Arora M.G., Jain S.S., “Airport Planning & Design”,1st Edition, Nemch and Bros. Roorkee, 2009
Articles	https://www.researchgate.net/publication/228007533_Airport_Engineering_Planning_Design_and_Development_of_21st_Century_Airports_Fourth_Edition
References Books	Robert Horonjeff, Francis Mc Kelvey, William Sproule and Seth Young, “Planning and Design of Airports” 5th Edition, 2010
MOOC Courses	https://archive.nptel.ac.in/courses/105/107/105107123/
Videos	https://www.youtube.com/watch?v=WUq3uN4MDms

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	-	-	-	-	-	-	2	2	3	3	2
CO2	3	2	3	1	-	-	-	-	-	-	3	2	2	2	3
CO3	3	2	2	1	-	-	-	-	-	-	2	2	3	2	2
CO4	2	2	1	1	-	-	-	-	-	-	2	2	2	2	3
CO5	2	2	3	-	-	-	-	-	-	-	2	3	2	3	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-CivilEngineering

Title of the Course	Solid Waste Management
Course Code	CEE0813[T]

Part A

Year	4th	**Semester**	8th	**Credits**	L	T	P	C
					3	1	0	4
Course Type	Theory only							
Course Category	Discipline Electives							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Students will Understand the concept of solid waste management**(BL2-Understand)** **CO2-** Students will be able to explain handling and processing of solid waste**(BL2-Understand)** **CO3-** Students will be able to apply the concept of landfilling for disposal of solid waste**(BL3-Apply)** **CO4-** Students will be able to design composting and other solid waste conversion units**(BL4-Analyze)** **CO5-** Students will understand the various hazardous waste, risk assessment and legislation **(BL2-Understand)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG6(Clean water and sanitation) SDG11(Sustainable cities and economies)				

Part B

Modules	Contents	Pedagogy	Hours
1	Solid waste: Public health and ecological impacts, Sources and types of solid wastes, material flow and waste generation, Functional elements: Waste generation, storage, collection, Transfer and transport, processing and recovery, disposal. Physical and chemical composition of municipal solid waste, integrated solid waste management, hierarchy of waste management options, different methods for generation rates. Storage: movable bins, fixed bins. Collection: home to home collection, community bin system. Theory and design of hauled container system, stationary container system	Lectures with problem based learning, experimental learning, case study, field trips	8
2	Transportation: handcart, tri-cycle, animal cart, tripper truck, dumper placer, bulk refuse carrier, railroad transport, water transport, conveyors, layout of routes. Engineering system for on-site handling and processing of solid waste: separators, size reduction equipments, screening equipments, densification, baling, cubing, pelleting equipments	Lectures with problem based learning, experimental learning, case study, field trips	8
3	Land filling: Site selection criteria, landfill layout, landfill sections, Occurrence of gases and leachate in landfills: composition and characteristics, generation factors, initial adjustment phase, transition phase, acid formation phase, methane formation phase, maturation phase of gases and leachate, Introduction to engineered landfills	Lectures with problem based learning, experimental learning, case study, field trips	8
4	Composting, types of composting, process description, design and operational consideration of aerobic composting, process description, design and operational consideration of anaerobic composting. Thermal conversion technologies: incineration and pyrolysis system, energy recovery, system. Overview of solid waste management practices in India	Lectures with problem based learning, experimental learning, case study, field trips	8
5	Introduction to Hazardous wastes, Definition of Hazardous waste, The magnitude of the problem; Hazardous waste: Risk assessment, Environmental legislation, Characterization and site assessment, Waste minimization and resource recovery, Transportation of hazardous waste, Disposal of hazardous waste. Introduction to Electronic waste and Biomedical waste and their disposal	Lectures with problem based learning, experimental learning, case study, field trips	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
Module-I	Comparative study of different filters for water purification	PBL	BL3-Apply	15
Module-II	Project on collection and composting of waste	PBL	BL3-Apply	15

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Tchobanoglous, G., Theisen, H., & Vigil, S.A; Integrated Solid Waste Management: McGraw Hill,New York
Articles	https://investmeghalaya.gov.in/resources/homePage/17/megeodb/rules/Solid_Waste_Management_Rules.pdf
References Books	Solid Waste Engineering, Principle & Management issues by Ven Te Chow
MOOC Courses	https://archive.nptel.ac.in/courses/105/103/105103205/
Videos	https://www.youtube.com/watch?v=cjIacnNRLHE

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	-	1	2	-	-	-	1	1	2	2	3
CO2	2	1	1	1	-	1	2	-	-	-	1	1	2	3	2
CO3	2	2	2	1	-	2	2	-	-	-	1	2	2	2	2
CO4	3	3	1	1	-	1	1	-	-	-	1	1	2	2	1
CO5	2	2	1	2	-	2	2	-	-	-	1	2	2	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-CivilEngineering

Title of the Course	Urban Transportation Planning
Course Code	CEE0814[T]

Part A

Year	4th	**Semester**	8th	**Credits**	L	T	P	C
					3	1	0	4
Course Type	Theory only							
Course Category	Discipline Electives							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Students will be able to Understand the basic concepts of planning at urban and regional levels**(BL2-Understand)** **CO2-** Students will be able to Distinguish between the Conventional and current approaches for travel demand estimation**(BL4-Analyze)** **CO3-** Students will be able to Implement various types of models and trip generation**(BL3-Apply)** **CO4-** Students will be able to Analyze the urban travel markets**(BL4-Analyze)** **CO5-** Students will be able to Evaluate the transport planning proposals**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG8(Decent work and economic growth) SDG11(Sustainable cities and economies)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to transportation planning, planning concept, Goals, objectives, and Importance of transportation planning. Nature of traffic problems in cities. Present Scenario of road transport and rail transport assets. Role of transportation: Social, Political, Environmental. Transport and Socioeconomic Activities, Historical Development of Transport, Transportation in the Cities, Freight Transportation, Future Developments.	Lectures with problem based learning, experimental learning, case study, field trips	8
2	Urban form and Transport patterns, land use – transport cycle, concept of accessibility. Types of transport systems, evolution of transport modes, transport problems and mobility issues. Public Transport: Intermediate Public Transport (IPT) Rapid and mass transport system like MRTS & bus rapid transit. Transport Planning Process, Problem Definition, Solution Generation	Lectures with problem based learning, experimental learning, case study, field trips	8
3	Travel demand: Estimation and fore casting, trip classification, trip generation: factor and methods, multiple regression analysis. Trip distribution methods, modal split, trip assignment	Lectures with problem based learning, experimental learning, case study, field trips	8
4	Studying travel behavior. Analyzing urban travel markets. Traffic and transportation surveys and studies, traffic and travel characteristics, urban transport planning process – stages, study area, zoning, database	Lectures with problem based learning, experimental learning, case study, field trips	8
5	Evaluation of transport planning proposals: Land Use Transport Planning, Economic Evaluation methods like Net present Value methods, and Benefit Cost method. Transport system management: Long-term and short-term planning	Lectures with problem based learning, experimental learning, case study, field trips	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Traffic Survey of National Highways	PBL	BL4-Analyze	15
2	Parking Planning for given vehicles	PBL	BL4-Analyze	15

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Metropolitan Transportation planning-J.W. Dickey
Articles	https://www.tandfonline.com/journals/rupt20
References Books	Hutchinson, B.G.(1974).Principles of Urban Transport Systems Planning. Mc Graw Hill Book Company, New York
MOOC Courses	https://archive.nptel.ac.in/courses/105/105/105105208/
Videos	https://www.youtube.com/watch?v=pW-Qymxabsc

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	1	-	-	-	-	2	2	2	2	3
CO2	2	2	2	3	2	1	-	-	-	-	2	1	2	1	2
CO3	3	2	2	2	2	1	-	-	-	-	2	2	2	1	1
CO4	3	2	2	3	1	1	-	-	-	-	1	1	2	2	2
CO5	2	3	2	2	1	1	-	-	-	-	2	2	1	1	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-CivilEngineering

Title of the Course	Environmental Engineering
Course Code	CEL0634[T]

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	1	2	6
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember the various concepts in theory of sources of water.**(BL1-Remember)** **CO2-** To understand & analyze the concept of population forecasting**(BL2-Understand)** **CO3-** To provide experimental basis, and to enable the students to analyze physical, chemical and biological impurities**(BL4-Analyze)** **CO4-** To evaluate the applications of rain water harvesting**(BL5-Evaluate)** **CO5-** To apply the understanding of water treatment**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG6(Clean water and sanitation) SDG7(Affordable and clean energy) SDG9(Industry Innovation and Infrastructure) SDG11(Sustainable cities and economies)				

Part B

Modules	Contents	Pedagogy	Hours
1	Sewerage schemes and their importance, collection & conveyance of sewage, storm water quantity, fluctuation in sewage flow, flow through sewer, design of sewer, construction & maintenance of sewer, sewer appurtenances, pumps & pumping stations.	Lectures with Presentation, Site Visit to STP	8
2	Characteristics and analysis of waste wate, rcycles of decomposition, physical, chemical & biological parameters. Oxygen demand i.e. BOD & COD, TOC, TOD, Th OD, Relative Stability, population equivalent, instrumentation involved in analysis, natural methods of waste water disposal i.e. by land treatment & by dilution, self purification capacity of stream, Oxygen sag analysis.	Lectures with Presentation, Seminar and experiments	8
3	Unit operations for waste water treatment, preliminary treatment such as screens, grit chamber, floatation tank, sedimentation and chemical clarification, role of micro-organism in biological treatment, Sewage filtration- theory & design.	Lectures with Presentation, Site Visit to STP	8
4	Methods of Biological Treatment (Theory & Design) - Activated Sludge process, Oxidation ditch, stabilization ponds, aerated lagoon, anaerobic lagoons, septic tank & imhoff tank, sources & treatment of sludge, sludge thickening and digestion sludge drying beds, sludge disposal.	Lectures with Presentation, Seminar and experiments	8
5	Advanced Waste Water treatment - Diatomaceorus earth filters, ultrafiltration, Adsorption by activated carbon, Phosphorus removal, Nitrogen removal, Physico chemical waste water treatment, Solid waste disposal - classification, composition, collection, & disposal methods. Rural sanitation - collection & disposal of refuse, sullage & night soil.	Lectures with Presentation, Seminar and experiments	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Physical examination of Sewage/Water: a. Total Solid b. Total dissolve solid c. Total suspended solid d. pH, color and odor	Experiments	BL4-Analyze	8
2	Chemical estimation of Sewage/Water and soil a. Determination of Chlorides b. Estimation of Chemical oxygen Demand	Experiments	BL4-Analyze	4
3	Microbial examination of Sewage/Water a. Confirmation of coliforms b. Biological oxygen demand	Experiments	BL4-Analyze	4
4	Determination of soil microbial biomass carbon	Experiments	BL4-Analyze	2
5	Examination of different bacteria, algae, fungi, plants and animals by microscopic or morphological examination	Experiments	BL4-Analyze	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	20	60	0

Part E

Books	S.K.Garg, Environmental engineering volume 1 and 2 Khanna publisher B.C.Punamia Environmental engineering volume 1 and 2 Laxmi Publication
Articles	https://sciendo.com/journal/CEE
References Books	Viesman, Hammer and Chadik Water supply and pollution control PHI Publication
MOOC Courses	https://nptel.ac.in/courses/103107084
Videos	http://www.digimat.in/nptel/courses/video/105107176/L01.html

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	-	-	2	-	-	-	1	2	2	2	1
CO2	2	2	2	2	-	-	2	-	-	-	1	3	2	2	2
CO3	2	2	1	2	-	-	3	-	-	-	2	2	2	3	3
CO4	2	3	1	2	-	-	2	-	-	-	1	2	2	3	2
CO5	2	2	1	2	-	-	3	-	-	-	1	3	2	3	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-CivilEngineering

Title of the Course	Retrofitting and rehabilitation of structures
Course Code	CEL0831[T]

Part A

Year	4th	**Semester**	8th	**Credits**	L	T	P	C
					3	1	0	4
Course Type	Theory only							
Course Category	Discipline Core							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Students will be able to learn various distress and damages to concrete and masonry structures**(BL1-Remember)** **CO2-** To understand the importance of maintenance of structures**(BL2-Understand)** **CO3-** To study the various types and properties of repair materials**(BL2-Understand)** **CO4-** To asses the damage to structures using various tests **(BL4-Analyze)** **CO5-** To learn the importance and methods of substrate preparation**(BL3-Apply)** **CO6-** To learn various repair techniques of damaged structures, corroded structures **(BL4-Analyze)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG9(Industry Innovation and Infrastructure) SDG11(Sustainable cities and economies)				

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction Maintenance, rehabilitation, repair, retrofit and strengthening, need for rehabilitation of structures. Cracks in R.C. buildings Various cracks in R.C. buildings, causes and effects Maintenance Maintenance importance of maintenance, routine and preventive maintenance. Damages to masonry structures Various damages to masonry structures and causes	Lectures with problem based learning, experimental learning, case study, field trips	10
2	Repair materials Various repair materials, Criteria for material selection, Methodology of selection, Health and safety precautions for handling and applications of repair materials Special mortars and concretes Polymer Concrete and Mortar, Quick setting compounds Grouting materials Gas forming grouts, Salfoalumate grouts, Polymer grouts, Acrylate and Urethane grouts. Bonding agents Latex emulsions, Epoxy bonding agents. Protective coatings Protective coatings for Concrete and Steel FRP sheets	Lectures with problem based learning, experimental learning, case study, field trips	10
3	Damage diagnosis and assessment Visual inspection, Non Destructive Testing using Rebound hammer, Ultra sonic pulse velocity, Semi destructive testing, Probe test, Pull out test, Chloride penetration test, Carbonation, Carbonation depth testing, Corrosion activity measurement Substrate preparation Importance of substrate/surface preparation, General surface preparation methods and procedure, Reinforcing steel cleaning	Lectures with problem based learning, experimental learning, case study, field trips	10
4	Crack repair Various methods of crack repair, Grouting, Routing and sealing, Stitching, Dry packing, Autogenous healing, Overlays, Repair to active cracks, Repair to dormant cracks. Corrosion of embedded steel in concrete Corrosion of embedded steel in concrete, Mechanism, Stages of corrosion damage, Repair of various corrosion damaged of structural elements (slab, beam and columns)	Lectures with problem based learning, experimental learning, case study, field trips	8
5	Jacketing Jacketing, Column jacketing, Beam jacketing, Beam Column joint jacketing, Reinforced concrete jacketing, Steel jacketing, FRP jacketing. Strengthening Strengthening, Beam shear strengthening, Flexural strengthening	Lectures with problem based learning, experimental learning, case study, field trips	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	To Assess the maintenance of Buildings	PBL	BL4-Analyze	15
2	To diagnose the best technique for failiure of different components of concrete masonary structures	PBL	BL3-Apply	15

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	0
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	0	40	20	60	

