



ATMA MALIK INSTITUTE OF TECHNOLOGY AND RESEARCH (AMRIT)

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Key Indicator 1.3 - Curriculum Enrichment

Sub criteria 1.3.1 Institution integrates crosscutting issues relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability into the Curriculum.

Sr. No.	Description
1.	Cross cutting issues integration in the curriculum through various courses and activity

Dr. S. M. Munde

Academic Dean

Prof. G. E. Chavan

Vice-Principal

Dr. D. D. Shinde

Principal



Atma Malik Institute of Technology and Research
Mohili-Aghai, Thane, Maharashtra

1.3.1 Cross cutting Issues addressed In Curriculum

Sr. No.	Description of Cross Cutting Issue	Title of Course wherein the issue is addressed	Course Code	Unit no.	Remarks
1	Environment & Sustainability	Environmental Engineering	CEC604	Unit I: Quality of Water Unit II: Treatment of Water UNIT III: Drainage & Rainwater Harvesting UNIT IV: Domestic sewage and Sewerage System UNIT V: Sewage Treatment Unit VI : Air Pollution, Noise pollution and Solid waste management	Rationale behind this course is to make every civil engineer to be acquainted with the principles of Public health engineering, purification of water, design of sewage treatment and to develop rational approach towards sustainable waste management. The course also lays emphasis on the knowledge of Air and Noise pollution.
2	Environment & Sustainability	Engineering Geology	CEC303	Unit I: Introduction & Physical Geology Unit VI: Geological Disasters and Control Measures	To explain the concepts of Geology and its application for safe, stable and economic design of any civil engineering structure and Interpret the causes of geological hazards and implement the knowledge for their prevention
3	Environment & Sustainability	Water Resource Engineering	CEC602	Unit IV: Dams & Spillways Unit V: Irrigation Channels	This course helps students to analyze and design gravity dams and eatheren dams with spillways for sustainable development.
4	Environment & Sustainability	Solid and Hazardous Waste Management	CEDLO7022	Unit I: Municipal Solid Waste Management Unit II: Waste Segregation, storage, collection & Transport Unit III: Waste processing techniques and Energy Recovery Unit IV: Landfills for disposal of waste Unit V: Hazardous waste management Unit VI: Assorted Solid Waste	To achieve sustainable development proper solid waste management should be subjected to various types of waste treatments for obtaining value added products. Robust implementation of planned facilities for reuse, recycling, maximum resource recovery from various waste facilities, combined with safe residual waste disposal through sanitary landfills, incineration and novel methods of composting is initiated.
5	Environment & Sustainability	Green Building Constructions	CEDLO7024	Unit I : Environmental impact of buildings and concept of sustainable development Unit III: Water Conservation and Energy Efficiency Unit IV: Green building materials and Indoor Environmental Quality Unit VI: Green audit and Green retrofitting	Green building construction practices aim to reduce the environmental impact of building as the building sector has the greatest potential to deliver significant cuts in emissions at little or no cost. As civil engineering graduates, it is of utmost importance to have a deep understanding of the concepts and technologies involved in the sustainable development with respect to the construction industry. It is also further desirable for the graduates to have an indepth knowledge of the green rating systems as well as green auditing & green retrofitting – which will have tremendous scope in the future.



Principal

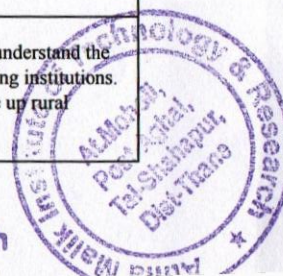
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6	Environment & Sustainability	Industrial Waste Treatment	CEDLO8015	Unit I: Introduction to industrial waste and treatments Unit III: Waste minimization Unit IV: Wastewater Treatments for Industries Unit VI: Environmental Impact assessment	Industrial wastewater is much more polluted than the domestic wastewater and hence has to be treated with the efficient choice of treatment units by preventing pollution of natural streams and rivers. The rationale behind this course is to enable students to understand the impact of industrial wastewater on natural streams. To enable the students to understand legislative framework for the remediation of industrial wastewater through environmental audit, environmental impact assessment and common effluent treatment plant.
7	Environment & Sustainability	Internal combustion engine	MEC501	UNIT V: Exhaust emission & Fuels	Role of Mechanical Engineers Understand the study & analysis of engine performance characteristics and engine emission
8	Environment & Sustainability	Energy Audit & Management	ILO7018	Unit II: Energy audit principles Unit III: Energy Conservation in Electrical System Unit IV: Energy Management and Energy Conservation in Thermal Systems	To study general aspects of energy management, economics & auditing. To Identify and describe basic principles and methodologies adopted in energy audit of an utility.
9	Environment & Sustainability	Power Plant engineering	MEDLO8041	Unit II:-Hydro electric power plant Unit III:-Steam Power plant Unit V:- Nuclear power plant Unit VI:- Power plant economics	To study Discuss types of reactors, waste disposal issues in nuclear power plants & Illustrate power plant economics
10	Environment & Sustainability	Refrigeration & air conditioning	MEC604	Unit II-Vapour compression refrigeration system	To study working and operating principles of Vapour Compression and Vapour absorption systems.
11	Environment & Sustainability	Heating Ventilation Air Conditioning and Refrigeration	MEC603	Unit II: Vapour Compression and Absorption refrigeration Unit VI: Application of HVAC&R	To study working and operating principles of Vapour Compression and Vapour absorption systems and apply the knowledge of HVAC for the sustainable development of refrigeration and air conditioning systems.
12	Environment & Sustainability	Renewable Energy Systems	MEDLO8043	Unit I: Introduction to Energy Sources Unit II: Solar Energy Unit III: Wind Energy Unit IV: Energy from Biomass Unit V: Geothermal Energy and Ocean Unit VI: Hydrogen Energy	Role of Mechanical Engineer will be able to demonstrate need of different renewable energy sources, discuss importance of renewable energy sources, discuss various renewable energy sources in Indian context, calculate and analyse utilization of solar and wind energy, illustrate design of biogas plant, demonstrate basics of hydrogen energy.
13	Environment & Sustainability	Environmental Management	ILO8019	Unit II: Global Environmental concerns Unit III: Concepts of Ecology Unit IV: Environment Quality Management Unit VI: General overview of major legislations	Learner will be able to understand the concept of environmental management, understand ecosystem and interdependence, food chain etc., understand and interpret environment related legislations.