Part E

Books	1. Repair and protection of concrete structures by Noel P.Mailvaganam, CRC Press,1991. 2. Concrete repair and maintenance Illustrated by Peter.H.Emmons, Galgotia publications Pvt. Ltd., 2001. 3. “Earthquake resistant design of structures” by Pankaj agarwal, Manish shrikande, PHI, 2006.
Articles	https://www.researchgate.net/publication/344775584_Modern_Techniques_for_the_Restoration_and_Rehabilitation_of_Concrete_Structures
References Books	1. Failures and repair of concrete structures by S.Champion, John Wiley and Sons, 1961. 2. Diagnosis and treatment of structures in distress by R.N.Raikar Published by R & D Centre of Structural Designers and Consultants Pvt.Ltd, Mumbai. 3. Handbook on repair and rehabilitation of RCC buildings, CPWD, Government of India. 4. Handbook on seismic retrofit of buildings, A. Chakrabarti et.al., Narosa Publishing House, 2010
MOOC Courses	https://archive.nptel.ac.in/courses/105/105/105105213/
Videos	https://www.youtube.com/watch?v=widz1C17omE&embeds_referring_euri=https%3A%2F%2Farchive.nptel.ac.in%2F&source_ve_path=OTY3MTQ&feature=emb_imp_woyt

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	2	-	-	3	3	-	-	3	-	2
CO2	2	-	2	2	1	2	-	-	3	3	-	-	3	2	2
CO3	-	-	2	1	1	-	-	-	2	1	-	-	3	2	2
CO4	-	1	2	3	1	-	-	-	-	-	-	-	3	-	2
CO5	-	1	1	2	1	-	-	-	-	-	-	-	3	-	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-Electronics_and_Communication

Title of the Course	Electric Vehicle Technology
Course Code	ECO0701A[T]

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Open Elective							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** •CO1: Identify various types of EV's and their characteristics **(BL1-Remember)** **CO2-** CO2: Describe battery basics and their types in EV and HEV**(BL2-Understand)** **CO3-** CO3: Identify various types of electrical machines used in EV installation**(BL3-Apply)** **CO4-** CO4: Describe Solar panel design and integration. **(BL4-Analyze)** **CO5-** CO5: Identify installation and commissioning of solar panel. **(BL5-Evaluate)**							
Coures Elements	Skill Development ✕ Entrepreneurship ✕ Employability ✓ Professsonal Ethics ✓ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG3(Good health and well-being) SDG4(Quality education) SDG8(Decent work and economic growth) SDG11(Sustainable cities and economies) SDG12(Responsible consuption and production) SDG13(Climate action)				

Part B

Modules	Contents	Pedagogy	Hours
I	UNIT-I The knowledge of Principles of EV and HEV and Basic knowledge about renewable energy sources UNIT-I No. of Lectures: 8 Types of EV : Battery electric vehicles, The IC engine/electric hybrid vehicle, fuelled electric vehicles, Electric vehicles using supply lines, Solar powered vehicles, Electric vehicles which use flywheels or super capacitors, Electric Vehicles for the Future	Lecture Method/Video	8
II	UNIT-II No. of Lectures: 07 EV Batteries : Electric Vehicle Operation, Battery Basics, Introduction to Electric Vehicle Batteries, Fuel Cell Technology, Choice of a Battery, Electric Vehicle Body and Frame, Fluids, Lubricants, and Coolants, Effects of Current Density on Battery Formation, Effects of Excessive Heat on Battery Cycle Life, Battery Storage, Battery Capacity	Lecture Method/Video Clips/Group Discussion	8
III	UNIT-III No. of Lectures: 08 Special Electrical Machines for EV : Real-Time Model of a Two-Phase PMSM, PM Brushless DC Machine for EV, Switched Reluctance Motor (SRM) uses in EV, Synchronous Reluctance Motor (SyRM) for EV and HEV, Linear Induction Motor (LIM) – Construction, DC Linear Motor (DCLM) for EV, Analyze the control aspects of brushless DC motor	Lecture Method/Video Clips/Group Discussion	9
IV	UNIT-IV No. of Lectures: 08 Solar Panel Design and Integration : Solar Radiation Energy Measurements, Estimating Energy requirement, Types of Solar PV System, Design methodology for SPV system, Design of Off Grid Solar Power Plant, Case studies of 3KWp Off grid Solar PV Power Plant, Design and Development of Solar Street Light and Solar Lantern, Off Grid Solar power Plant	Lecture Method/Video Clips/Group Discussion	10
V	UNIT-V No. of Lectures: 07 Solar Panel Installation and Commissioning : Installation and Trouble shooting of Standalone Solar PV System, Maintenance of Solar PV System, Safety in installation of Solar PV System, Maintenance of Solar PV System. Installation, Commissioning, Trouble shooting of 1KWp off Grid Solar Power Plant, Check list for Solar PV Plant Installation and Commissioning	Lecture Method/Video Clips/Group Discussion	10

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Babu, A. (n.d.). Electric & Hybrid Vehicles. KHANNA PUBLISHING HOUSE. http://books.google.ie/books?id=AzsIEAAAQBAJ&printsec=frontcover&dq=9789386173713&hl=&cd=1&source=gbs_api Tripathi, P. (2022, June 15). Handbook on Electric Vehicles Manufacturing (E- Car, Electric Bicycle, E- Scooter, E-Motorcycle, Electric Rickshaw, E- Bus, Electric Truck with Assembly Process, Machinery Equipments & Layout). NIIR PROJECT CONSULTANCY SERVICES. http://books.google.ie/books?id=gSZ1EAAAQBAJ&pg=PA351&dq=8195676928&hl=&cd=1&source=gbs_api
Articles	
References Books	1 Mike Blundell and Damian Harty The Multi body systems Approach to Vehicle Dynamics Elsevier, 2004. 2 John Twidell & Toney Weir Renewable Energy Resources E & F N Spon
MOOC Courses	Electric Vehicles - Part 1 By Prof. Amit Jain | IIT Delhi EV - Vehicle Dynamics and Electric Motor Drives By Prof. Amit Jain, Prof. Avanish Tripathi | IIT Delhi
Videos	https://www.youtube.com/watch?v=UgtjRob5qMg&list=PLyqSpQzTE6M9spod-UH7Q69wQ3uRm5thr https://www.youtube.com/watch?v=L2HbpEMfryM&list=PLp6ek2hDcoNCROoQbG05xNfiBEY7492Vn

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-1	1	1	1	-	1	1	-	-	-	1	1	2	1	2
CO2	1	1	1	1	1	1	-	-	-	-	1	1	3	2	2
CO3	1	1	1	1	1	-	1	-	-	-	1	-	2	2	3
CO4	1	1	-	1	-	1	1	-	-	-	1	1	2	2	2
CO5	1	1	-	-	-	-	-	-	-	-	1	1	3	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-ElectricalEngineering

Title of the Course	Linear Control Systems
Course Code	EEL 0612

Part A

Year	3rd	**Semester**	6th	**Credits**	L	T	P	C
					3	1	1	5
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	Knowledge of Laplace transform and Fourier transform.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Understand the transfer function model for Physical systems**(BL1-Remember)** **CO2-** Illustrate adequate knowledge in the time response of systems and steady state error analysis..**(BL2-Understand)** **CO3-** Examine the frequency-domain response of closed loop system.**(BL3-Apply)** **CO4-** Build a compensator system satisfying requirements. **(BL4-Analyze)** **CO5-** Analyze the stability of linear systems**(BL5-Evaluate)** **CO6-** Develop state models for linear time invariant system.**(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG7(Affordable and clean energy) SDG11(Sustainable cities and economies)				

Part B

Modules	Contents	Pedagogy	Hours
Unit 1	Introduction to Control Systems: Types of control systems, Effect of feedback systems, Transfer functions, Block diagrams, Signal Flow graphs, Mason's gain formula , Differential equations of physical systems – Mechanical systems, Translational systems Rotational systems, Electrical systems, Analogous systems.	Talks and presentations	11
Unit 2	Time Response analysis: Standard test signals, Unit step response of First and second order systems, Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Feedback control actions: Proportional, derivative and integral	Talks and presentations	13
Unit 3	Stability analysis: Concepts of stability, Necessary conditions for Stability, Routh-Hurwitz stability criterion, Relative stability analysis; Special cases of RH criterion. Root locus concepts, construction of root loci	Talks and presentations	12
Unit 4	Frequency response Analysis: Frequency response, correlation between time and frequency responses, polar plots, Bode plots , Effect of adding poles and Zeros. Stability in Frequency Domain: Nyquist stability criterion, assessment of relative stability: gain margin and phase margin.	Talks and presentations	10
Unit 5	Introduction to Design: The design problem and preliminary considerations lead, lag and lead-lag networks , Design of compensating networks. Review of state variable technique: Concepts of state, state variable and state models for electrical systems, Solution of state equations. conversion of state variable model to transfer function model and vice-versa, diagonalization, Controllability and observability and their testing	Talks and presentations	14

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
Experiment-1	study and analysis of stroboscope	Experiments	BL2-Understand	2
Experiment-2	stepper motor application and uses	Experiments	BL3-Apply	2
Experiment-3	servo motor testing	Experiments	BL4-Analyze	2
Experiment-4	Study of P,PI,PID controller	Experiments	BL2-Understand	2
Experiment-5	Uses of function generator	Experiments	BL2-Understand	2
Experiment-6	Compensation design	Experiments	BL4-Analyze	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	28
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	30

Part E

Books	Nagrath & Gopal "Control System Engineering", 4th Edition New age International.
Articles	
References Books	Gopal M Control System : Principles & Design. TMH B.C. Kuo Automatic Control systems PHI
MOOC Courses	1.Advanced Linear Continuous Control Systems: Applications with MATLAB Programming and Simulink Electrical Engineering Prof. Yogesh Vijay Hote IIT Roorkee 2.Nonlinear Control System Electrical Engineering Dr. Arun D. Mahindrakar IIT Madras
Videos	1.https://www.youtube.com/watch?v=HcLYoCmWOjI 2.https://www.youtube.com/watch?v=DtV0ASunhqU 3.https://www.youtube.com/watch?v=XMfH2P2Fc6Q

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	1	-	1	1	-	-	-	1	-	-	1	-	-
CO2	-	-	1	-	1	-	-	1	-	-	-	-	-	-	1
CO3	1	-	-	1	-	1	-	-	-	-	-	-	-	1	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	1	1	1	-	1	1	-	-	-	-	-	-	-	-	-
CO6	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-

Syllabus-2023-2024

BTech-ElectricalEngineering

Title of the Course	Introduction of Electric Vehicle Technology
Course Code	EEL0132

Part A

Year	1st	**Semester**	1st	**Credits**	L	T	P	C
					2	1	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Identify EV concepts and parameters for better understanding of the EV technology**(BL1-Remember)** **CO2-** Analyze the EV Propulsion system for vehicular applications for their control.**(BL2-Understand)** **CO3-** Identify different energy sources used in EV.**(BL3-Apply)** **CO4-** Identify concepts of renewable energy sources**(BL4-Analyze)** **CO5-** Identify various alternative energy sources of energy.**(BL2-Understand)**							
Coures Elements	Skill Development ✕ Entrepreneurship ✓ Employability ✓ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG7(Affordable and clean energy) SDG8(Decent work and economic growth) SDG11(Sustainable cities and economies)				

Part B

Modules	Contents	Pedagogy	Hours
I	Introduction to transportation, Emissions from Vehicle, Evolution of e- mobility, EV Ecosystem and e-mobility in India, current demand in EV industry and opportunities of skilled EV engineers Past, Present & Future of EV, Current Major Issues, Recent Development Trends,	talks and presentations	8
II	Basic concepts related to EV, Types of Electric Vehicles in use today – Battery Electric Vehicle, Hybrid (ICE & others), Fuel Cell EV, Solar Powered Vehicles. Social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.	talks and presentations	9
III	Conventional and Non-conventional sources of energy Conventional energy sources. Non-conventional energy sources. Need of non-conventional energy sources. Renewable Sources of Energy such as Hydro, Solar, Wind, Biomass, Tidal and Geothermal - their availability and limitations.	talks and presentations, quiz	10
IV	Solar constants, Measurement of solar radiations, Solar Energy Conversion CSP generators, construction and working principle construction of a solar PV Systems: Solar cell, Module, Panel and array Types of solar PV system i. Stand –Alone Solar PV system ii. Grid-Interactive solar PV system iii. Hybrid Solar PV system Grid connection issues of solar power plants	talks and presentations, field visits	10
V	Indian & Global Scenarios in Electric Vehicles Technology Scenario, Market Scenario, Policies & Regulations, Payback & Commercial Model, Policies in India	talks and presentations	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
II	Study of electric vehicle system	Experiments	BL2-Understand	2
II	Study of hybrid electric vehicle system.	Experiments	BL4-Analyze	2
IV	Solar based EV Charging station.	Experiments	BL5-Evaluate	2
III	Electric Rickshaw Motor kit	Experiments	BL3-Apply	2
IV	Demonstration of battery management System	Experiments	BL4-Analyze	2
III	Demonstration of Brushless DC motor-based EV	Experiments	BL3-Apply	2
IV	To study about solar photo-voltaic system	Experiments	BL2-Understand	2
III	To study about solar lightning	Experiments	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	20

Part E

Books	1.Ali Emadi, “Advanced Electric Drive Vehicles”, CRC Press 2.Iqbal Husain, “Electric and Hybrid Vehicles – Design Fundamentals”, Second Edition, CRC Press.
Articles	E. Karden, S. Ploumen, B. Fricke, T. Miller and K. Snyder, “Energy storage devices for future hybrid electric vehicles,” J. Power Sources, vol. 168, no. 1, pp. 2–11, 200
References Books	1.Alfred Rufer, “Energy Storage systems and components”, CRC Press
MOOC Courses	1.https://nptel.ac.in/courses/108106170 Institute Logo NOC:Fundamentals of Electric vehicles: Technology & Economics, IIT Madras Prof. Ashok Jhunjhunwala Prof. Prabhjot Kaur Prof. Kaushal Kumar Jha Prof. L Kannan 2.https://onlinecourses.nptel.ac.in/noc22_ee53/preview Electric Vehicles - Part 1 By Prof. Amit Jain | IIT Delhi
Videos	1.https://www.youtube.com/watch?v=CWulQ1ZSE3c 2.https://www.youtube.com/watch?v=UgtjRob5qMg&list=PLyqSpQzTE6M9spod-UH7Q69wQ3uRm5thr

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	1	-	-	-	-	1	-	-	1	-	1	-	-
CO2	-	1	-	1	-	1	1	-	2	-	-	-	-	-	1
CO3	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
CO4	-	1	-	-	-	-	2	-	-	-	-	-	-	1	-
CO5	2	-	1	-	-	-	-	-	1	1	-	-	-	-	-
CO6	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-ElectricalEngineering

Title of the Course	Architecture of Electric Vehicle and solar Panels
Course Code	EEL0233

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					2	1	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Basic understanding of EV & HEV			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Identify various types of EV's and their characteristics**(BL1-Remember)** **CO2-** Describe battery basics and their types in EV and HEV.**(BL2-Understand)** **CO3-** Identify various types of electrical machines used in EV installation.**(BL3-Apply)** **CO4-** Describe Solar panel design and integration. **(BL4-Analyze)** **CO5-** Identify installation and commissioning of solar panel.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG7(Affordable and clean energy) SDG8(Decent work and economic growth) SDG9(Industry Innovation and Infrastructure) SDG11(Sustainable cities and economies)				