14	Environment & Sustainability	Engineering Chemistry -I	FEC103	Unit VI: Water	Analyze the quality of water and suggest suitable methods of treatment.
15	Environment & Sustainability	Engineering Chemistry -II	FEC203	Unit V : Green Chemistry and Synthesis of Drugs Unit VI : Fuels and Combustion	Illustrate the principles of green chemistry and study environmental impact. Explain the Knowledge of determining the quality of fuel and quality the Oxygen required for combustion of fuel.
16	Environment & Sustainability	Product Life cycle management	ECCILO7011	Unit V: Integration of Environmental Aspects in Product Design	This course covers issues such as Sustainable Development, Design for Environment, Need for Life Cycle Environmental Strategies.
17	Professional Ethics	Professional communication and Ethics-II	ECL 504	Unit V: Interpersonal Skills Unit VI: Corporate Ethics	Learners would be able to develop creative thinking and interpersonal skills required for effective professional communication and would be able to apply codes of ethical conduct, personal integrity and norms of organizational behaviour.
18	Professional Ethics	Professional communication and Ethics-I	FEC206	Unit I: Communication at Workplace Unit IV: Personality development and social etiquettes	This Course helps learner to demonstrate the fundamental concepts of interpersonal and professional communication. It also helps to inculcate confident personality traits and to learn social etiquettes. To learn responsibility in using social media , showing empathy and respect, learning accountability and accepting criticism.
19	Professional Ethics	Industrial Skills	MEL703	Unit II: Aptitude and Logical Reasoning Unit III:Developing Metacognitive skills Unit IV:Collaborative Techniques:Team building skills Unit V: GD – PI	Role of Mechanical engineer will able to learn how to navigate tasks and execute functions in G-suite, understand and practice metacognitive skillsof creativity and problem solving, hone team building and leadership skills.
20	Professional Ethics	Management Information Systems	ECCILO 7013	Unit III: Ethical issues and Privacy	This module helps to inculcate professional ethics to maintain security of Information.
21	Professional Ethics	Cyber Security & Laws	ECCILO7016	Unit I: Introduction to Cybercrime Unit II: Cyber offenses & Cybercrime	This course aware learner about issues of cybercrime and the related Indian act. It helps to develop a sense of ethics too.
22	Professional Ethics	Project Management	ECCILO8011	Unit VI: Project Leadership and Ethics	This course gives Introduction to project leadership, ethics in projects, Multicultural and virtual projects.
23	Professional Ethics	Professional Ethics & CSR	ECCILO8015	Unit I: Professional Ethics & Business Unit II: Professional Ethics in the Marketplace and Environment Unit III: Professional Ethics of Consumer Protection and Job Discrimination	This course helps learner to demonstrate professional ethics and understand its importance in business
24	Human Values	Development Engineering	ECCILO7019	Unit I: Introduction to Rural Development Unit III: Sustainable Rural development Unit V: Values in Planning Profession	This course is an exploration of human values, to understand the nature and type of human values relevant to planning institutions. Learners will be able to develop confidence to take up rural projects activities independently

Principal





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Environment and Sustainability

Semester-VI

Course Code	Course Name	Credits
CEC604	Environmental Engineering	04

Contact Hours			Credits Assigned			
Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
04	-	-	04	-	-	04

Theory					Term Work/Practical/Oral			Total
Internal Assessment			End Sem Exam	Duration of End Sem Exam	Term Work	Pract.	Oral	
Test-I	Test-II	Average						
20	20	20	80	3 Hours	-	-	-	100

Rationale

Every civil engineer must be acquainted with the principles of public health engineering purification of water, sewage collection, design of water and sewage treatment and develop rational approaches towards sustainable waste management via appropriate treatment and reuse. The course deals with the overall features and study of treatment of water, building drainage, rain water harvesting, sewage treatment processes and solid waste management. The course also lays emphasis on the knowledge of Air and Noise pollution.

Objectives

- 1 To demonstrate the necessary knowledge and concepts in the fields of water supply and quality of water.
- 2 To impart necessary skill for the design and operation of various units of water treatment facilities.
- 3 To recognize the necessary knowledge of good plumbing system, building drainage and rainwater harvesting.
- 4 To demonstrate the necessary knowledge on domestic sewage and Sewerage system.
- 5 To develop a flow Content for sewage treatment and design its units.
- 6 To impart the basic understanding of Air pollution, noise pollution and solid waste so as to control its adversity on ambient environment.



Detailed Syllabus

Module	Course Module / Contents		Periods
1	Water Supply and Quality Of Water		04
	1.1	Water supply: Water supply systems, water resources, types of intake structures, distribution systems of water and distribution layouts.	
	1.2	Quality of water: Introduction to pure water: potable, wholesome, palatable, distilled, polluted and contaminated water, drinking water standards and characteristics of water, water borne diseases.	
2	Water Treatment		15
	2.1	WTP: Typical layout of WTP, Aeration, Types of Aeration systems, sedimentation, types of settling, tube settlers, design of sedimentation tank.	
	2.2	Coagulation and flocculation: Principle of coagulation, flocculation, Clari flocculator, coagulants aids.	
	2.3	Filtration: rapid sand filters, operation, cleaning and back-washing, Entire design of rapid gravity filter with under drainage system. Pressure filter: Construction and operation	
	2.4	Disinfection: Different methods of disinfection, chlorination and chemistry of chlorination, chlorine demand, free and combined chlorine, various forms of chlorine, types of chlorination. Numerical to calculate quantity of required chlorine doses.	
	2.5	Advanced and Miscellaneous Treatments: Water softening by lime soda process and by base exchange method, Reverse Osmosis, Activated carbon, Membrane filtration, Removal of Iron and Manganese.	
3	Building Water Supply, Drainage and Rainwater Harvesting		04
	3.1	Building water supply: Water demands, Per capita Supply, Service connection from main, Water meter.	
	3.2	Building drainage: basic principles, traps-types, location and function, Systems of Plumbing, anti siphonic and vent pipes.	
	3.3	Rainwater harvesting: Need for rainwater harvesting, Annual potential, Roof-top rain water harvesting. Numerical on annual rainwater harvesting potential.	



4	Domestic Sewage and Sewerage System:		08
	4.1	Sewage: Introduction to domestic sewage, and storm water, System of sanitation, Physical and chemical characteristics, decomposition of sewage, BOD, COD, numerical on BOD. MPCB norms for disposal of sewage effluent.	
	4.2	Sewerage system: Systems of sewerage and their layouts: Separate, Combined and partially combined system, merits and demerits, self-cleaning velocity and non-scouring velocity, Sewer- Shape, hydraulic design of sewers, Laying and testing of sewers, manhole-location, necessity, types and drop manhole, ventilation	
5	Sewage Treatment		15
	5.1	Treatment processes: Objective, methods of treatment, flow sheets showing Preliminary, Primary, Secondary and Tertiary treatment. Primary treatment: Screening, Grit removal, Oil and Grease removal, settling tank.	
		Secondary Treatment Methods: Trickling filter- Principle, Process description and Design of trickling filter. Activated sludge process (ASP) - Principle, Process description, Recirculation of sludge, (numerical), Sludge volume index.	
	5.2	Introduction to Biological Treatment: Aerated lagoons, Oxidation ponds, oxidation ditches.	
		Self-purification of natural waterbodies: Oxygen economy, Disposal of treated effluent. Disposal of Raw and treated sewage on land and water, DO sag curve.	
	5.3	Rural and Low-cost sanitation: Septic Tank and Soak Pit – Operation, suitability and Design	
6	Air Pollution, Noise Pollution and Municipal Solid Waste Management		06
	6.1	Air pollution: Composition of air, Quantification of air pollutants, Air quality standards, Effect of air pollution on Environment, Introduction to Air pollution control devices.	
	6.2	Noise pollution: Basic concept and measurement, Effects of noise, and control methods, and numerical on sound level.	
	6.3	Municipal Solid Waste Management: Sources, storage, treatment, disposal, 5R Principles.	
Total			52



Contribution to Outcome

On completion of this course, the students will be able to:

- 1 Analyse the quality of water and make outline of water Supply scheme.
- 2 Design the various units of water treatment plant and apply the advanced, miscellaneous treatments whenever necessary.
- 3 Build service connection of water supply from main and building drainage system at construction site along with rain water harvesting layout.
- 4 Analyse and plan sewerage system along with test for sewer line.
- 5 Design the units of sewage treatment plant. Also, able to apply the knowledge of low-cost treatment and stream sanitation.
- 6 Understand air pollution, noise pollution and functional elements of solid waste management.

Internal Assessment

20 Marks

Consisting of two Compulsory Class Tests –

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in first test).

Average of marks will be considered for IAE.

End Semester Examination

80 Marks

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

- 1 Question paper will comprise of total six questions, each carrying 20 marks.
- 2 Question 1 will be compulsory and should cover maximum contents of the curriculum.
- 3 Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).
- 4 Only Four questions need to be solved.

Site Visit:

The students will visit to sewage treatment plant/ water treatment plant in the nearby vicinity or in the city and prepare detailed report thereof. This report will form a part of the term work

Recommended Books:

- 1 Water Supply Engineering: S. K. Garg, Khanna Publication.
- 2 Water Supply Engineering: P.N. Modi, Rajsons Publication.
- 3 Water Supply and Sanitary Engineering: S.K. Hussain, Oxford & IBH Publication, New Delhi
- 4 Environmental Engineering: B. C. Punmia, Laxmi Publications, New Delhi.
- 5 Solid waste management in developing countries: A.D. Bhide and B.B. Sundaresan
- 6 Environmental Engineering Vol II- Sewage Disposal and Air Pollution Engineering: S. K. Garg, Khanna Publishers New Delhi
- 7 Wastewater Treatment- Concepts and Design Approach: G. L. Karia and R. A. Christian
- 8 Integrated solid waste management, Tchobanoglous, Theissen and Vigil, McGraw Hill Publication.



Semester-III

Course Code	Course Name	Credits
CEC 303	Engineering Geology	3

Contact Hours			Credits Assigned			
Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
3		-	3		-	3

Theory					Term Work/Practical/Oral			Total
Internal Assessment			End Sem Exam	Duration of End Sem Exam	TW	PR	OR	
Test-I	Test-II	Average						
20	20	20	80	3 hrs		-		100

Rationale

Engineering geology is an applied geology discipline that involves the collection, analysis, and Interpretation of geological data and information required for the safe development of civil works. The objective of this course is to focus on the core activities of engineering geologists – site characterization, geologic hazard identification and mitigation. Through lectures, labs, and case study examination student will learn to couple geologic expertise with the engineering properties of rock in the characterization of geologic sites for civil work projects.

Understanding of the foundation rocks and structures present in them is of utmost importance for the safety and stability of Civil engineering structures. The study also helps in the assessment of groundwater, oil and gas and mineral resource evaluation.

Objectives

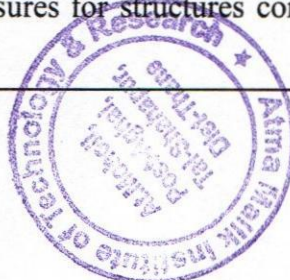
1. To acquire basic knowledge of Geology and to understand its significance in various civil engineering projects.
2. To study minerals and rocks in order to understand their fundamental characteristics and engineering properties.
3. To study structural geology for characterization of site, analysis and report geologic data using standards in engineering practice.
4. To study methods of subsurface investigation, advantages and disadvantages caused due to geological conditions and assessment of site for the construction of civil structures.
5. To study rock mass characterization for the construction of tunnels and assessment of rock as source of ground water.
6. To study the control of geology over the natural hazards and their preventive measures.



Detailed Syllabus

Module		Course Modules / Contents	Periods
1		Introduction & Physical Geology	5
	1.1	Branches of geology useful to civil engineering, Importance of geological studies in various civil engineering Projects. Departments dealing with this subject in India and their scope of work- GSI, Granite Dimension Stone Cell, NIRM.	
	1.2	Internal structure of the Earth and use of seismic waves in understanding the interior of the earth. Theory of Plate Tectonics.	
	1.3	Weathering types, Erosion and Denudation. Factors affecting weathering and product of weathering (engineering consideration) Superficial deposits and its geological Importance.	
	1.4	Brief study of geological action of wind, glacier and river.	
2		Mineralogy and Petrology	7
	2.1	Identification of minerals with the help of physical properties, rock forming minerals, megascopic identification of primary and secondary minerals, study of common ore minerals.	
	2.2	Igneous Petrology - Mode of formation, Texture and structure, form of Igneous rocks, Classification of Igneous rocks, study of commonly occurring igneous rocks, Engineering aspect of Granite and Basalt.	
	2.3	Sedimentary Petrology - Mode of formation, Textures, characteristics of shallow water deposits like lamination, bedding, current bedding etc., classification, study of commonly occurring sedimentary rocks and their engineering application.	
	2.4	Metamorphic Petrology - Mode of formation, agents and types of metamorphism, structures and textures of metamorphic rocks, classification and study of commonly occurring metamorphic rocks and their engineering application.	
3		Structural Geology and Stratigraphy	12
	3.1	Dip and Strike. Outcrop and width of outcrop. Inliers and Outliers. Type of discontinuities in the rocks. Fold: Terminology, Classification on the basis of position of axial plane, Criteria for their recognition in field and engineering consideration. Fault: Terminology, Classification on the basis of movement of faulted block, Criteria for recognition in field, effects on outcrops and Engineering consideration.	