Part B

Modules	Contents	Pedagogy	Hours
I	Battery electric vehicles, The IC engine/electric hybrid vehicle, fuelled electric vehicles, Electric vehicles using supply lines, Solar powered vehicles, Electric vehicles which use flywheels or super capacitors, Electric Vehicles for the Future	talks and presentations	8
II	Electric Vehicle Operation, Battery Basics, Introduction to Electric Vehicle Batteries, Fuel Cell Technology, Choice of a Battery, ElectricVehicle Body and Frame, Fluids, Lubricants, and Coolants, Effects of Current Density on Battery Formation, Effects of Excessive Heat on Battery Cycle Life, Battery Storage, Battery Capacity	talks and presentations, PBL	8
III	Real-Time Model of a Two-Phase PMSM, PM Brushless DC Machine for EV, Switched Reluctance Motor (SRM) uses in EV, Synchronous Reluctance Motor (SyRM) for EV and HEV, Linear Induction Motor (LIM) – Construction, DC Linear Motor (DCLM) for EV, Analyze the control aspects of brushless DC motor	talks and presentations	9
IV	Solar Radiation Energy Measurements, Estimating Energy requirement, Types of Solar PV System, Design methodology for SPV system, Design of Off Grid Solar Power Plant, Case studies of 3KWp Off grid Solar PV Power Plant, Design and Development of Solar Street Light and Solar Lantern, Off Grid Solar power Plant	talks and presentations, Field visits	8
V	Installation and Trouble shooting of Standalone Solar PV System, Maintenance of Solar PV System, Safety in installation of Solar PV System, Maintenance of Solar PV System. Installation, Commissioning, Trouble shooting of 1KWp off Grid Solar Power Plant, Check list for Solar PV Plant Installation and Commissioning	talks and presentations, PBL	10

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Familiarization of EV control Modules	Experiments	BL2-Understand	2
I	Study of observer design for EV	Experiments	BL3-Apply	2
III	PI and PID controller for EV	Experiments	BL4-Analyze	2
III	Speed control of DC shunt machine for EV	Experiments	BL5-Evaluate	2
II	Speed control of Induction machine for EV	Experiments	BL5-Evaluate	2
IV	To plot V-I characteristics of solar cell and determine the fill factor	Experiments	BL5-Evaluate	2
IV	Series and parallel connections of solar cells	Experiments	BL5-Evaluate	2
V	Testing of photovoltaic cells	Experiments	BL5-Evaluate	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	20

Part E

Books	1. Vehicle Powertrain Systems by Behrooz Mashadi and David Crolla, Wiley, 2012 2. Automotive Aerodynamics by Joseph Katz, Wiley, 2016 3. Automotive Chassis Engineering, by David C. Barton and John D. Fieldhouse, Springer, 2018 4. Automotive Engineering Powertrain, Chassis System and Vehicle Body Edited by David A. Crolla, Elsevier,2009 5. Automotive Power Transmission Systems by Yi Zhang and Chris Mi, Wiley, 2018 6. Linear Electric Machines, Drives, and MAGLEVs Handbook, by Ion Boldea, CRC Press. 2013
Articles	
References Books	1.Encyclopaedia of Automotive Engineering edited by David Crolla et al, Wiley, 2014 2. Design and Control of Automotive Propulsion Systems by Zongxuan Sun and Guoming Zhu, CRC Press, 2015 3. The Automotive Transmission Book by Robert Fischer, Ferit Küçükay, Gunter Jürgens, Rolf Najork, and Burkhard Pollak, Springer, 2015 4. Noise and Vibration Control in Automotive Bodies by Jian Pang, Wiley, 2019
MOOC Courses	1.https://onlinecourses.nptel.ac.in/noc22_ee53/preview Fundamentals of Electric vehicles: Technology & Economics, IIT Madras Prof. Ashok Jhunjhunwala Prof. Prabhjot Kaur Prof. Kaushal Kumar Jha Prof. L Kannan 2.https://nptel.ac.in/courses/108106170 Electric Vehicles - Part 1 By Prof. Amit Jain | IIT Delhi
Videos	1.https://www.youtube.com/watch?v=UgtjRob5qMg&list=PLyqSpQzTE6M9spod-UH7Q69wQ3uRm5thr 2.https://www.youtube.com/watch?v=mNOYS-duUJY

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	1	-	1	-	-	1	-	-	-	-	1	-
CO2	-	-	1	-	-	-	1	-	-	1	-	2	-	-	-
CO3	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	1	-	2	-	2	-	-	-	-	-	-	1
CO5	-	-	2	-	-	-	-	-	-	-	1	-	1	-	-
CO6	2	-	-	-	1	-	-	-	3	-	-	-	-	-	-

Syllabus-2023-2024

BTech-ElectricalEngineering

Title of the Course	Electrical & Electronic Materials
Course Code	EEL0304

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					3	0	0	3
Course Type	Theory only							
Course Category	Disciplinary Minor							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** to understand different conducting materials**(BL2-Understand)** **CO2-** to understand different semiconducting materials**(BL2-Understand)** **CO3-** to understand different magnetic materials**(BL2-Understand)** **CO4-** to understand different insulating materials**(BL2-Understand)** **CO5-** to classify different materials**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professsonal Ethics ✓ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**					

Part B

Modules	Contents	Pedagogy	Hours
1	Conducting Material: Classification and main properties, High resistivity alloy: Constantan Manganin, Nichrome, properties of copper, Aluminum, steel tungsten, Molybdenum, Platinum, Tantalum, Niobium, Mercury, Nickel, Titanium, Carbon, Lead, thermocouple, materials, specific resistance, conductance, variation of resistance with temperature, super conductors.	Talks and presentations	10
2	Semi Conductor Materials: General conception, variation of electrical conductivity, Elements having semiconductor properties, general application, hall effect, energy levels, conduction in semiconductors, Intrinsic conduction, impurity conduction, P and N type impurities, electrical charge, Drift, Mobility current flow in semi conductors P-N junction formation by alloying, (forward and reverse) of P-n junction, Reverse separation current.	Talks and presentations	9
3	Magnetic Materials: Details of magnetic materials, relation between B. H. and μ, soft and hard magnetic materials. Di-magnetic, Para magnetic and Ferromagnetic materials, electrical sheet steel, cast iron. Permanent magnetic materials. Dynamic and static hysteresis loop. Hysteresis loss, eddy current loss, Magnetization, magnetic susceptibility, coercive force, core temperature, rectangular hysteresis loops.	Talks and presentations	8
4	Insulating Materials: General electrical mechanical and chemical properties of insulating material, Electrical characteristics volume and surface resistivity complex permittivity loss, and dielectric loss, equivalent circuits of an imperfect dielectric polarization and polarisability classification of dielectric.	Talks and presentations	9
5	Classification of insulating materials on the basis of temperature rise. General properties of transformer oil, commonly used varnishes, solidifying insulating materials, resins, bituminous waxes, drying oils, Fibrous insulating materials, wood, paper and cardboard, insulating textiles, varnished adhesive tapes, inorganic fibrous material and other insulating materials, such as mica, ceramic, Bakelite, ebonite, glass, PVC, rubber, other plastic molded materials.	Talks and presentations	9

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Text Books: 1. A.J.Dekker: Electrical Engineering Materials PHI 2. Indulkar and S. Thruvengadem; Electrical Engineering Materials; S. Chand
Articles	
References Books	References: 1. Kortisky; Electrical Engineering Materials: 2. Electrical Engineering Material s & Devices; John Allison ;TMH 3. Materials for Electrical Engineering: B.M. Tareev. 4. Anderson; Di-Electrics :
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	-	1	1	-	-	-	-	1	1	2	2	2
CO2	1	1	1	1	1	-	-	-	-	-	1	1	2	2	3
CO3	1	1	1	1	1	1	-	-	-	-	1	1	2	3	2
CO4	1	1	1	1	1	1	-	-	-	-	1	1	3	2	3
CO5	1	1	1	1	1	1	-	-	-	-	1	-	3	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-ElectricalEngineering

Title of the Course	Energy Storage Systems for electric vehicles
Course Code	EEL0334

Part A

Year	2nd	**Semester**	3rd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Basics of vehicle mechanism			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Understand the basic history of electric vehicles.**(BL1-Remember)** **CO2-** Discuss the various energy storage systems**(BL2-Understand)** **CO3-** Analyze the battery characteristics & parameters**(BL3-Apply)** **CO4-** Enlighten the battery management system**(BL5-Evaluate)** **CO5-** Apply the knowledge battery testing, disposal & recycling to avoid environmental pollution for the betterment of society**(BL3-Apply)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG7(Affordable and clean energy) SDG8(Decent work and economic growth) SDG9(Industry Innovation and Infrastructure) SDG11(Sustainable cities and economies)				

Part B

Modules	Contents	Pedagogy	Hours
I	Energy storage systems overview - Scope of energy storage, needs and opportunities in energy storage, Technology overview and key disciplines, comparison of time scale of storages and applications, Energy storage in the power and transportation sectors. Importance of energy storage systems in electric vehicles, Current electric vehicle market.	talks and presentations	7
II	Batteries: Lead Acid Battery, Nickel based batteries, Sodium based batteries, Lithium based batteries – Li-ion & Li-poly, Metal Air Battery, Zine Chloride battery; Ultra capacitors; Flywheel Energy Storage System; Hydraulic Energy Storage System; Comparison of different Energy Storage System.	talks and presentations	8
III	20.05.2022 2/3 Cells and Batteries- conversion of chemical energy to electrical energy- Battery Specifications: Variables to characterize battery operating conditions and Specifications to characterize battery nominal and maximum characteristics; Efficiency of batteries; Electrical parameters Heat generation- Battery design- Performance criteria for Electric vehicles batteries- Vehicle propulsion factors- Power and energy requirements of batteries- Meeting battery performance criteria- setting new targets for battery performance	talks and presentations	9
IV	Selection of battery for EVs & HEVs, Traction Battery Pack design, Requirement of Battery Monitoring, Battery State of Charge Estimation methods, Battery Cell equalization problem, thermal control, protection interface, SOC Estimation, Energy & Power estimation, Battery thermal management system, Battery Management System: Definition, Parts: Power Module, Battery, DC/DC Converter, load, communication channel, Battery Pack Safety, Battery Standards & Tests.	Chalk and talk/power point presentation,Videos/Learning material	9
V	Chemical & structure material properties for cell safety and battery design, battery testing, limitations for transport and storage of cells and batteries, Recycling, disposal and second use of batteries. Battery Leakage: gas generation in batteries, leakage path, leakage rates. Ruptures: Mechanical stress and pressure tolerance of cells, safety vents, Explosions: Causes of battery explosions, explosive process.	talks and presentations	9

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
I	Develop a comparative case Study of different types of batteries with their characteristics & detailed specifications.	Experiments	BL2-Understand	2
II	Perform Vibration Test for traction batteries (Lead-Acid/Li-ion) as per AIS 048 standard.	Experiments	BL4-Analyze	2
II	Perform Shock Test for traction batteries (Lead-Acid/Li-ion) as per AIS 048 standard.	Experiments	BL5-Evaluate	2
III	SOC Estimation by Open Source voltage for Lead-Acid battery, Ni-MH battery and Liion battery	Experiments	BL4-Analyze	2
III	SOC Estimation by specific gravity for Lead-Acid battery.	Experiments	BL5-Evaluate	2
IV	Design a circuit for Battery monitoring System for Lead acid battery.	Experiments	BL4-Analyze	2
V	Series connection of batteries.	Experiments	BL5-Evaluate	2
V	Prallel connection of batteries	Experiments	BL5-Evaluate	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	20

Part E

Books	1.Energy Resource Management, Krupal Singh Jogi (Sarup & Sons). 2. Non-Conventional Energy resources, Dr. B.H. Khan, Tata McGraw Hill. 3. Electrochemical Energy Storage: Physics and Chemistry of Batteries, De Gryuter, Reinhart Job. 4. Batteries: Materials Principles and Characterization Methods, Chen Liao, Chemical Sciences and Engineering Division, Argonne National Laboratory, Lemont, USA. 5. Batteries, Fuel Cells, and related Electrochemistry, U.S. Department of Energy, Washington, D.C. 2058
Articles	
References Books	1..Encyclopaedia of Automotive Engineering edited by David Crolla et al, Wiley, 2014 2. Design and Control of Automotive Propulsion Systems by Zongxuan Sun and Guoming Zhu, CRC Press, 2015 3. The Automotive Transmission Book by Robert Fischer, Ferit Küçükay, Gunter Jürgens, Rolf Najork, and Burkhard Pollak, Springer, 2015 4. Noise and Vibration Control in Automotive Bodies by Jian Pang, Wiley.
MOOC Courses	1.https://nptel.ac.in/courses/108106170 2.https://onlinecourses.nptel.ac.in/noc22_ee53/preview
Videos	1.https://www.youtube.com/watch?v=mNOYS-duUJY 2.https://www.youtube.com/watch?v=nrxmQhbZUTc&t=100s

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	1	-	-	1	1	-	-	-	1	-	1	-
CO2	-	1	-	-	1	-	-	-	1	1	-	-	-	-	-
CO3	2	-	1	-	-	1	-	-	-	-	-	-	-	-	1
CO4	-	-	-	2	-	-	1	-	2	-	-	-	1	-	-
CO5	-	-	-	-	1	-	-	2	-	-	2	-	-	-	-
CO6	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-ElectricalEngineering

Title of the Course	Power system operation & Control
Course Code	EEL0839

Part A

Year	4th	**Semester**	8th	**Credits**	L	T	P	C
					2	1	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Understand the concept of Optimal Power System Operation under various operating constraints.**(BL1-Remember)** **CO2-** To know the importance of frequency control**(BL2-Understand)** **CO3-** To analyze different methods to control reactive power**(BL3-Apply)** **CO4-** To understand unit commitment problem and importance of economic load dispatch**(BL4-Analyze)** **CO5-** To understand real time control of power systems **(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professsonal Ethics ✓ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG4(Quality education) SDG8(Decent work and economic growth) SDG9(Industry Innovation and Infrastructure) SDG11(Sustainable cities and economies) SDG12(Responsible consuption and production)				

Part B

Modules	Contents	Pedagogy	Hours
Unit-1	PRELIMINARIES ON POWER SYSTEM OPERATION AND CONTROL Power scenario in Indian grid – National and Regional load dispatching centers –requirements of good power system - necessity of voltage and frequency regulation – real power vs frequency and reactive power vs voltage control loops - system load variation, load curves and basic concepts of load dispatching - load forecasting - Basics of speed governing mechanisms and modeling - speed load characteristics - regulation of two generators in parallel.	Talks and presentations	12
Unit-2	REAL POWER - FREQUENCY CONTROL - Load Frequency Control (LFC) of single area system-static and dynamic analysis of uncontrolled and controlled cases - LFC of two area system - tie line modeling – block diagram representation of two area system - static and dynamic analysis - tie line with frequency bias control – state variability model - integration of economic dispatch control with LFC.	Talks and presentations	13
Unit-3	REACTIVE POWER – VOLTAGE CONTROL - Generation and absorption of reactive power - basics of reactive power control – Automatic Voltage Regulator (AVR) – brushless AC excitation system – block diagram representation of AVR loop - static and dynamic analysis – stability compensation – voltage drop in transmission line - methods of reactive power injection - tap changing transformer, SVC (TCR + TSC) and STATCOM for voltage control.	Talks and presentations	11
Unit-4	ECONOMIC OPERATION OF POWER SYSTEM - Statement of economic dispatch problem - input and output characteristics of thermal plant - incremental cost curve - optimal operation of thermal units without and with transmission losses (no derivation of transmission loss coefficients) - base point and participation factors method - statement of unit commitment (UC) problem - constraints on UC problem – solution of UC problem using priority list – special aspects of short term and long term hydrothermal problems.	Talks and presentations	14
Unit-5	COMPUTER CONTROL OF POWER SYSTEMS - Need of computer control of power systems-concept of energy control centers and functions – PMU - system monitoring, data acquisition and controls - System hardware configurations - SCADA and EMS functions - state estimation problem – measurements and errors - weighted least square estimation - various operating states - state transition diagram.	Talks and presentations	10

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
Experiment 1	To study characteristics of solid state over voltage and under voltage relay	Experiments	BL2-Understand	2
Experiment 2	To study characteristics of static type over current relay	Experiments	BL2-Understand	2
Experiment 3	Under voltage relay static type	Experiments	BL3-Apply	2
Experiment 4	To study IDMT Over current relays single phase and to determine the pick up and reset value	Experiments	BL4-Analyze	2
Experiment 5	To study line to line fault	Experiments	BL5-Evaluate	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	60	30	40	20

Part E

Books	1. Olle.I.Elgerd, 'Electric Energy Systems theory - An introduction', McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010. 2. Allen. J. Wood and Bruce F. Wollen berg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2016. 3. Abhijit Chakrabarti and Sunita Halder, 'Power System Analysis Operation and Control', PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.
Articles	
References Books	1. Kothari D.P. and Nagrath I.J., 'Power System Engineering', Tata McGraw-Hill Education, Second Edition, 2008. 2. Hadi Saadat, 'Power System Analysis', McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010. 3. Kundur P., 'Power System Stability and Control, McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	-	-	3	-	-	-	-	3	3	2
CO2	3	2	2	-	-	-	-	-	-	1	-	-	2	3	-
CO3	1	3	1	2	1	-	1	-	1	-	1	-	2	2	3
CO4	2	1	1	-	-	3	-	1	-	-	1	-	2	1	-
CO5	2	3	3	2	1	-	-	-	-	1	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-ElectricalEngineering

Title of the Course	Special Electrical machine & Design
Course Code	EEM0612

Part A

					L	T	P	C
Year	3rd	**Semester**	6th	**Credits**	3	1	1	5
Course Type	Embedded theory and lab							
Course Category	Disciplinary Major							
Pre-Requisite/s	To understand the contents and successfully complete this course, participant must have a basic understanding of AC Machines, DC Machines.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Classify & select proper material for the design of an electrical machine **(BL1-Remember)** **CO2-** Design overall transformer**(BL2-Understand)** **CO3-** Estimate the performance characteristics of Transformer with the constraints specified.**(BL3-Apply)** **CO4-** Design Stator core & stator winding of an Induction motor. **(BL4-Analyze)** **CO5-** Design rotor core & rotor winding of an induction motor & calculate load current & other performance characteristics **(BL5-Evaluate)** **CO6-** Design overall dimensions of synchronous machine & cooling of synchronous generator**(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓			**SDG (Goals)**	SDG7(Affordable and clean energy) SDG8(Decent work and economic growth) SDG11(Sustainable cities and economies)			

Part B

Modules	Contents	Pedagogy	Hours
Unit-1	Design of Synchronous Machine Features of construction of low speed and medium speed Machine, design consideration of turbo and water wheel alternators, output coefficient and choice of main dimensions, design of stator winding, and design of field systems, regulation, losses and efficiency, cooling systems.	Talks and presentations	12
Unit-2	Design of 3 Phase Induction Motor: Design consideration of ac motors, calculation of main dimensions, design of stator winding, effect of air gap on performance. Rotor Design: Design of slip ring and squirrel cage rotor, components of leakage reactance, calculation of leakage reactance and its effect on the performance.	Talks and presentations, ,Brainstorming	11
Unit-3	Design of single phase Induction motor: Calculation of main dimensions of stator, complete design of stator with its punching details, design of main and auxiliary winding, design of rotor, performance calculation of designed rotor and performance by equivalent circuit approach.	Talks and presentations	13
Unit-4	Design of Electrical Equipments Design of choke, DC motor starter, Lifting magnets and other electromagnetic devices.	Talks and presentations, Case studies	10
Unit-5	Computer Aided Design: Philosophy and economics of computer aided design, advantages limitations, analysis and synthesis methods, and selection of input data and design variables, flow charts for design of induction motor and synchronous machine. Optimization of design constrained and unconstrained optimization problem.	Talks and presentations	14

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
Experiment-1	Design and construction analysis of 3-phase squirrel cage Induction machine.	Experiments	BL2-Understand	2
Experiment-2	Design and construction analysis of 3-phase slip ring Induction machine.	Experiments	BL2-Understand	
Experiment-3	TO STUDY 3 PHASE TRANSFORMER & AUTOTRANSFORMER	Experiments	BL2-Understand	
Experiment-4	Introduction to design of Dc shunt Machine.	Experiments	BL3-Apply	
Experiment-5	Elementary analysis and design of synchronous machine through cut section model .	Experiments	BL4-Analyze	

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	28
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	30

Part E

Books	Deshpandey M.V Design of Electrical Machines PHI Learning
Articles	
References Books	Veinot Cyril G Computer Aided Design of Electrical Machinery Veinot Cyril G Sharanugasundaram A., Gangadharan G., & Palani R. Electrical Machine Design Data Book Wiley Eastern Ltd., New Delhi
MOOC Courses	1.Optimisation for Machine Learning: Theory and Implementation (Hindi) Computer Science and Engineering Prof. Pravesh Biyani IIT Madras 2.Electrical Equipment and Machines: Finite Element Analysis Electrical Engineering Prof. Shrikrishna V. Kulkarni IIT Bombay 3.Electrical Machines Electrical Engineering Prof. G.Bhuvaneshwari IIT Delhi
Videos	1.https://www.youtube.com/watch?v=PGihCyWoVGE 2.https://www.youtube.com/watch?v=M-WOeclY9Vc 3.https://www.youtube.com/watch?v=UYRxK2huBOY 4.https://www.youtube.com/playlist?list=PL9s6YpaXlcJt1leX3JV1z1j1E9JUi3bFj

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	-	1	-	-	-	1	-	-	-	-	-	-
CO2	1	1	-	-	-	2	-	-	-	1	-	-	-	-	-
CO3	1	-	2	1	1	-	3	-	-	-	1	-	-	-	1
CO4	1	1	1	-	-	-	-	4	1	-	-	-	-	4	-
CO5	-	-	-	3	-	-	-	-	-	-	-	1	-	-	-
CO6	-	-	-	-	1	-	-	-	-	-	-	-	5	-	-

Syllabus-2023-2024

BTech-ElectricalEngineering

Title of the Course	Power quality and industrial application
Course Code	EEM0717

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					3	1	0	4
Course Type	Theory only							
Course Category	Discipline Electives							
Pre-Requisite/s	Basic knowledge of power system and power electronics			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember various aspects of Power quality and industrial applications.**(BL1-Remember)** **CO2-** To understand Industrial utilization, Power quality and maintenance.**(BL2-Understand)** **CO3-** To implement Flow charts and practice set to understand the subject.**(BL3-Apply)** **CO4-** To analyze the different numeric problems for well understand subjects problems**(BL4-Analyze)** **CO5-** To evaluate and summarize the data using statistical & visualization tools.**(BL5-Evaluate)** **CO6-** To prepare the models based on of real world problems of power quality. **(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG7(Affordable and clean energy) SDG11(Sustainable cities and economies)				

Part B

Modules	Contents	Pedagogy	Hours
Unit-1	Industrial Utilization: Type of lighting scheme, Design of Lighting schemes, factory lighting, methods of lighting calculations, street lighting, flood lighting.	Talks and presentations	12
Unit-2	Design of Distribution Systems: Development of a distribution plan, primary distribution design, secondary distribution design, planning and design of town electrification scheme, design of industrial distribution systems.	Talks and presentations	12
Unit-3	Power Quality: Overview of Power quality, power quality & EMC standards, Overview of Reliability evaluation: Generation reliability, distribution reliability, Industrial Power Systems reliability.	Talks and presentations, field work	12
Unit-4	Maintenance: An overview , role of maintenance in failure , design of maintenance system, need for maintenance planning , benefits of maintenance planning . Predictive maintenance, non destructive testing and diagnostic instruments, Safety management: Safety principle and guidelines, computers in maintenance and maintenance budget.	Talks and presentations, PBL, Case studies	12
Unit-5	Introduction to ISO 9000 and TQM: History of Quality, Quality management, quality principles, total quality , total quality control, total quality management, ISO9000.	Talks and presentations	12

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100		40	12	60	28
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	M.V. Deshpande Electrical Power System Design TMH, New Delhi
Articles	
References Books	1. J.B. Gupta Utilization of Electric Power & Electric Traction Katson Publishing House Murphy M. D., and Tumbuli F Power Electronic Control of AC Motors Pergamon Press, Oxford University Press Math H.J. Bollen Understanding Power Quality Problems IEEE Press, Standard Publishers & Distributor, Delhi
MOOC Courses	1.Power Quality Electrical Engineering Prof. Bhim Singh IIT Delhi 2.Power Quality Improvement Technique Electrical Engineering Prof. Avik Bhattacharya IIT Roorkee 3.Power Quality in Power Distribution Systems Electrical Engineering Dr. Mahesh Kumar IIT Madras
Videos	https://www.youtube.com/watch?v=q4VjsHq4LOk https://www.youtube.com/watch?v=x_H3kqJR_YE

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	-	1	-	-	-	-	1	-	-	-	-	-	-	1	-
CO3	-	-	2	1	-	-	-	-	1	-	-	1	-	-	-
CO4	-	-	-	-	2	-	-	-	-	1	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	1	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-

Syllabus-2023-2024

BTech-ElectricalEngineering

Title of the Course	Advanced power system protection
Course Code	EEM0718

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					3	1	0	4
Course Type	Theory only							
Course Category	Discipline Electives							
Pre-Requisite/s				**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Understand the various types of relays, comparators and their realization using static circuits.**(BL1-Remember)** **CO2-** Understand the realization of over current, distance and differential relays using comparators.**(BL2-Understand)** **CO3-** Realize the various dynamic characteristics of digital relays for protection of transmission lines, transformers**(BL3-Apply)** **CO4-** Analyze different Protection schemes of bus bar and transmission lines.**(BL4-Analyze)** **CO5-** Identify the new developments in Digital Protection.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professsonal Ethics ✓ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG4(Quality education) SDG7(Affordable and clean energy) SDG9(Industry Innovation and Infrastructure) SDG13(Climate action)				

Part B

Modules	Contents	Pedagogy	Hours
Unit-1	Protective Relays: Relaying review, characteristics and operating equations of relays.CT's and PT's differential relay, over-current relay, reverse power relay, distance relays, applications of relays.	Talks and presentations	12
Unit-2	STATIC RELAYS: Introduction, advantages and disadvantages, classification logic ckts, smoothing circuits, voltage regulator square wave generator, time delay ckts level detectors, summation device, sampling circuit, zero crossing detector, output devices. COMPARATORS: Replica Impedance, mixing transformers, general equation of phase and amplitude comparator, realization of ohm, impedance and off set impedance characteristics, duality principle, static amplitude comparators, coincidence circuit, Hall effect devices, Magneto receptivity, zener diode phase comparator multi input comparators.	Talks and presentations	13
Unit-3	Generator and transformer protection: Protective devices for system. Protective devices for stator, rotor, and prime mover of generator, percentage differential relays protection, three winding transformer protection, earth fault protection, generator Transformer unit protection	Talks and presentations	11
Unit-4	Bus bar and transmission line protection: Distance protective schemes, directional wave detection relay. Phase compensation carrier protection. High impedance differential scheme, supervisory and check relay, Some features of 500 KV relaying protection.	Talks and presentations	10
Unit-5	Modern trends in power system protection: Different types of digital and computer aided relays, Microprocessor based relays, auto-reclosing, frequency relays, under and over frequency relays, di/dt relays. Algorithms for transmission line, transformer & bus bar protection; out-of-step relaying Introduction to adaptive relaying & wide area measurements	Talks and presentations	14

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	22
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	1. Power System Protection and Switchgear, B.Ram – Tata Mc-Graw Hill Pub. 2. Switchgear and Protection, M.V.Deshpande - Tata Mc-Graw Hill Pub.
Articles	
References Books	1. Power System Protection & Switchgear, Ravindra Nath, M.Chander, Willy P 2.Computer Relaying for power system, Arun Phadke, James Thorp, Johns W P
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	3	-	-	-	-	-	-	-	-	-	2	3	-
CO2	3	-	2	-	-	-	-	-	-	-	-	-	2	3	-
CO3	3	-	3	-	-	-	-	-	-	-	-	-	3	2	-
CO4	2	-	2	-	-	-	-	-	-	-	-	-	3	3	-
CO5	2	-	3	-	-	-	-	-	-	-	-	-	3	2	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-ElectricalEngineering

Title of the Course	industrial instrumentation
Course Code	EEM0821

Part A

Year	4th	**Semester**	8th	**Credits**	L	T	P	C
					3	1	0	4
Course Type	Theory only							
Course Category	Disciplinary Major							
Pre-Requisite/s	To understand the contents and successfully complete this course, a participant must have a basic knowledge of Pressure, Sound, Flow, Temperature, Level, Humidity, Torque, Viscosity and Vibration measurements.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Describes the purpose of instrumentation in Industrial processes. **(BL1-Remember)** **CO2-** Describes the working of RTD, Thermostats, and thermocouple.**(BL2-Understand)** **CO3-** Describes the Bourdon tube, diaphragms and Bell gauges for pressure measurement and to employ flapper-nozzle assembly for differential pressure measurement.**(BL3-Apply)** **CO4-** Describes the various flow and level measurement devices used for industrial purposes.**(BL4-Analyze)** **CO5-** Elucidate the construction and working of various industrial devices used to measure pressure, sound and flow**(BL5-Evaluate)** **CO6-** Illustrate measurement techniques for acceleration, vibration and density **(BL6-Create)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG1(No poverty) SDG2(Zero hunger) SDG4(Quality education) SDG7(Affordable and clean energy) SDG8(Decent work and economic growth) SDG11(Sustainable cities and economies)				

Part B

Modules	Contents	Pedagogy	Hours
Unit-1	Review of different transducers, their characteristics, displacement, force, torque and speed measurement, measurement of different industrial processes, pressure measurement, flow measurement, temperature measurement.	Talks and presentations	12
Unit-2	Pressure measurement: Different type of manometers, diaphragm gauges, bellow and force balance type sensors, bourdern gauge, piezoelectric, capacitive and inductive pressure pickups, Vacuum pressure measurements: Mcleod gauge, pirani gauge, thermocouple gauge, knudsen gauge, ionization calibration procedures.	Talks and presentations	12
Unit-3	Flow measurement: Differential pressure flow meters, pitat tube, orifice, vanturi flow nozzle, hot wire flow meter, constant pressure drop, variable area meters (rotameter), turbine meters. Electromagnetic flow meters, ultrasonic flow meters, measurement of level, differiential pressure method, conductive and capacitive method, electrochemical method, use of radio scope for level measurement.	Talks and presentations, Cse study	12
Unit-4	Temperature measurements: Different types of temperature transducers, RTDS, industrial type RTD sensor, laboratory grade platinum temperature thermometer, thermo resistance thermometer, thermisters temperature detectors, digital quartz crystal thermometer	Talks and presentations, Problem-based learning	12
Unit-5	Displacement measurement: Linear variable displacement transducer, capacitive transducer. Force measurement: Hydraulic force meter, pneumatic force meter, electric force transducers, strain gauge load cell, inductor load cells.	Talks and presentations	12