		Joints & Unconformity: Types and geological importance. Three point problems to determine attitude of the strata	
	3.2	Determination of thickness of the strata with the help of given data.	
	3.3	Geological Maps and their application for civil engineering works, Identification of symbols in maps.	
	3.4	General principles of Stratigraphy, geological time scale, Physiographic divisions of India and their characteristics. Stratigraphy of Deccan Volcanic Province.	
4	Geological Investigation, study of dam and reservoir site:		7
	4.1	Required geological consideration for selecting dam and reservoir site. Favorable & unfavorable conditions in different types of rocks in presence of various structural features, precautions to be taken to counteract unsuitable conditions.	
	4.2	Electrical resistivity and Seismic method of geological investigation. Rock Quality Designation and its importance to achieve safety and economy of the projects like dams and tunnels.	
	4.3	Borehole problems and their significance in determining subsurface geology of the area.	
5	Tunnel Investigation and Ground Water Control		5
	5.1	Importance of geological considerations while choosing tunnel sites and alignments of the tunnel, safe and unsafe geological and structural conditions.	
	5.2	Geo-mechanics classification (RMR) and its application.	
	5.3	Sources, zones, water table, unconfined, confined and Perched water tables. Factors controlling water bearing capacity of rocks, Pervious and Impervious rocks, Different types of rocks as source of ground water. Artesian well (flowing and non-flowing). Cone of Depression and its use in Civil engineering.	
6	Geological Disasters and Control Measures		3
	6.1	Landslides-Types, causes and preventive measures for landslides, Landslides in Deccan region.	
	6.2	Volcano- Central type and fissure type, products of volcano.	
	6.3	Earthquake- Terminology, Earthquake waves, construction and working of seismograph, Earthquake zones of India, elastic rebound theory, Preventive measures for structures constructed in Earthquake prone area.	



Contribution to Outcome

On completion of this course, the students will be able to:

- 1) Explain the concepts of Geology and its application for safe, stable and economic design of any civil engineering structure.
- 2) Interpret the lithological characters of the rock specimen and distinguish them on the basis of studied parameters.
- 3) Describe the structural elements of the rocks and implement the knowledge for collection and analysis of the geological data.
- 4) Interpret the geological conditions for the dam site and calculate RQD for the assessment of rock masses.
- 5) Analyze the given data and suggest rock mass rating for assessment of tunnelling conditions.
- 6) Interpret the causes of geological hazards and implement the knowledge for their prevention.

Internal Assessment (20 Marks):

Consisting **Two Compulsory Class Tests** - First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination (80 Marks):

Weightage of each module in end semester examination will be proportional to number of respective lecturehours mentioned in the curriculum.

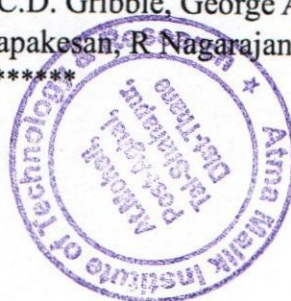
- 1) Question paper will comprise of total **six questions, each carrying 20 marks.**
- 2) **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
- 3) **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
- 4) Only **Four questions need to be solved.**

Recommended Books:

- 1) Text book of Engineering Geology: N. Chenna, Kesavulu, Mc-Millan.
- 2) Text book of Engineering and General Geology, 8th edition (2010): Parbin Singh, S K Kataria & Sons.
- 3) Text book of Engineering Geology: P. K. Mukerjee, Asia.
- 4) Text book of Engineering Geology: Dr. R. B. Gupta, Pune Vidyarthi Griha
- 5) Prakashan, Pune.
- 6) Principles of Engineering Geology: K. M. Banger.

Reference Books:

- 7) A Principles of Physical Geology: Arthur Homes, Thomas Nelson Publications, London.
- 8) Structural Geology, 3rd edition (2010): Marland P. Billings, PHI Learning Pvt. Ltd. New Delhi
- 9) Earth Revealed, Physical Geology: David McGeeary and Charles C. Plummer
- 10) Principles of Geomorphology: William D. Thornbury, John Wiley Publications, New York.
- 11) Geology for Civil Engineering: A. C. McLean, C.D. Gribble, George Allen & Unwin London.
- 12) Engineering Geology: A Parthasarathy, V. Panchapakesan, R Nagarajan, Wiley India 2013.



Semester-VI

Course Code	Course Name	Credits
CEC602	Water Resources Engineering	03

Contact Hours			Credits Assigned			
Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
03	-	-	03	-	-	03

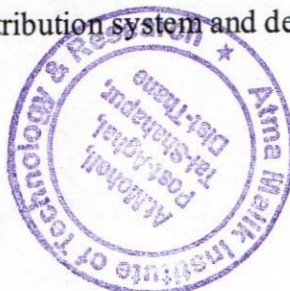
Theory					Term Work/Practical/Oral			Total
Internal Assessment			End Sem Exam	Duration of End Sem Exam	Term Work	Pract.	Oral	
Test-I	Test-II	Average						
20	20	20	80	3 Hours	-	-	-	100

Rationale

India is an agricultural country where majority of population lives in villages so agricultural industry is the backbone of Indian economy. Being a tropical country with large temporal and spatial variation of rainfall and availability of rainfall only for three to four months, irrigation is strongly needed in India. To satisfy this need, enhancing the irrigation facilities in the country is required. This course provides necessary knowledge and information about various irrigation methods as well as water requirements of crops, hydrologic processes, control level fixation of dams and reservoirs and hydraulics of wells. In addition to this, it provides necessary knowledge about analysis and design of gravity dams and earthen dams, different silt theories related to irrigation channels, detailed classification of canal head-works and its distribution system and finally discusses about different canal structures and cross drainage works.

Objectives

- 1 To study different irrigation engineering methods and water requirement of crops.
- 2 To study hydrological cycle, its elements and plotting of hydrographs.
- 3 To study and calculate discharge from aquifers.
- 4 To study control level fixation for reservoir, Dams i.e., gravity dam, its various components and analysis and suitable conditions of earthen dam and its seepage analysis.
- 5 To study importance of silt theories and its design considerations.
- 6 To study Canal headwork, its distribution system and design of canal structures.



Detailed Syllabus

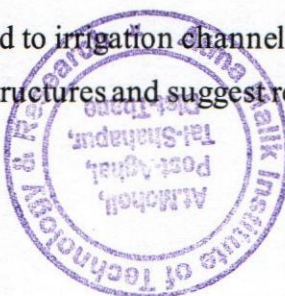
Module	Course Module / Contents		Periods
1	Irrigation Methods and Water Requirement of Crops		07
	1.1	National water policy. Introduction to irrigation and need of irrigation, Benefits of irrigation and ill effects of irrigation, types of Irrigation Projects: minor, medium and major irrigation projects and National water policy.	
	1.2	Methods of Irrigation Systems: Surface irrigation and different techniques of water distribution for surface irrigation, Subsurface irrigation, sprinkler irrigation and drip irrigation.	
	1.3	Water Requirement of Crops: Crops and crop seasons in India, delta and duty of crops, relationship between delta and duty of crops. Soil water relationship and its significance from irrigation considerations, root zone soil water, infiltration, consumptive use, frequency of irrigation.	
2	Hydrology		07
	2.1	Hydrologic cycle, Precipitation: Forms and Types of precipitations.	
	2.2	Measurement of rainfall by rain gauges and stream flow measurement. calculation of missing rainfall data and adequacy of rain gauge stations.	
	2.3	Runoff: Runoff- factors affecting runoff, computation of runoff, yield of the catchment runoff hydrograph, flood discharge and its calculations.	
	2.4	Hydrograph: Flood hydrograph- Its components and base-flow separation, Unit hydrograph, application of unit hydrograph, methods of deriving unit hydrograph, S-hydrograph and its application.	
3	Ground Water and Well Hydraulics		05
	3.1	Ground water resources and occurrence of ground water.	
	3.2	Well hydraulics: steady state flow conditions in wells.	
	3.3	Equilibrium equations for confined and unconfined aquifer.	
	3.4	Aquifer tests.	
	3.5	Difference between open well and tube well, Well Losses	
4	Dams and Spillways		09
	4.1	Reservoir, various zones of storage reservoir, control level fixation for a reservoir. Introduction to reservoir sedimentation and control measures.	
	4.2	Gravity Dams: Definition, typical cross section and components of gravity dam, forces acting on gravity dam, modes of failure	

		of gravity dam, structural stability analysis of gravity dam, elementary and practical profile of gravity dam, low and high gravity dam, galleries in gravity dam – Function of gallery and different cross-sections of gallery adopted in practice, joints in gravity dam. control of cracking in concrete dams.	
	4.3	Earthen Dam: Types of earthen dams and methods of construction of earthen dam, causes and failures of earthen dams, seepage line/phreatic line for different conditions and its location using graphical method, seepage control through embankment and through foundations.	
	4.4	Spillways: Introduction, types of spillways – its working and functionality.	
5	Irrigation Channels (Silt Theories)		06
	5.1	Kennedy's theory and method of channel designs silt supporting capacity according to Kennedy's theory.	
	5.2	Lacey's regime theory and application of Lacey's theory for designing channel cross-section.	
	5.3	Comparison between Kennedy's theory and Lacey's theory.	
	5.4	Drawbacks of Kennedy's theory and Lacey's theory.	
	5.5	Introduction to sediment transport in channels.	
6	Canal Headwork-Distribution System and Canal Structures		05
	6.1	Canal Headwork and Distribution System: Classification of canals, canal alignment, canal losses, canal lining, water logging and remedial measures for water logging.	
	6.2	Canal Structures Canal Falls and types of canal falls, canal escapes and types of canal escapes, canal regulators and types of canal regulators, canal outlets and types of canal outlets, cross drainage works and types of cross drainage work.	
Total			39

Contribution to Outcome

On completion of this course, the students will be able to:

- 1 Describe National water Policy, Calculate Crop water requirement and Classify various types and methods of irrigation.
- 2 Estimate flood discharge and Runoff by traditional and modern usage tools for planning and management of water resources projects.
- 3 Apply knowledge on ground water, well hydraulics to estimate the safe yield and ground water potential
- 4 Analyze and design gravity dams and earthen dams with spillways for sustainable development
- 5 Compare different silt theories related to irrigation channel and design the same.
- 6 Classify and Explain various canal structures and suggest remedial measures for water logging to save fertile irrigation



Internal Assessment**20 Marks**

Consisting of two Compulsory Class Tests –

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in first test).

Average of marks will be considered for IAE.

End Semester Examination**80 Marks**

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

- 1 Question paper will comprise of total six questions, each carrying 20 marks.
- 2 Question 1 will be compulsory and should cover maximum contents of the curriculum.
- 3 Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).
- 4 Only four questions need to be solved in total.

Recommended Books:

- 1 Irrigation and Water Power Engineering: B.C. Punmia, Pande B.B.Lal, A.K Jain. Laxmi Publications Pvt, Ltd. New Delhi.
- 2 Irrigation Engineering and Hydraulic Structures: S.K. Ukarande, Ane Books Pvt. Ltd. ISBN-9789383656899.
- 3 Irrigation Water Resources and Water Power Engineering: P.N. Modi, Standard Book House, Delhi, ISBN 978-81-87401-29-0.
- 4 Irrigation Engineering and Hydraulics Structures: S. K. Garg, Khanna Publishers. Delhi.
- 5 Design of Irrigation Structures: S. K. Sharma, S. Chand and Co.
- 6 Theory and Design of Irrigation Structures: R. S. Varshney and R, C. Gupta, Nem Chand
- 7 Engineering for Dams, Vol. I to III: Crager, Justin and Hinds, John Wiley
- 8 Design of Small Dams: USBR.
- 9 Hydro Power Structures: R. S. Varshney, Nem Chand and Bross.
- 10 Concrete Dams: R. S. Varshney, Oxford and IBH Publishing Co.



Semester VII

Course Code	Course Name	Credits
CEDLO7022	Department Optional Course-4 Solid and Hazardous Waste Management	03

Contact Hours			Credits Assigned			
Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
03	--	--	03	--	--	03

Theory					Term Work/Practical/Oral			Total
Internal Assessment			End Sem Exam	Duration of End Sem Exam	Term Work	Pract.	Oral	
Test-I	Test-II	Average						
20	20	20	80	03 Hrs.	--	--	--	100

Rationale

Management of solid and Hazardous waste is a challenge for all developed and developing nations. Measures like proper collection, segregation, treatment, and solid waste disposal needs more attention in today's world. To achieve sustainable development proper solid waste management should be subjected to various types of waste treatments for obtaining value added products. Robust implementation of planned facilities for reuse, recycling, maximum resource recovery from various waste facilities, combined with safe residual waste disposal through sanitary landfills, incineration and novel methods of composting is initiated.