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	28
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	B.C. Nakra & K.K. Instrumentation Measurement and Analysis by B.C. Nakra & K.K. Chaudhary (VII Edition). Chaudhary (VII Edition), Tata McGraw Hill Publishing Ltd., New Delhi. 1. Electrical Measurement and Measuring Instruments by A K sawhney (VII Edition), Dhanpat Rai & Co. Tata McGraw Hill Publishing Ltd., New Delhi.
Articles	
References Books	A K sawhney Electrical Measurement and Measuring Instruments by A K sawhney (VII Edition), Dhanpat Rai D. Patranabis Principle of Industrial Instrumentation by Patranabis TMH , New Delhi. J.B. Gupta A Course in Electronic & Electrical Measurements & Instrumentation Kataria Sons
MOOC Courses	1.INSTART - Instrumentation Course https://www.udemy.com/course/instart-ic-training-course-chapter-1-basics/?couponCode=24T3MT53024 2.Instrumentation, Prof. Ashis Kumar Dutta, IIT Kharagpur
Videos	1.https://www.youtube.com/watch?v=7if7MSqiepg 2.https://www.youtube.com/watch?v=BOJqnvvWauE 3.https://www.youtube.com/watch?v=h8BlWgE8bH0

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	-	-	-	1	-	1	1	2	2	2
CO2	1	1	1	1	1	-	-	-	-	1	1	1	2	3	2
CO3	1	1	1	-	1	-	1	-	-	-	1	-	2	2	3
CO4	1	1	1	1	1	-	-	1	-	-	1	1	2	2	3
CO5	1	1	1	1	1	-	-	-	-	-	1	1	2	3	2
CO6	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-ElectricalEngineering

Title of the Course	Environmental Pollution and global issues
Course Code	MCL0201

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					2	1	0	3
Course Type	Theory only							
Course Category	Foundation core							
Pre-Requisite/s	Basic knowledge of natural resources, biodiversity, ecological succession, energy flow, environmental issues and problems.			**Co-Requisite/s**	A detailed understanding of the complexity of environment and its challenges and solutions to these problems and challenges.			
Course Outcomes & Bloom's Level	**CO1-** CO1. Develop environmental scientists and engineers and sensitize them towards environmental issues.**(BL2-Understand)** **CO2-** CO2. To acquire analytical skills in assessing environmental impacts through a multidisciplinary approach**(BL3-Apply)** **CO3-** CO3. Ability to distinguish between various methods of various pollution analysis**(BL4-Analyze)** **CO4-** CO4.Acquire expertise and skills needed for the Environmental Management Systems and techniques of monitoring, Environment audit, Environmental Impact Analysis, environment instrumentation and control systems and for the projects development, implementation, and maintenance.**(BL5-Evaluate)** **CO5-** CO5. Students acquire skills for to communicate, prepare, plan and implement the environmental management project**(BL6-Create)**							
Coures Elements	Skill Development ✕ Entrepreneurship ✕ Employability ✓ Professsonal Ethics ✕ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG2(Zero hunger) SDG3(Good health and well-being) SDG5(Gender equality) SDG6(Clean water and sanitation) SDG7(Affordable and clean energy) SDG8(Decent work and economic growth) SDG10(Reduced inequalities) SDG11(Sustainable cities and economies) SDG12(Responsible consuption and production) SDG13(Climate action) SDG14(Life below water) SDG15(Life on land) SDG16(Peace Justice and strong institutions) SDG17(Partnerships for the goals)				

Part B

Modules	Contents	Pedagogy	Hours
Unit – 1 (Environment, Ecosystem and Environmental Education)	Environment – Definition and its segments, (Lithosphere, Hydrosphere, Atmosphere and Biosphere), Multidisciplinary nature of Environmental Science, Ecology and Ecosystem: Basic concepts, functions of ecosystem, Energy Flow, Food chain, food web, Ecological Pyramids, Ecological Successions. Environmental Education- Definition, scope, importance, Need for Public Awareness, Environmental Ethics. Environmental Impact Assessment: Screening, Scoping, Base line Analysis, Impact Mitigation, Documentation, Review, Public hearing, Post Project Monitoring.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, discussion (questions & answers section)	8
Unit – 2 (Natural Resources Management)	Natural Resources – Classification, Water Resources (availability, quality, water budget), Mineral Resources (distribution, availability and future perspectives), and Forest Resources. Energy Resources- Classification and alternatives of conventional energy resources- Solar, working of solar photovoltaic cells, Geothermal, Wind energy, Nuclear Energy, Biomass and Bio-gas	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	8
Unit – 3 (Water, Soil & Noise Pollution)	Water pollution – sources & effects, characteristics and treatment of waste water, engineered systems for water purification: Aeration, solid separation, settling operations, filtration and disinfection. Soil - formation of soil, elementary and mineral composition, types of soil in India, soil pollution, effects and abatements. Noise Hazards: Continuous and impulse noise, Effect of noise on man, Measurement and evaluation of Noise, noise isolation and absorption techniques, silencers, practical aspects of noise.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	8
Unit –4 (Atmospheric chemistry and Air Pollution)	Classification, sources and toxic effects of air pollutants, dispersal of air pollutants, engineered systems for air purification: Atmospheric cleansing process, approaches to contamination control. Air pollutants with emphasis on reactive intermediates in atmosphere like hydroxyl radical, ozone and nitrate radical, types of hydrocarbon in the troposphere, reaction of organic compounds in the atmosphere.(Green house gas effect, Global warming, Climate change).	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures,Audio/Video clips, Group discussion.	8
Unit – 5 (Waste Management)	Solid waste: Generation and waste characterization. Collection, storage and transport. Waste disposal, waste processing techniques, reduction, reuse and recycling, resource recovery and utilization. Physical and chemical treatment methods and composting. Hazardous waste management and treatment.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion. Field visits. Industrial Visit (MSW/BMW/STP/ETP)	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100		60	30	40	20
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	Environmental Science by B. S. Chauhan; Firewall Media, 2008 • Environmental Science by Cuningham and Cuningham; McGraw-Hill Education; 13th edition (16 February 2014) • Environmental Engineering by S. K. Dhameja; S. K. Kataria & Sons, 2009 • Environmental Science by Richard T Wright; Benjamin-Cummings Pub Co.
Articles	
References Books	Environmental Engineering by Howards S Peavy, Donald R Rowe, T. George • Environmental Science & Engineering by Gilbert M. Master • Environmental Chemistry by Stanley
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	2	2	-	-	-	2	-	-	1	-	1
CO2	1	2	1	2	2	2	-	-	-	2	-	-	1	-	3
CO3	2	1	1	-	1	-	-	-	-	-	-	-	3	2	3
CO4	2	2	-	2	1	-	-	-	-	-	-	-	2	3	3
CO5	2	2	-	2	1	-	-	-	-	-	-	-	2	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-Electronics_and_Communication

Title of the Course	Environmental Pollution & Global Issues
Course Code	MCL0201[T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					2	1	0	3
Course Type	Theory only							
Course Category	Foundation core							
Pre-Requisite/s	Basic knowledge of natural resources, biodiversity, ecological succession, energy flow, environmental issues and problems.			**Co-Requisite/s**	A detailed understanding of the complexity of environment and its challenges and solutions to these problems and challenges.			
Course Outcomes & Bloom's Level	**CO1-** CO1. Develop environmental scientists and engineers and sensitize them towards environmental issues.**(BL2-Understand)** **CO2-** CO2. To acquire analytical skills in assessing environmental impacts through a multidisciplinary approach**(BL3-Apply)** **CO3-** CO3. Ability to distinguish between various methods of various pollution analysis**(BL4-Analyze)** **CO4-** CO4.Acquire expertise and skills needed for the Environmental Management Systems and techniques of monitoring, Environment audit, Environmental Impact Analysis, environment instrumentation and control systems and for the projects development, implementation, and maintenance.**(BL5-Evaluate)** **CO5-** CO5. Students acquire skills for to communicate, prepare, plan and implement the environmental management project**(BL6-Create)**							
Coures Elements	Skill Development ✕ Entrepreneurship ✕ Employability ✓ Professsonal Ethics ✓ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG2(Zero hunger) SDG3(Good health and well-being) SDG5(Gender equality) SDG6(Clean water and sanitation) SDG7(Affordable and clean energy) SDG8(Decent work and economic growth) SDG10(Reduced inequalities) SDG11(Sustainable cities and economies) SDG12(Responsible consuption and production) SDG13(Climate action) SDG14(Life below water) SDG15(Life on land) SDG17(Partnerships for the goals)				

Part B

Modules	Contents	Pedagogy	Hours
Unit – 1 (Environment, Ecosystem and Environmental Education)	Environment – Definition and its segments, (Lithosphere, Hydrosphere, Atmosphere and Biosphere), Multidisciplinary nature of Environmental Science, Ecology and Ecosystem: Basic concepts, functions of ecosystem, Energy Flow, Food chain, food web, Ecological Pyramids, Ecological Successions. Environmental Education- Definition, scope, importance, Need for Public Awareness, Environmental Ethics. Environmental Impact Assessment: Screening, Scoping, Base line Analysis, Impact Mitigation, Documentation, Review, Public hearing, Post Project Monitoring.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, discussion (questions & answers section)	8
Unit – 2 (Natural Resources Management)	Natural Resources – Classification, Water Resources (availability, quality, water budget), Mineral Resources (distribution, availability and future perspectives), and Forest Resources. Energy Resources- Classification and alternatives of conventional energy resources- Solar, working of solar photovoltaic cells, Geothermal, Wind energy, Nuclear Energy, Biomass and Bio-gas	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	8
Unit – 3 (Water, Soil & Noise Pollution)	Water pollution – sources & effects, characteristics and treatment of waste water, engineered systems for water purification: Aeration, solid separation, settling operations, filtration and disinfection. Soil - formation of soil, elementary and mineral composition, types of soil in India, soil pollution, effects and abatements. Noise Hazards: Continuous and impulse noise, Effect of noise on man, Measurement and evaluation of Noise, noise isolation and absorption techniques, silencers, practical aspects of noise.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	8
Unit –4 (Atmospheric chemistry and Air Pollution)	Classification, sources and toxic effects of air pollutants, dispersal of air pollutants, engineered systems for air purification: Atmospheric cleansing process, approaches to contamination control. Air pollutants with emphasis on reactive intermediates in atmosphere like hydroxyl radical, ozone and nitrate radical, types of hydrocarbon in the troposphere, reaction of organic compounds in the atmosphere.(Green house gas effect, Global warming, Climate change).	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures,Audio/Video clips, Group discussion.	8
Unit – 5 (Waste Management)	Solid waste: Generation and waste characterization. Collection, storage and transport. Waste disposal, waste processing techniques, reduction, reuse and recycling, resource recovery and utilization. Physical and chemical treatment methods and composting. Hazardous waste management and treatment.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion. Field visits. Industrial Visit (MSW/BMW/STP/ETP)	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	60	18	40	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Environmental Science by B. S. Chauhan; Firewall Media, 2008 • Environmental Science by Cuningham and Cuningham; McGraw-Hill Education; 13th edition (16 February 2014) • Environmental Engineering by S. K. Dhameja; S. K. Kataria & Sons, 2009 • Environmental Science by Richard T Wright; Benjamin-Cummings Pub Co.
Articles	
References Books	Environmental Engineering by Howards S Peavy, Donald R Rowe, T. George • Environmental Science & Engineering by Gilbert M. Master • Environmental Chemistry by Stanley
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	2	2	-	-	-	2	-	-	1	-	1
CO2	1	2	1	2	2	2	-	-	-	2	-	-	1	-	3
CO3	2	1	1	-	1	-	-	-	-	-	-	-	3	2	3
CO4	2	2	-	2	1	-	-	-	-	-	-	-	2	3	3
CO5	2	2	-	2	1	-	-	-	-	-	-	-	2	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-MechanicalEngineering

Title of the Course	Environmental Pollution and global issues
Course Code	MCL0201[T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					3	1	0	4
Course Type	Theory only							
Course Category	Foundation core							
Pre-Requisite/s	Basic knowledge of natural resources, biodiversity, ecological succession, energy flow, environmental issues and problems.			**Co-Requisite/s**	A detailed understanding of the complexity of environment and its challenges and solutions to these problems and challenges.			
Course Outcomes & Bloom's Level	**CO1-** CO1. Develop environmental scientists and engineers and sensitize them towards environmental issues.**(BL2-Understand)** **CO2-** CO2. To acquire analytical skills in assessing environmental impacts through a multidisciplinary approach**(BL3-Apply)** **CO3-** CO3. Ability to distinguish between various methods of various pollution analysis**(BL4-Analyze)** **CO4-** CO4.Acquire expertise and skills needed for the Environmental Management Systems and techniques of monitoring, Environment audit, Environmental Impact Analysis, environment instrumentation and control systems and for the projects development, implementation, and maintenance.**(BL5-Evaluate)** **CO5-** CO5. Students acquire skills for to communicate, prepare, plan and implement the environmental management project**(BL6-Create)**							
Coures Elements	Skill Development ✕ Entrepreneurship ✕ Employability ✓ Professsonal Ethics ✓ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG5(Gender equality) SDG6(Clean water and sanitation) SDG7(Affordable and clean energy) SDG12(Responsible consuption and production) SDG13(Climate action) SDG15(Life on land)				