Objectives

1. To understand functional elements of solid waste management and its need.
2. To explain the segregation and transportation of municipal solid waste.
3. To recognize waste disposal methods and energy recovery techniques.
4. To comprehend the necessary knowledge and concepts of landfill for disposal.
5. To understand hazardous waste management through its safe handling and disposal.
6. To identify assorted types of solid waste.



Detailed Syllabus

Module	Course Module / Contents		Periods
I	Municipal Solid Waste Management		06
	1.1	Sources, Types, Quantities, Composition, sampling of wastes, Properties of wastes, Numericals related to moisture content, density and Energy content, Problems and issues of solid waste management - Need for solid waste management- Awareness programme, Legal issues related to solid waste disposal	
	1.2	Functional Elements of SWM- waste generation (factors affecting), storage, collection, transfer and transport, processing, recovery and disposal in the management of solid waste. 7R concept	
II	Waste Segregation, Storage, Collection and Transport		06
	2.1	Segregation - wet and dry method, Volume reduction at source, Recycling and Reuse of waste, Methods of collection - House to House collection, On site storage of municipal solid waste, Hauled container and stationary container system, Collection routes; Optimization of transportation routes, Numericals on container and collection systems.	
	2.2	Transfer station -Significance, Site selection, Types, Material Recovery facility	
III	Waste processing techniques and Energy Recovery		06
	3.1	Waste transformation- Biological and Thermal Biological Conversion Technologies – Composting, Factors affecting for composting, Various Composting Methods as Indore and Bangalore, Vermi, Mechanical and In vessel composting, Numericals on aerobic and anaerobic composting	
	3.2	Thermal conversion technologies – Incineration, Pyrolysis, Gasification, Refuse derived fuel	
IV	Landfills for Disposal of Waste		07
	4.1	Landfill Classification-Sanitary, Secure and Bioreactor, Design criteria for landfill site selection, operation and maintenance, Landfill methods -Trench, Area, Slope	
	4.2	Leachate generation, Characteristics and it's control methods. Landfill gas management and landfill closure	
	4.3	IoT in solid waste management	
V	Hazardous Waste Management		07
	5.1	Sources, Characteristics and classification of hazardous wastes, Storage, Handling, Collection, Transportation and Minimization, Need for Hazardous Waste Management	
	5.2	Treatment and Disposal Hazardous Site remediation – onsite and offsite Techniques.	



		Hazardous waste management using secure landfill, Disposal practices in Indian Industries, Hazardous Waste Management Rules 2016.	
VI	Assorted Solid Wastes		
	6.1	Biomedical waste Need for Biomedical Waste Management, Sources, Classification, Storage and Segregation- Color coding, Collection and Transportation, Treatment and Disposal. Latest Biomedical waste management rules. Electronic Waste Types, Component separation, Collection, Recycling and Recovery, E-waste management techniques and Latest E- waste management rules	07
	6.2	Plastic Waste Problems related to plastic wastes, Plastic waste management- Recycling & recovery, Energy production, Plastic waste management- Rules and Regulation Construction and Demolition waste Composition, Recycling and reduction, Proper Management	

Contribution to Outcome

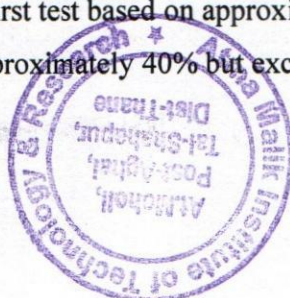
After the completion of the course the learner should be able to:

1. Acquire the knowledge of functional elements of solid waste management.
2. Illustrate solid waste collection system, route optimization techniques, transfer station and processing of solid waste.
3. Develop the ability to plan waste minimization and processing of solid waste.
4. Explain approaches to treat the solid waste in the most effective manner for sustainable development.
5. Discuss safe methods of handling, management and disposal of hazardous waste.
6. Summarize waste management techniques used for assorted solid waste

Internal Assessment

20 Marks

Consisting Two Compulsory Class Tests - First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test



Semester – VII								
Course Code			Course Name					Credits
CEDLO7024			Department Level Optional Course-4: Green Building Constructions					03
Contact Hours			Credits Assigned					
Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total		
03	--	--	03	--	--	03		
Theory				Term Work/Practical/Oral				Total
Internal Assessment			End Sem Exam	Duration of End Sem Exam	TW	PR	OR	
Test-I	Test-II	Average						
20	20	20	80	3 hours	--	--	--	

Rationale

Globally, buildings are responsible for a huge share of energy, electricity, water and materials consumption. As of 2018, buildings account for 28% of global emissions or 9.7 billion tonnes of CO₂. The United Nations' 2020 global status report and other sources detail that around 35 - 40% of globally generated energy was used by buildings; which also contributed to 33% of worldwide emissions. If new technologies in construction are not adopted during this time of rapid growth, emissions could double by 2050, according to the United Nations Environment Program. Green building construction practices aim to reduce the environmental impact of building as the building sector has the greatest potential to deliver significant cuts in emissions at little or no cost. As civil engineering graduates, it is of utmost importance to have a deep understanding of the concepts and technologies involved in the sustainable development with respect to the construction industry. It is also further desirable for the graduates to have an in-depth knowledge of the green rating systems as well as green auditing & green retrofitting – which will have tremendous scope in the future.

Objectives

1. To outline the environmental impact of buildings
2. To explain the concepts of sustainable development and green building
3. To summarize the features of green buildings
4. To explain green building rating systems
5. To describe green audit
6. To explain green retrofitting



Detailed Syllabus		
Module	Course Modules / Contents	Duration
I	Introduction	3
	1.1. Environmental impact of buildings, concept of sustainable development, concept of green buildings, necessity of green buildings, benefits of green buildings	
	1.2. Overview of features of green building – design and construction efficiency, water efficiency, energy efficiency, materials efficiency, indoor environmental quality, waste reduction, operations and maintenance	
	1.3. Examples of green buildings	
II	Site Selection, Planning and Design	8
	2.1. Site preservation	
	2.2. Passive architecture	
	2.3. Soil erosion control	
	2.4. Natural topography and on-site vegetation	
	2.5. Preservation of transportation of trees on-site	
	2.6. Heat island reduction	
	2.7. Optimization in structural design	
	2.8. Innovation in design process	
III	Water Conservation and Energy Efficiency	10
	3.1. Rainwater harvesting	
	3.2. Water efficient plumbing fixtures	
	3.3. Irrigation systems	
	3.4. Wastewater treatment and reuse	
	3.5. Water metering	
	3.6. Wastewater reuse during construction	
	3.7. Minimum and enhanced energy efficiency	
	3.8. Commissioning plan for building equipment and systems and post-installation	
	3.9. On-site and off-site renewable energy	
	3.10. Energy Metering and Management	
IV	Green building materials and indoor environmental quality	10
	4.1. Sustainable building materials	
	4.2. Use of certified green building materials, products & equipment	
	4.3. Segregation of waste, organic waste management and handling of waste materials	
	4.4. Fresh air ventilation	
	4.5. CO ₂ monitoring	
	4.6. Day lighting	
	4.7. Minimizing of indoor and outdoor pollutants	
	4.8. Low-emitting materials	
	4.9. Occupant well-being facilities	