Part B

Modules	Contents	Pedagogy	Hours
1 (Environment, Ecosystem and Environmental Education)	Environment – Definition and its segments, (Lithosphere, Hydrosphere, Atmosphere and Biosphere), Multidisciplinary nature of Environmental Science, Ecology and Ecosystem: Basic concepts, functions of ecosystem, Energy Flow, Food chain, food web, Ecological Pyramids, Ecological Successions. Environmental Education- Definition, scope, importance, Need for Public Awareness, Environmental Ethics. Environmental Impact Assessment: Screening, Scoping, Base line Analysis, Impact Mitigation, Documentation, Review, Public hearing, Post Project Monitoring.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, discussion (questions & answers section)	8
2 (Natural Resources Management)	Natural Resources – Classification, Water Resources (availability, quality, water budget), Mineral Resources (distribution, availability and future perspectives), and Forest Resources. Energy Resources- Classification and alternatives of conventional energy resources- Solar, working of solar photovoltaic cells, Geothermal, Wind energy, Nuclear Energy, Biomass and Bio-gas	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	8
3 (Water, Soil & Noise Pollution)	Water pollution – sources & effects, characteristics and treatment of waste water, engineered systems for water purification: Aeration, solid separation, settling operations, filtration and disinfection. Soil - formation of soil, elementary and mineral composition, types of soil in India, soil pollution, effects and abatements. Noise Hazards: Continuous and impulse noise, Effect of noise on man, Measurement and evaluation of Noise, noise isolation and absorption techniques, silencers, practical aspects of noise.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	8
4 (Atmospheric chemistry and Air Pollution)	Classification, sources and toxic effects of air pollutants, dispersal of air pollutants, engineered systems for air purification: Atmospheric cleansing process, approaches to contamination control. Air pollutants with emphasis on reactive intermediates in atmosphere like hydroxyl radical, ozone and nitrate radical, types of hydrocarbon in the troposphere, reaction of organic compounds in the atmosphere.(Green house gas effect, Global warming, Climate change).	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures,Audio/Video clips, Group discussion.	8
5 (Waste Management)	Solid waste: Generation and waste characterization. Collection, storage and transport. Waste disposal, waste processing techniques, reduction, reuse and recycling, resource recovery and utilization. Physical and chemical treatment methods and composting. Hazardous waste management and treatment.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion. Field visits. Industrial Visit (MSW/BMW/STP/ETP)	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	Environmental Science by B. S. Chauhan; Firewall Media, 2008 • Environmental Science by Cuningham and Cuningham; McGraw-Hill Education; 13th edition (16 February 2014) • Environmental Engineering by S. K. Dhameja; S. K. Kataria & Sons, 2009 • Environmental Science by Richard T Wright; Benjamin-Cummings Pub Co.
Articles	
References Books	Environmental Engineering by Howards S Peavy, Donald R Rowe, T. George • Environmental Science & Engineering by Gilbert M. Master • Environmental Chemistry by Stanley
MOOC Courses	https://onlinecourses.swayam2.ac.in/cec21_ge08/preview
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	2	2	-	-	-	2	-	-	1	-	1
CO2	1	2	1	2	2	2	-	-	-	2	-	-	1	-	3
CO3	2	1	1	-	1	-	-	-	-	-	-	-	3	2	3
CO4	2	2	-	2	1	-	-	-	-	-	-	-	2	3	3
CO5	2	2	-	2	1	-	-	-	-	-	-	-	2	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-ComputerScience

Title of the Course	Environmental Science & Global Issues
Course Code	MCL0201[T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Embedded theory and lab							
Course Category	Ability Enhancement Courses							
Pre-Requisite/s	Should be acquainted with the basics knowledge of environment and its management			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember the concept of different types of environmental challenges and associated technologies and measures to control it.**(BL1-Remember)** **CO2-** Develop environmental scientists and engineers and sensitize them towards environmental issues.**(BL2-Understand)** **CO3-** To acquire analytical skills in assessing environmental impacts through a multidisciplinary approach**(BL3-Apply)** **CO4-** Ability to distinguish between various methods of various pollution analysis**(BL4-Analyze)** **CO5-** Acquire expertise and skills needed for the Environmental Management Systems and techniques of monitoring, Environment audit, Environmental Impact Analysis, environment instrumentation and control systems and for the projects development, implementation, and maintenance. They also able to develop projects in view of Socio Cultural and behavioral aspects of Energy production and environmental changes The trained manpower in Environmental and Waste Management provide the environmental Auditors/ Managers/Consultants.**(BL5-Evaluate)** **CO6-** Students acquire skills for to communicate, prepare, plan and implement the environmental management project**(BL6-Create)**							
Coures Elements	Skill Development ✕ Entrepreneurship ✕ Employability ✕ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG1(No poverty) SDG2(Zero hunger) SDG3(Good health and well-being) SDG4(Quality education) SDG6(Clean water and sanitation) SDG7(Affordable and clean energy) SDG8(Decent work and economic growth) SDG11(Sustainable cities and economies) SDG13(Climate action) SDG14(Life below water) SDG15(Life on land)				

Part B

Modules	Contents	Pedagogy	Hours
1	Environment – Definition and its segments, (Lithosphere, Hydrosphere, Atmosphere and Biosphere) multidisciplinary nature of Environmental Science, Ecology and Ecosystem: Basic concepts, functions of ecosystem, Energy Flow, Food chain, food web, Ecological Pyramids, Ecological Successions. Environmental Education- Definition, scope, importance, Need for Public Awareness, Environmental Ethics. Environmental Impact Assessment: Screening, Scoping, Base line Analysis, Impact Mitigation, Documentation, Review, Public hearing, Post Project Monitoring.	Whiteboard, PPT, Video Case Study, Project Based Activity, Application Based Activity	8
2	Natural Resources – Classification, Water Resources and Forest Resources. Energy Resources- Classification-Conventional resources (Mineral, Oil, Coal, Gas and Thermal Power)-Non-conventional resources (Solar, Geothermal, Wind energy, Nuclear Energy, Biomass and Bio-gas). Environmentalists of India (Anupam Mishra, Sundarlal Bahauguna, Chandi Prasad Bhatt etc.).	Whiteboard, PPT, Video Case Study, Project Based Activity, Application Based Activity	8
3	Water pollution – sources & effects, characteristics and treatment of waste water, engineered systems for water purification: Aeration, solid separation, settling operations, filtration and disinfection. Soil - formation of soil, elementary and mineral composition, soil pollution, effects and abatements. Noise Hazards: Continuous and impulse noise, Effect of noise on man, Measurement and evaluation of Noise, noise isolation and absorption techniques, silencers, practical aspects of noise.	Whiteboard, PPT, Video Case Study, Project Based Activity, Application Based Activity	8
4	Classification, sources and toxic effects of air pollutants, dispersal of air pollutants, engineered systems for air purification: Atmospheric cleansing process, approaches to contamination control. Air pollutants with emphasis on reactive intermediates in atmosphere like Green house gas effect, Global warming, Climate change, Acid rain, Ozone layer depletion and Photochemical smog.	Whiteboard, PPT, Video Case Study, Project Based Activity, Application Based Activity	8
5	Solid waste: Generation and waste characterization. Collection, storage and transport. Waste disposal, waste processing techniques, reduction, reuse and recycling, resource recovery and utilization. Physical and chemical treatment methods and composting. Swachha Bharat Abhiyan. Sustainable Habitat: Green Building, GRIHA Rating Norms.	Whiteboard, PPT, Video Case Study, Project Based Activity, Application Based Activity	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	To measure the intensity of Noise at different places in the ITM University campus by using Sound Meter.	Experiments	BL4-Analyze	4
2	To analyze the grassland ecosystem and calculate the Important Value Index (IVI) by quadrate method.	Field work	BL2-Understand	4
3	To determine the TDS and Conductivity of the given water samples.	Experiments	BL4-Analyze	4
4	To determine the pH of given water and soil samples.	Experiments	BL4-Analyze	4
5	To determine the turbidity of given water samples.	Experiments	BL4-Analyze	4
6	To determine the Total Hardness of a given water sample by a complexometric method	Experiments	BL4-Analyze	4
7	To determine the strength of calcium ion in the given water sample.	Experiments	BL4-Analyze	4
8	To find out the amount of Dissolved Oxygen (DO) in the given sample of water.	Experiments	BL4-Analyze	4

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	0	40	12	60	30
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
60	30	20	10	20	10

Part E

Books	Environmental Science by B. S. Chauhan; Firewall Media, 2008 Environmental Science by Cuningham and Cuningham; McGraw-Hill Education; 13th edition (16 February 2014) Environmental Engineering by S. K. Dhameja; S. K. Kataria & Sons, 2009 Environmental Science by Richard T Wright; Benjamin-Cummings Pub Co.
Articles	
References Books	Environmental Engineering by Howards S Peavy, Donald R Rowe, T. George • Environmental Science & Engineering by Gilbert M. Master Environmental Chemistry by Stanley
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	1	2	3	1	2	1	1	2	1	3	3
CO2	-	-	-	-	-	-	2	-	-	-	-	-	1	-	1
CO3	1	-	-	2	2	-	-	-	-	-	-	-	1	2	2
CO4	-	-	-	-	-	3	3	2	-	-	1	-	1	2	-
CO5	-	-	-	-	-	-	-	1	-	-	-	-	1	2	3
CO6	-	-	-	-	-	-	-	1	-	-	-	-	1	2	3

Syllabus-2023-2024

BTech-CivilEngineering

Title of the Course	Environmental Pollution and Global Issues
Course Code	MCL0201[T]

Part A

Year	1st	**Semester**	2nd	**Credits**	L	T	P	C
					2	1	0	3
Course Type	Theory only							
Course Category	Foundation core							
Pre-Requisite/s	Basic knowledge of natural resources, biodiversity, ecological succession, energy flow, environmental issues and problems.			**Co-Requisite/s**	A detailed understanding of the complexity of environment and its challenges and solutions to these problems and challenges.			
Course Outcomes & Bloom's Level	**CO1-** CO1. Develop environmental scientists and engineers and sensitize them towards environmental issues.**(BL2-Understand)** **CO2-** CO2. To acquire analytical skills in assessing environmental impacts through a multidisciplinary approach**(BL3-Apply)** **CO3-** CO3. Ability to distinguish between various methods of various pollution analysis**(BL4-Analyze)** **CO4-** CO4.Acquire expertise and skills needed for the Environmental Management Systems and techniques of monitoring, Environment audit, Environmental Impact Analysis, environment instrumentation and control systems and for the projects development, implementation, and maintenance.**(BL5-Evaluate)** **CO5-** CO5. Students acquire skills for to communicate, prepare, plan and implement the environmental management project**(BL6-Create)**							
Coures Elements	Skill Development ✕ Entrepreneurship ✕ Employability ✕ Professsonal Ethics ✕ Gender ✕ Human Values ✓ Environment ✓		**SDG (Goals)**	SDG2(Zero hunger) SDG3(Good health and well-being) SDG5(Gender equality) SDG6(Clean water and sanitation) SDG7(Affordable and clean energy) SDG8(Decent work and economic growth) SDG10(Reduced inequalities) SDG11(Sustainable cities and economies) SDG12(Responsible consuption and production) SDG13(Climate action) SDG14(Life below water) SDG15(Life on land) SDG17(Partnerships for the goals)				

Part B

Modules	Contents	Pedagogy	Hours
Unit – 1 (Environment, Ecosystem and Environmental Education)	Environment – Definition and its segments, (Lithosphere, Hydrosphere, Atmosphere and Biosphere), Multidisciplinary nature of Environmental Science, Ecology and Ecosystem: Basic concepts, functions of ecosystem, Energy Flow, Food chain, food web, Ecological Pyramids, Ecological Successions. Environmental Education- Definition, scope, importance, Need for Public Awareness, Environmental Ethics. Environmental Impact Assessment: Screening, Scoping, Base line Analysis, Impact Mitigation, Documentation, Review, Public hearing, Post Project Monitoring.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, discussion (questions & answers section)	8
Unit – 2 (Natural Resources Management)	Natural Resources – Classification, Water Resources (availability, quality, water budget), Mineral Resources (distribution, availability and future perspectives), and Forest Resources. Energy Resources- Classification and alternatives of conventional energy resources- Solar, working of solar photovoltaic cells, Geothermal, Wind energy, Nuclear Energy, Biomass and Bio-gas	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	8
Unit – 3 (Water, Soil & Noise Pollution)	Water pollution – sources & effects, characteristics and treatment of waste water, engineered systems for water purification: Aeration, solid separation, settling operations, filtration and disinfection. Soil - formation of soil, elementary and mineral composition, types of soil in India, soil pollution, effects and abatements. Noise Hazards: Continuous and impulse noise, Effect of noise on man, Measurement and evaluation of Noise, noise isolation and absorption techniques, silencers, practical aspects of noise.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion.	8
Unit –4 (Atmospheric chemistry and Air Pollution)	Classification, sources and toxic effects of air pollutants, dispersal of air pollutants, engineered systems for air purification: Atmospheric cleansing process, approaches to contamination control. Air pollutants with emphasis on reactive intermediates in atmosphere like hydroxyl radical, ozone and nitrate radical, types of hydrocarbon in the troposphere, reaction of organic compounds in the atmosphere.(Green house gas effect, Global warming, Climate change).	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures,Audio/Video clips, Group discussion.	8
Unit – 5 (Waste Management)	Solid waste: Generation and waste characterization. Collection, storage and transport. Waste disposal, waste processing techniques, reduction, reuse and recycling, resource recovery and utilization. Physical and chemical treatment methods and composting. Hazardous waste management and treatment.	Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion. Field visits. Industrial Visit (MSW/BMW/STP/ETP)	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100		60	30	40	20
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	Environmental Science by B. S. Chauhan; Firewall Media, 2008 • Environmental Science by Cuningham and Cuningham; McGraw-Hill Education; 13th edition (16 February 2014) • Environmental Engineering by S. K. Dhameja; S. K. Kataria & Sons, 2009 • Environmental Science by Richard T Wright; Benjamin-Cummings Pub Co.
Articles	
References Books	Environmental Engineering by Howards S Peavy, Donald R Rowe, T. George • Environmental Science & Engineering by Gilbert M. Master • Environmental Chemistry by Stanley
MOOC Courses	
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	2	2	-	-	-	2	-	-	1	-	1
CO2	1	2	1	2	2	2	-	-	-	2	-	-	1	-	3
CO3	2	1	1	-	1	-	-	-	-	-	-	-	3	2	3
CO4	2	2	-	2	1	-	-	-	-	-	-	-	2	3	3
CO5	2	2	-	2	1	-	-	-	-	-	-	-	2	2	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-MechanicalEngineering

Title of the Course	Non-Conventional Energy resources
Course Code	MEE0705

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					2	1	0	3
Course Type	Theory only							
Course Category	Discipline Electives							
Pre-Requisite/s	Basic knowledge of energy and souses of energy.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To recall the energy conversion systems.**(BL1-Remember)** **CO2-** To understanding the solar thermal plate.**(BL2-Understand)** **CO3-** To apply the concept related to non conventional energy.**(BL3-Apply)** **CO4-** To analyze the energy conversion in non-conventional energy conversion in various fields.**(BL4-Analyze)** **CO5-** To evaluate the performance and efficiency of energy aspects on the basis of different parameters.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✕ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG7(Affordable and clean energy) SDG8(Decent work and economic growth)				

Part B

Modules	Contents	Pedagogy	Hours
Unit-1	General Introduction Various non-conventional energy resources–Introduction availability classification relative merits and demerits. Solar Cells Theory of solar cells. Solar cell materials. Solar cell array. Solar cell power plant imitation.	Lectures with white board and PPT, Quiz,Reportwriting,Case Based Assignments	8
Unit-2	Solar Thermal Energy Solar radiation flat plate collectors and their materials, applications and performance, focusing of collectors and their materials, application and performance. Solar thermal power plants. Thermal energy storage for solar heating and cooling limitations	Lectures with white board and PPT, Quiz,Reportwriting,Case Based Assignments	8
Unit-3	Geothermal Energy Resources of geothermal energy thermodynamics of geo-thermal energy conversion- electrical conversion non- electrical conversion environmental Magneto hydrodynamics (MHD) Principle of working of MHD power plant, Performance and limitations. Fuel Cells Principle of working of various types of fuel cells and their working, Performance and limitations.	Lectures with white board and PPT, Quiz,Reportwriting,Case Based Assignments	8
Unit-4	Thermo-electrical and thermionic conversions Principle of working, performance and limitations. Wind Energy; Wind power and its source, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems.	Lectures with white board and PPT, Quiz,Reportwriting,Case Based Assignments	8
Unit-5	Bio mass Ocean thermal energy conversion (OTEC) Availability, theory and working principle performance and limitations Wave and Tidal wave principle of working, performance and limitations. Water recycling plant.	Lectures with white board and PPT, Quiz,Reportwriting,Case Based Assignments	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	1. Raja etal, Introduction Non-Conventional energy resources" SciTech Publications. 2. Johan Twiden and Tony weir "Renewal energy resources "BSP Publications 2006. 3. D.S Chauhan " Non-Conventional energy resources" New Age International. 4. C.S Solanki" Renewal Energy Technology" A Practical Guide for Beginners" PHI.
Articles	
References Books	1. Ghosh and Mallick "Manufacturing Science" East West Press, 2010. 2. Jain R. K. "Production Technology" Khanna Publishers, 2001.
MOOC Courses	https://onlinecourses.nptel.ac.in/noc22_ge14/preview
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	2	2	3	-	3	3	-	1	3	-	3
CO2	3	-	2	2	1	2	2	-	3	3	2	-	3	3	3
CO3	2	-	2	1	3	-	3	1	2	1	-	2	3	3	3
CO4	1	2	2	3	2	2	2	1	-	-	1	2	3	-	3
CO5	1	2	1	3	2	-	2	-	-	-	-	1	3	-	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-MechanicalEngineering