	4.10	Indoor air quality testing, after construction and before occupancy	
	4.11	Indoor air quality management	
V	Green building rating systems		4
	5.1.	Introduction to green building rating systems	
	5.2.	Overview of various green building rating systems	
	5.3.	Indian Green Building Council (IGBC) rating system – overview, benefits of new green buildings, overview of certification process and project checklist	
VI	Green audit and green retrofitting		4
	6.1.	Green audit: pre-audit, on-site audit and post-audit report	
	6.2.	Case study of any one green audit	
	6.3.	Green retrofit – overview, components of green retrofit: integrated design, occupant behaviour, lighting retrofits, HVAC retrofits, window retrofits, green roof retrofits	

Contribution to Outcomes

On completion of this course, students will be able to:

1. Explain environmental impact of buildings, discuss the concepts of sustainable development & green buildings and overview the features of green buildings
2. Describe site selection, planning and designing of green buildings
3. Explain water conservation and energy efficiency in green buildings
4. Identify green building materials and indoor environmental quality
5. Apply green building rating systems
6. Understand green audit and green retrofitting

Internal Assessment (20 Marks):

Consisting **Two Compulsory Class Tests**

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

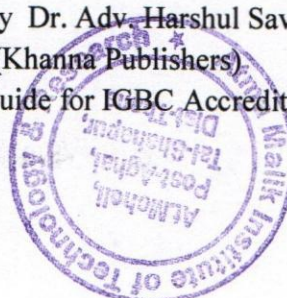
End Semester Examination (80 Marks):

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total six questions, each carrying 20 marks.
2. Question 1 will be compulsory and should cover maximum contents of the curriculum.
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only four questions need to be solved.

Recommended Books:

1. Green Building: Principles and Practices by Dr. Adv. Harshul Savla (Notion Press)
2. The Idea of Green Building by A. K. Jain (Khanna Publishers)
3. Green Building Guidance: The Ultimate Guide for IGBC Accredited Professional



Semester VIII

Course Code	Course Name	Credits
CEDLO8015	Department Optional Course 5: Industrial Waste Treatment	03

Contact Hours			Credits Assigned			
Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
03	--	--	03	--	--	03

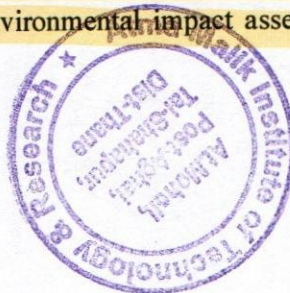
Theory					Term Work/Practical/Oral			Total
Internal Assessment			End Sem Exam	Duration of End Sem Exam	Term Work	Pract.	Oral	
Test-I	Test-II	Average						
20	20	20	80	3 Hrs.	--	--	--	100

Rationale

Industrial wastewater is much more polluted than the domestic wastewater and hence has to be treated with the efficient choice of treatment units by preventing pollution of natural streams and rivers. Wastewater treatments may not suffice only with primary treatments until they are modified and supplemented by additional techniques because of toxic chemicals. Industries are therefore generally prevented by legal aspects, from discharging their untreated effluents. It becomes mandatory for industries to treat their wastewater in their individual treatment plant or common effluent treatment plant before discharging their waste on land, lake, river, municipal sewer, streams as the case may be.

Objectives

1. To enable the students to understand quality, characteristics, toxicity of industrial wastewater and its effects on streams.
2. To enable the students to understand the impact of industrial wastewater on natural streams.
3. To enable the students to understand waste minimization techniques for industrial wastewater.
4. To enable the students to understand the necessary knowledge and concepts of biological treatment and advanced/emerging techniques.
5. To enable the students to understand various industrial manufacturing process, effluents and treatments.
6. To enable the students to understand legislative framework for the remediation of industrial wastewater through environmental audit, environmental impact assessment and common effluent treatment plant.



Detailed Syllabus

Module	Course Module / Contents	Periods
I	Introduction to industrial waste and treatments: Sources and types of industrial wastewater, Effects of industrial wastewater on streams and wastewater treatment plants. Population equivalence, generation rates, characterization, important contaminants of concern from industries. Toxicity and Bioassay tests. Regulation for protection of streams. BOD Numericals.	06
II	Stream Protection Measures: Stream and effluent standards, stream sampling, stream sanitation, Procedures for improving stream water quality, zones of pollution, oxygen sag curve, Streeter Phelps Equation and numerical.	06
III	Waste minimization: 3.1 Minimizing effects of industrial waste water: Volume reduction and Strength reduction 3.2 Equalization, Neutralization, Proportioning, Precipitation, Coagulation and flocculation. Flotation - Oil separation and Emulsion breaking.	06
IV	Wastewater treatments for industries 4.1 Biological treatments: Aerobic and Anaerobic biological treatment methods (Ponds, lagoons, UASB, RBC). Sludge dewatering techniques- Filter Press, Vacuum Filtration, Sludge thickening, Membrane filtration and Centrifuge. 4.2 Advanced treatments: Need for advance technologies, Automated Chemostat Treatment (ACT) Soil Biotechnology (SBT) Reed Bed Technology (RBT) Ozonation	06
V	Industries and wastewater management: Raw material, Manufacturing process and flowsheets, sources of effluents, characteristics, ETP, byproduct recovery for following industries: ● Sugar ● Distillery	10

	• Tannery • Dairy • Paper and Pulp • Metal Processing Industry (Electroplating)	
VI	Legal Aspects, Environment Management Tools and Common Treatment Facility for industries	05
	6.1 Environmental Impact Assessment, Case Study.	
	6.2 Environmental Audit for industries.	
	6.3 Common Effluent Treatment Plants (CETPs): Flow chart, Location, Need, Operation & Maintenance Problems and Economical aspects. Case study.	

Contribution to Outcome

Having completed this course, the students shall acquire the knowledge of biological treatment and will be able to decide and select precise treatment for particular waste. The students shall be able to determine and design the treatment facilities and assess the guidelines for disposing of waste. They shall be able to formulate approaches to treat waste water in the most effective manner for contamination removal.