Title of the Course	Alternative fuels and emission control
Course Code	MEE0710

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					2	1	0	3
Course Type	Theory only							
Course Category	Discipline Electives							
Pre-Requisite/s	Basic knowledge of applied chemistry, thermodynamics and IC engines			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** recall the basics of chemistry and thermodynamics**(BL1-Remember)** **CO2-** Describe the significance of alternative fuels over conventional fuels**(BL2-Understand)** **CO3-** Test the fuels in various engines**(BL3-Apply)** **CO4-** Analyze the performance of an engine under standard conditions with a specific alternative fuel**(BL4-Analyze)** **CO5-** Evaluate the various alternative fuels and their suitability with a specific engine and environment**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG7(Affordable and clean energy) SDG9(Industry Innovation and Infrastructure)				

Part B

Modules	Contents	Pedagogy	Hours
Unit-I	Introduction Alternate fuels and renewable sources of energy in automobile field -availabilities, Storage, Handling and Safety aspects- Costs and other factors.	Lectures with whiteboard/PPT, Quiz, Group discussion	8
Unit-III	Renewable sources of energies Introduction about the solar energy collectors- Concentrating, Flat plate collectors- application wind energy-Bio energy, Geo thermal energy- Chemical energy: Fuel cells, Batteries; Hydrogen energies- Energy conservations in sterling and heat pumps.	Lectures with whiteboard/PPT, Quiz, Group discussion	
Unit-IV	Pollutants: Sources from SI and CI Engines, Two Stroke (SI and CI) engine pollution formation; Indian Emission Standards for SI and CI engines; European Emission Standards Comparison with alternate fuel emissions.	Lectures with whiteboard/PPT, Quiz, Group discussion	
Unit-V	Pollution control Techniques and Test procedures: Optimization of operating factor- EGR Fumigation- Air injection-PCV system (opens Closed) Catalytic Converters-Catalyst use of unleaded petrol. Gas Analyzers-Different Smoke meters-Different test methods; Electric Vehicles-Simple layout-Traction batteries-Re charging methods-rating pollution factors, Fuel Cells.	Lectures with whiteboard/PPT, Quiz, Group discussion	8

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100		40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
	0				

Part E

Books	1. Ganesan V., Internal Combustion Engines. 2. Held P.M., High speed Combustion Engines 3. Rai,GD Non Conventional sources of Energy
Articles	
References Books	1. Obert E.F., Internal Combustion Engines. 2. SAE Transaction-Vehicle emission. 3. John. H. Jhonson, Diesel Particulate Emissions Landmark Research
MOOC Courses	https://www.mooc-list.com/tags/renewable-energy
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	3	1	3	3	2	1	1	1	1	3	2	2
CO2	2	2	1	2	2	3	3	2	1	2	1	2	3	2	2
CO3	3	3	3	3	3	3	3	2	2	2	3	3	3	3	3
CO4	3	3	3	3	2	2	3	2	1	2	2	2	3	3	3
CO5	3	3	3	3	2	3	3	2	2	3	2	3	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-MechanicalEngineering

Title of the Course	Vibration and Noise- Measurement and Control
Course Code	MEE0809

Part A

Year	4th	**Semester**	8th	**Credits**	L	T	P	C
					3	0	1	4
Course Type	Theory only							
Course Category	Discipline Electives							
Pre-Requisite/s	Prerequisites for the course "Mechanical Vibration and Noise" include a solid understanding of dynamics, mechanics of materials, and mathematics, particularly differential equations and linear algebra. Familiarity with mechanical systems and their behavior under varying loads is also essential.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember the basic of mechanical vibration and noise.**(BL1-Remember)** **CO2-** To Understand the mathematical model and determine the natural and forced frequency of mechanical system**(BL2-Understand)** **CO3-** To implement measurement of the free, Noise and forced vibration with damping**(BL3-Apply)** **CO4-** To analyze the theoretical concept of vibration in shock absorber**(BL4-Analyze)** **CO5-** To evaluate the applications of mechanical vibration and noise in various fields such as research, structure health monitoring and industries**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG4(Quality education)				

Part B

Modules	Contents	Pedagogy	Hours
Unit -1	Fundamental Aspects of Vibrations: Vibration, main causes, advantages and disadvantages; engineering applications of vibration and noise; vector method of representing harmonic motion; characteristics of vibration, harmonic analysis and beats phenomenon, work done by harmonic forces on harmonic motion; periodic, non-harmonic functions- Fourier series analysis; evaluation of coefficients of Fourier series; elements of vibratory system; lumped and distributed parameter systems. Undamped Free Vibrations: Undamped free vibration: Single degree of freedom Systems, introduction, undamped free vibration – Natural frequency' of free vibration, Rayleigh's method, stiffness of spring elements, effects of spring mass, Energy method, Newton's method and D' Alembert' s principle- problems	Audio/Video clips, group discussion, lecture with PPT, quiz	8
Unit -2	Damped Free Vibrations: Viscous damping: coefficient of damping; damping ratio; under damped, over damped and critically damped systems; logarithmic decrement; frequency of damped free vibration; Coulomb or dry friction damping; frequency, decay rate and comparison of viscous and Coulomb damping; solid and structural damping; slip or interfacial damping.	Audio/Video clips, group discussion, lecture with PPT, Review Analysis	8
Unit -3	Forced Vibration: Forced vibration: Single degree of freedom systems, steady state solution with viscous damping due to harmonic force solution by complex algebra, concept of response, reciprocating and rotating unbalance, vibration isolation Transmissibility ratio, energy dissipated by damping equivalent, Viscous damping, Structural damping, sharpness or resonance, base excitation. Whirling Motion and Critical Speed: Whirling motion and Critical speed: Definitions and significance .Critical –speed of a vertical , light –flexible shaft with single rotor : with and without damping .Critical speed of a shaft carrying multiple discs (without damping), Secondary critical speed.	Audio/Video clips, group discussion, lecture with PPT, Review Analysis	8
Unit -4	Systems With Two Degrees of Freedom : Un-damped free vibration of Two-D.O.F and Principal modes of vibration; torsion vibrations; Forced, Un-damped vibrations with harmonic excitation; Coordinate coupling; Dynamic vibration absorber; torsion Vibration Absorber; Pendulum type of dynamic vibration.	Audio/Video clips, group discussion, lecture with PPT, quiz	8
Unit -5	Noise Engineering – Subjective response of sound: Frequency and sound dependent human response; the decibel scale; relationship between, sound pressure level (SPL), sound power level and sound intensity scale; relationship between addition, subtraction and averaging, sound spectra and Octave band analysis; loudness; weighting networks; equivalent sound level, auditory effects of noise; hazardous noise, exposure due to machines and equipment's; hearing conservation and damage risk criteria, daily noise doze. Noise: Sources, Isolation and Control: Major sources of noise on road and in industries, noise due to construction equipments and domestic appliances, industrial noise control, strategies- noise control at source (with or without sound enclosures), noise control along the path (with or without partitions and acoustic barriers); noise control at the receiver, ear defenders, earplugs, semi-insert protectors.	Audio/Video clips, group discussion, lecture with PPT, quiz	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Fabrication of Model of Spring Mass System	PBL	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**

Part E

Books	Grover, G. K. (2009). Mechanical Vibrations. Nem Chand & Bros. Rao, S. S. (2011). Mechanical Vibrations. Pearson Education.
Articles	
References Books	Thomson, W. T. (2010). Theory of Vibration with Applications. Cengage Learning. Den Hartog, J. P. (1985). Mechanical Vibrations. Dover Publications.
MOOC Courses	https://archive.nptel.ac.in/courses/112/107/112107212/
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	2	-	-	3	3	-	-	3	-	2
CO2	3	-	2	1	1	3	-	-	3	3	-	-	3	2	2
CO3	2	-2	2	-	2	2	2	-	2	1	1	2	3	2	2
CO4	2	2	2	2	2	-	-	-	-	1	3	3	-	2	2
CO5	1	2	1	1	2	2	-	-	-	-	2	1	3	-	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-MechanicalEngineering

Title of the Course	Energy Conversion Systems
Course Code	MEL0411[T]

Part A

Year	2nd	**Semester**	4th	**Credits**	L	T	P	C
					2	1	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Students should have fundamental knowledge of thermodynamics, basic mathematics and physic.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** Recall the concepts of Basic Thermodynamics**(BL1-Remember)** **CO2-** Understating the concept of Energy conversion systems**(BL2-Understand)** **CO3-** Applying the basic concept of Heat Transfer**(BL3-Apply)** **CO4-** Analyzing the working of boilers, turbines, condensers**(BL4-Analyze)** **CO5-** Evaluating the working of boilers, turbines, condensers**(BL5-Evaluate)**							
Coures Elements	Skill Development ✕ Entrepreneurship ✕ Employability ✓ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG7(Affordable and clean energy) SDG9(Industry Innovation and Infrastructure)				

Part B

Modules	Contents	Pedagogy	Hours
Unit-1	Thermodynamic Relation: Thermodynamic Coordinates, Exact differentials, Mathematical conditions for exact differentials, Maxwell relations, Clausius Clayborn equation, its applications, Joule Thomson coefficient, Inversion curve, coefficient of volume expansion, adiabatic and Isothermal Compressibility	Lectures with white board/PPT, Quiz, Group discussion	8
Unit-2	Boilers: Definition, Classification, working of fire tube and water tube Boilers, Natural and forced Draught, Chimney height calculation, Mountings and accessories Air Preheater, feed water heater, super heater, Boiler efficiency, equivalent evaporation, Boiler trial, heat balance sheet.	Lectures with white board/PPT, Quiz, Group discussion	8
Unit-3	Steam nozzles: Flow through nozzles, variation of velocity, area and specific volume, conditions for maximum discharge, chocked flow, throat area, nozzle efficiency, effect of friction on nozzle, supe saturated flow. Condensers: Classification, Air leakage, performance, comparison, efficiency	Lectures with white board/PPT, Quiz, Group discussion	8
Unit-4	Steam Engines and Turbines: Introduction of steam engines, Classification, working of steam engine, Indicator Diagram, Impulse and reaction turbine, staging, stage and overall efficiencies, reheat factor, Bleeding, velocity diagrams, simple impulse and reaction turbine, Work done, comparison with steam engines, losses in steam turbines, Governing of turbines, Vapour Power Cycles: Comparison of Carnot and Rankine cycles, Effect of pressure and temperature on Rankine cycle, Reheat cycle, Regenerative cycle	Lectures with white board/PPT, Quiz, Group discussion	8
Unit-5	Gas turbines: Gas turbines classification, Brayton cycle, principles of gas turbine, gas turbine cycles with intercooling, reheat, regeneration and their combinations, stage efficiency, polytrophic efficiency, deviation of actual cycles from ideal cycle.	Lectures with white board/PPT, Quiz, Group discussion	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
Experiment -1	Study of Babcock and Wilcox Boiler	Experiments	BL4-Analyze	2
Experiment -2	Study of Fire Tube Boiler	Experiments	BL4-Analyze	2
Experiment -3	Study of Boiler Mountings	Experiments	BL4-Analyze	2
Experiment -4	Study of Accessories of Boiler Economizer	Experiments	BL4-Analyze	2
Experiment -5	Study of Other Mountings of the boiler	Experiments	BL4-Analyze	2
Experiment -6	Study of The Locomotive Boiler	Experiments	BL4-Analyze	2
Experiment -7	Study of The Pelton Wheel Turbine	Experiments	BL4-Analyze	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	D. Text Books P.K. Nag “Basic and Applied Thermodynamics” Tata MC Graw Hill.
Articles	
References Books	D. S. Kumar “Engineering Thermodynamics” First edition (June 2012)
MOOC Courses	https://onlinecourses.nptel.ac.in/noc23_ch76/preview
Videos	<

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	2	-	-	3	3	-	-	3	2	2
CO2	3	1	2	2	2	2	2	1	3	3	1	-	3	3	3
CO3	-	1	3	3	1	2	2	2	-	2	-	3	3	3	2
CO4	1	2	3	3	2	-	3	2	-	-	2	1	3	2	2
CO5	-	1	-	-	2	3	-	-	-	-	2	-	3	-	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-MechanicalEngineering

Title of the Course	IC Engines
Course Code	MEL0516[T]

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					2	1	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Knowledge of basic thermal science.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember basic principles of thermal sciences.**(BL1-Remember)** **CO2-** To understand the basic concept of thermodynamics, heat engines and air standard cycles.**(BL2-Understand)** **CO3-** To implement the knowledge of thermodynamics in determining the engine parameters.**(BL3-Apply)** **CO4-** To analyze the thermal efficiency of various cycles and cooling and lubrication systems.**(BL4-Analyze)** **CO5-** To evaluate the findings of analysis of supercharging, cooling and lubrication systems within permissible limits of pollutants.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**					

Part B

Modules	Contents	Pedagogy	Hours
Unit-I	Introduction to IC Engines: Definition of engine; classification, Application of IC Engines, Air Standard Cycle and deviation from air standard cycle actual cycle, indicator diagram, MEP, Shaft Power, Indicated Power.	Lectures with whiteboard/PPT, Recorded video/interactive videos	8
Unit-II	Actual working of IC engine: Introduction to fuel air cycles and their significance, composition of cylinder gases, variable specific heats, comparison of air standards & fuel air cycles, effect of operating variable like compression ratio, fuel air ratio, actual cycles and their analysis; difference between actual and fuel-air cycle; actual and fuel-air cycles for S.I. and C.I. engines. Working of 4 stroke petrol & diesel engines and their valve timing diagram, working of 2-stroke petrol & diesel engines & their valve timing diagrams, comparison of two stroke & four stroke engines, actual working of 2 & 4 stroke gas engines and their valve diagram	Lectures with whiteboard/PPT, Recorded video/interactive videos	8
Unit-III	Fuel and Combustion: Fuels for SI and CI engine, Important qualities of SI and CI engines fuels, rating of SI engines, and CI engines fuels, Dopes, Combustion in CI engines, ignition delay, knock and its control, combustion chamber design for CI engines. Combustion in SI engine, detonation, additives, Gaseous fuels, LPG, CNG, Biogas, producer gas, alternatives fuels for IC engines.	Lectures with whiteboard/PPT, Recorded video/interactive videos	8
Unit-IV	Fuel Supply System: Fuel supply system and fuel pumps, properties of air fuel mixture, a sample carburetor an its working, actual air fuel ratio of single jet carburetor, supercharger, introduction to petrol injection, fuel injection systems for C.I., cooling and lubricants of IC engines. Classification of injection systems, injection pump, fuel injection systems, Fuel Injector, Nozzle, Injection of S.I. Engines, Fuel Filters.	Lectures with whiteboard/PPT, Recorded video/interactive videos	8
Unit-V	Measurement and Testing: Measurement of shaft power, indicated power, measurement of speed, air consumption, fuel consumption, heat carried by cooling water, heat carried by the exhaust gases, Morse test heat balance sheet, governing of I.C. Engines, performance characteristics of I.C. Engines: Performance parameters, performance of S.I. Engines, performance of C.I. Engine.	Lectures with whiteboard/PPT, Recorded video/interactive videos	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Study of working of Two stroke Petrol engine	Experiments	BL2-Understand	2
2	Study of working of Two stroke Diesel engine	Experiments	BL2-Understand	2
3	Study of working of four- stroke Diesel engine	Experiments	BL2-Understand	2
4	Study of working of four- stroke Petrol engine	Experiments	BL2-Understand	2
5	To determine the efficiency and heat balance of petrol engine	Experiments	BL3-Apply	2
6	To determine the efficiency and heat balance of Dieselengine	Experiments	BL3-Apply	2
7	Study of brake dynamometer	Experiments	BL2-Understand	2
8	To determine brake power of Petrol engine	Experiments	BL3-Apply	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40		60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40		60	

Part E

Books	1. Sharma and Mathur, Internal Combustion Engines, Dhanpat Rai Publ.
Articles	
References Books	1 Heywood John, Fundamentals of IC Engines, McGraw Hill. 2 Ganeshan V. , Internal Combustion Engines Tata McGRaw Hill 3 Domkundwar, Internal Combustion Engines, Dhanpath Rai & Sons
MOOC Courses	https://ocw.mit.edu/courses/2-61-internal-combustion-engines-spring-2017/
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	3	3	1	-	1	3	3	1	1	1
CO2	3	3	3	1	-	3	3	1	-	1	3	3	1	1	1
CO3	3	3	3	2	2	3	3	1	-	-	3	3	2	2	2
CO4	3	3	2	3	2	3	3	2	2	2	3	3	3	3	3
CO5	3	3	3	3	2	3	3	2	2	2	3	3	3	3	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-MechanicalEngineering

Title of the Course	Fluid Machinery
Course Code	MEL0521[T]

Part A

Year	3rd	**Semester**	5th	**Credits**	L	T	P	C
					2	1	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	integral calculus and differential equations, so these courses are prerequisites. It also helps to have taken physics and thermodynamics prior to this course			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To recall concept of basic sciences and fluid mechanics**(BL1-Remember)** **CO2-** To Understand Components and operation; velocity triangles, work output**(BL2-Understand)** **CO3-** To apply fluid mechanics in Components and operation, velocity triangles and work output**(BL3-Apply)** **CO4-** To analyze Main elements and their functions; Various types and classification**(BL4-Analyze)** **CO5-** To evaluate new Components, working principle; pressure variations due to piston acceleration**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✓ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓	**SDG (Goals)**						

Part B

Modules	Contents	Pedagogy	Hours
1	Euler's turbomachinery equation, Specific speed, impulse and reaction principle, impulseMomentum principle, jet impingementon stationary and moving flat plates and vanes, calculation for force exerted, work done and efficiency of jet, basic components of turbo machinery and its classification.	Lectures with white board and PPT, Assignment	10
2	Components and operations, velocity triangles, work output, effective head, available power and efficiency, design aspects such as mean diameter of a wheel, Jet ratio, number of jets, number of buckets with working proportion	Lectures with white board and PPT,Quiz, Seminar	10
3	Component and operations, velocity triangle and work output, working proportions and design parameters for Runner, degree of reaction, draft tubes, its function and types, function and brief description of commonly used surge tanks.	Lectures with white board and PPT,Assignment, Poster presentation	8
4	Main elements and their function, periods types and classification, pressure change in a pump, suction, delivery and manometric head, vane shape and its effect on head capacity relationships, Departure from Euler's theory and losses, pump output and efficiency, minimum starting speed and impeller diameters at the inner and Outer periphery	Lectures with white board and PPT,Assignment, quiz	8
5	Components, working principles, pressure variation due to piston acceleration, acceleration effect in suction and delivery pipe, work done against friction, maximum permissible vacuum during suction stroke, Air vessel.	Lectures with white board and PPT,Quiz, seminar, Assignment	6

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	To verify momentum equation by impact of jet apparatus	Experiments	BL3-Apply	04
2	Study of Pelton turbine and perform experiment on Pelton turbine test rig	Experiments	BL4-Analyze	04
3	Study of Francis turbine	Experiments		04
4	Study of Kaplan turbine and perform experiment on Kaplan turbine test rig	PBL	BL6-Create	04
5	Study of centrifugal pump and perform the experiment on centrifugal pump test rig	Experiments	BL2-Understand	04
6	Study of Reciprocating pump and perform the experiment on reciprocation pump test rig	Experiments	BL5-Evaluate	04

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	Hydraulic Turbines, Daughaty R L, McGraw Hill Book Co.. A Text book of Fluid Mechanics and Hydraulic Machines, Rajput, R.K., S. Chand and Co., New Delhi
Articles	
References Books	Fluid Mechanics and Fluid Power Engineering by Kumar D S, S K Kataria and Sons, Delhi Hydraulic Machines by Jagdish Lal, Metropolitan Book Co Pvt. Ltd Fluid Mechanics and Hydraulic Machines, Bansal, R.K., Laxmi Publications, New Delhi
MOOC Courses	https://archive.nptel.ac.in/courses/112/105/112105206/
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	2	-	-	3	3	-	-	3	2	2
CO2	3	1	2	2	2	2	2	1	3	3	1	-	3	3	3
CO3	-	1	3	2	1	2	2	2	-	2	-	3	3	3	2
CO4	1	2	3	3	2	-	3	2	-	-	2	1	3	2	2
CO5	-	2	2	2	2	3	3	-	-	-	2	-	3	-	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-MechanicalEngineering

Title of the Course	Refrigeration and Air Conditioning
Course Code	MEL0723[T]

Part A

Year	4th	**Semester**	7th	**Credits**	L	T	P	C
					2	1	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Knowledge of thermodynamics and fluid mechanics			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To recall the concepts of Basic Thermodynamics.**(BL1-Remember)** **CO2-** To understating the concept of Energy conversion systems.**(BL2-Understand)** **CO3-** To applying the basic concept of Heat Transfer.**(BL3-Apply)** **CO4-** To determine the options of Refrigerants**(BL4-Analyze)** **CO5-** To evaluate the safe conditions of emission levels.**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✕ Employability ✕ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**					

Part B

Modules	Contents	Pedagogy	Hours
1	Introduction to refrigeration system, Methods of refrigeration, Carnot refrigeration cycle, Unit of refrigeration, Refrigeration effect and C.O.P. Open and closed air refrigeration cycles, Reversed Carnot cycle, Bell Coleman or Reversed Joule air refrigeration cycle, Boot strap refrigeration	Lectures with whiteboard/PPT, Quiz, Group discussion	10
2	Vapor Compression System, Single stage system, Analysis of vapor compression cycle, Use of T-S and P-H charts, Effect of change in suction and discharge pressures on C.O.P., Effect of sub cooling of condensate & superheating of refrigerant vapor on C.O.P. of the cycle, Actual vapor compression refrigeration cycle, Multistage vapor compression system requirements, Inter cooling, Different configuration of multistage system, Cascade system.	Lectures with whiteboard/PPT, Quiz, Group discussion	8
3	Principle of vapour absorption refrigeration system, Comparison between absorption and compression systems, Elementary idea of refrigerant absorbent mixtures, Temperature - concentration diagram and Enthalpy – concentration diagram, Adiabatic mixing of two streams, Ammonia – Water vapor absorption system, Lithium- Bromide water vapor absorption system, Comparison. Refrigerants: Classification, nomenclature, properties. Types of refrigerants	Lectures with whiteboard/PPT, Quiz, Group discussion	10
4	Introduction to air conditioning, Psychometric properties and their definitions, Psychometric chart, Different Psychometric processes, Effective temperature and comfort chart, Cooling and heating load calculations, Selection of inside and outside design conditions, Heat transfer through walls & roofs, Infiltration and ventilation, Internal heat gain, Sensible heat factor, By pass factor, Grand Sensible heat factor, Apparatus dew point.	Lectures with whiteboard/PPT, Quiz, Group discussion	8
5	Refrigeration and air conditioning equipment e. g. compressors, condensers, evaporators & expansion devices, air washers, cooling towers and humidifying efficiency, Cold storage and food preservation, Freezers, Ice plant, Water coolers, Basic difference between comfort and industrial air conditioning.	Lectures with whiteboard/PPT, Quiz, Group discussion	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
1	Study of VCRC	Experiments	BL2-Understand	03
2	To estimate COP of mechanical heat pump and refrigerator	Experiments	BL3-Apply	03
3	To study VARC	Experiments		03
4	To estimate COP of vapor compression ice plant	Experiments	BL4-Analyze	03
5	Estimate performance of window air conditioning system	Experiments	BL5-Evaluate	03
6	Study of 2 stage reciprocating air compressor	Experiments	BL6-Create	03
7	To study element of air conditioning system	Experiments	BL5-Evaluate	03
8	Study about various refrigerant	PBL	BL3-Apply	03

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	Refrigeration and Air Conditioning Technology Modern Refrigeration and Air Conditioning
Articles	
References Books	1 Hooman Gohari Air Conditioning and Refrigeration Repair Made Easy McGraw-Hill Education
MOOC Courses	https://onlinecourses.nptel.ac.in/noc22_me135/preview
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	1	1	2	2	-	-	3	3	-	-	3	2	2
CO2	3	1	2	2	2	2	2	1	3	3	1	-	3	3	3
CO3	3	2	2	2	1	2	2	2	2	1	-	3	3	3	3
CO4	1	3	3	3	2	-	3	2	-	-	3	2	3	2	2
CO5	-	2	2	2	2	3	3	-	-	-	2	-	3	-	3
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus-2023-2024

BTech-MechanicalEngineering

Title of the Course	Automobile Engineering
Course Code	MEL0825[T]

Part A

Year	4th	**Semester**	8th	**Credits**	L	T	P	C
					2	1	1	4
Course Type	Embedded theory and lab							
Course Category	Discipline Core							
Pre-Requisite/s	Basic knowledge of engine parts. body of vehicle and thermodynamics.			**Co-Requisite/s**				
Course Outcomes & Bloom's Level	**CO1-** To remember basic parts of I C Engines**(BL1-Remember)** **CO2-** To Understand Transmission and Braking system**(BL2-Understand)** **CO3-** To Apply the knowledge of Braking System & Electrical System. in automobile**(BL3-Apply)** **CO4-** To analyze the braking and suspension system in automobile. **(BL4-Analyze)** **CO5-** To evaluated and summarize the braking, suspension, power transmission and Automobile Air Conditioning..**(BL5-Evaluate)**							
Coures Elements	Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professsonal Ethics ✕ Gender ✕ Human Values ✕ Environment ✓		**SDG (Goals)**	SDG7(Affordable and clean energy) SDG9(Industry Innovation and Infrastructure)				

Part B

Modules	Contents	Pedagogy	Hours
Unit-1	Power Unit: Design and Principles of major components, valve mechanism, power and torque characteristics, rolling, air and gradient resistance, tractive effort, gearbox, gear ratio determination, design of gear box.	Lectures with whiteboard/PPT, Quiz, Group discussion	8
Unit-2	Transmission: Requirements, clutches, torque converters, overdrive and free wheel, universaljoint, differential gear mechanism of rear axle, automatic transmission, steering, and front axle, castor angle, wheel camber and toe-in, toe-out etc, steering geometry, Ackerman mechanism, under steer and over steer.	Lectures with whiteboard/PPT, Quiz, Group discussion Lectures with whiteboard/PPT, Quiz, Group discussion	8
Unit-3	Braking System: General requirements, Road tyre adhesion, weight transfer, braking ratio, mechanical brakes, hydraulic Chassis and Suspension System: Loads on the frame, strength and stiffness,brakes, vacuum and air brakes, thermal aspects. Electrical System: Types of starting motors, generator and regulators, lighting system, ignition system, horn, battery.	Lectures with whiteboard/PPT, Quiz, Group discussion	8
Unit-4	Introduction to Electric Vehicles: Electric Vehicle – Need – Types, Electric Vehicle Technology – layouts, Batteries – overview and its types. Charging – Methods and Standards. Alternate charging sources – Wireless & Solar, Hybrid Electric vehicles – Classification – Micro, Mild, Full, Plug-in, EV.	Lectures with whiteboard/PPT, Quiz, Group discussion	8
Unit-5	Automobile Air Conditioning: Requirements, cooling and heating systems. Cooling and lubrication System: Different type of cooling system and lubrication system Fuel Supply System: Diesel & Petrol vehicle system such as fuel injection pump, injector and fuel pump, carburetor, MPFI	Lectures with whiteboard/PPT, Quiz, Group discussion	8

Part C

Modules	Title	Indicative-ABCA/PBL/ Experiments/Field work/ Internships	Bloom's Level	Hours
Experiment-1	To Study of Automobile Chasis.	Experiments	BL2-Understand	2
Experiment-2	To Study of differential mechanism of an Automobile	Experiments	BL2-Understand	2
Experiment-3	To Study of multiple clutch of an Automobile.	Experiments	BL2-Understand	2
Experiment-4	To Study and demonstration of different circuit of carburettor.	Experiments	BL2-Understand	2
Experiment-5	To Study of the electrical system of Automobile.	Experiments	BL2-Understand	2
Experiment-6	To Study of the Torque convertor.	Experiments	BL2-Understand	2

Part D(Marks Distribution)

Theory					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	40	40	12	60	
Practical					
Total Marks	**Minimum Passing Marks**	**External Evaluation**	**Min. External Evaluation**	**Internal Evaluation**	**Min. Internal Evaluation**
100	50	40	20	60	

Part E

Books	1. Automobile Engineering, Kripal Singh 2. Automotive Engineering, Hietner 3 Automotive Mechanics, Crouse
Articles	
References Books	1. Automobile Engineering,Narang 2. Automobile Engineering, Newton and Steeds. 3 Jack Erjavec and Jeff Arias, “Hybrid, Electric and Fuel Cell Vehicles”, Cengage Learning, 2012
MOOC Courses	https://archive.nptel.ac.in/courses/107/106/107106088/
Videos	

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	2	-	-	3	3	-	-	3	-	2
CO2	2	-	1	2	1	2	-	-	3	3	-	-	3	2	2
CO3	1	-	2	1	1	-	-	-	2	1	-	-	3	2	2
CO4	-	1	2	3	1	-	-	-	-	-	-	-	3	-	2
CO5	-	1	1	2	1	-	-	-	-	-	-	-	3	-	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-