After the completion of the course the learner should be able to:

1. Understand the impact of industrial wastewater characteristics on natural streams.
2. Analyze various stream protections measures to protect the natural streams.
3. Summarize waste minimization techniques for industrial wastewater.
4. Relate biological treatment concept and summarize various treatments along with advance technologies.
5. Understand waste water generated during manufacturing process and decide the suitable treatment for effluents.
6. Understand legislative framework for the remediation of industrial wastewater through environmental audit, environmental impact assessment and common effluent treatment plant.

Internal Assessment:

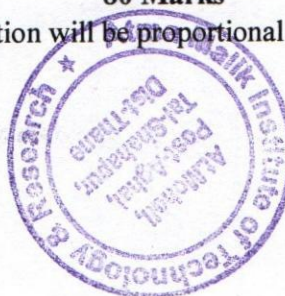
20 Marks

Consisting Two Compulsory Class Tests - First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

80 Marks

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.



Course Code	Course/Subject Name	Credits
MEC501	Internal Combustion Engines*	4

Objectives

1. To familiarize with the working of S.I. and C.I. engines and its important systems
2. To acquaint with the various methods for measurement of engine performance
3. To provide insight into the harmful effects of engine pollutants and its control
4. To familiarise with the latest technological developments in engine technology

Outcomes: Learner will be able to...

1. Demonstrate the working of different systems and processes of S.I. engines
2. Demonstrate the working of different systems and processes of C.I. engines
3. Illustrate the working of lubrication, cooling and supercharging systems.
4. Analyse engine performance
5. Illustrate emission norms and emission control
6. Comprehend the different technological advances in engines and alternate fuels

Module	Detailed Contents	Hrs.
01	Introduction Classification of I.C. Engines; Parts of I.C. Engine and their materials, Cycle of operation in Four stroke and Two-stroke IC engines and their comparative study; Fuel air cycles and their analysis, Actual working cycle, Valve Timing Diagram. LHR Engines, Homogeneous charge compression Ignition, Rotary engine-Six stroke engine concept	06
02	S.I. Engines Fuel Supply System: Spark ignition Engine mixture requirements, Fuel-Air ratio, Simple carburettor and auxiliary circuits (excluding mathematical analysis of carburettors) Injection systems: Single-point and Multipoint injection, Gasoline Direct Injection Ignition System: Battery Ignition System, Magneto Ignition System, Functions and working of ignition coil, spark plug, contact breaker point, Requirements and working of Ignition advance mechanisms; mechanical and vacuum, Electronic Ignition Systems; Capacitor Discharge Ignition System, Transistorized Coil Assisted Ignition System, Transistor Ignition system with contactless breaker Combustion : Combustion phenomenon in SI Engines, Ignition delay, Flame propagation, Pressure-Crank angle diagram, Abnormal combustion, Auto ignition, Detonation and Knocking, Factors affecting combustion and detonation, Types of combustion chambers	12
03	Compression Ignition Engines Fuel Injection Systems: Air injection systems, Airless/solid injection systems, Common rail, individual pump, distributor and unit systems. Injection pumps, Fuel injector, Types of nozzle, Electronically controlled unit fuel injection system Combustion: Combustion phenomenon in C I engines, Stages of combustion, Delay period, Knocking, Pressure-Crank angle diagram, Factors affecting combustion and knocking, Types of combustion chambers	10
04	Engine lubrication: Types of lubricants and their properties, SAE rating of lubricants, Types of lubrication systems Engine Cooling: Necessity of engine cooling, disadvantages of overcooling, Cooling systems and their comparison: Air cooling, Liquid cooling Supercharging/Turbo-charging: Objectives, Limitations, Methods and Types, Different arrangements of turbochargers and superchargers	06



05	Engine Testing and Performance Measurement of Brake Power, Indicated Power, Frictional Power, Fuel Consumption, Air flow, BMEP, Performance characteristic of SI and CI Engine Effect of load and speed on Mechanical, Indicated Thermal, Brake Thermal and Volumetric efficiencies, Heat balance sheet. Engine Exhaust Emission and its control Constituents of exhaust emission at its harmful effect on environment and human health, Formation of NO _x , HC, CO and particulate emissions, Methods of controlling emissions; Catalytic convertors, particulate traps, Exhaust Gas Recirculation, EURO and BHARAT norms.	10
06	Alternative Fuels Alcohol - Hydrogen - Natural Gas and Liquefied Petroleum Gas - Biodiesel- Biogas - Producer Gas - Properties - Suitability - Engine Modifications - Merits and Demerits as fuels. Basics of Electronic Engine Controls: Electronic Control module (ECM), Inputs required and output signals from ECM, Sensors: Throttle Position, Inlet Air Temperature, Coolant Temperature, Crankshaft Position, Camshaft Position, Mass Air flow and Exhaust Gas Oxygen sensors, their construction and importance in ECM. Electronic Spark control, Air Management system, Idle speed control	04

Assessment:

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based on approximately 40% of content and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the syllabus.

1. Question paper will comprise of total **six questions, each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the syllabus**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**

References:

1. Internal Combustion Engines, Willard W. Pulkrabek, Pearson Education.
2. Internal Combustion Engines, Shyam Agrawal, New Age International
3. Internal Combustion Engine, Mathur and Sharma
4. Internal Combustion Engines, Mohanty, Standard Book House
5. Internal Combustion Engine, Gills and Smith
6. Internal Combustion Engines Fundamentals, John B. Heywood, TMH
7. Internal Combustion Engines, Gupta H N, 2nd ed, PHI
8. Internal Combustion Engine, V Ganesan, TMH
9. Introduction to Internal Combustion Engines, Richard Stone, Palgrave Publication, 4th Edition
10. Internal Combustion Engine, S.L. Beohar
11. Internal Combustion Engine, P.M Heldt.
12. Internal Combustion Engines, V.L. Maleeve
13. Internal Combustion Engine, E.F. Oberi.
14. Internal Combustion Engine by Domkundwar



Course Code	Course Name	Credits
ILO 7018	Energy Audit and Management	03

Objectives:

1. To understand the importance energy security for sustainable development and the fundamentals of energy conservation.
2. To introduce performance evaluation criteria of various electrical and thermal installations to facilitate the energy management
3. To relate the data collected during performance evaluation of systems for identification of energy saving opportunities.

Outcomes: Learner will be able to...

1. To identify and describe present state of energy security and its importance.
2. To identify and describe the basic principles and methodologies adopted in energy audit of an utility.
3. To describe the energy performance evaluation of some common electrical installations and identify the energy saving opportunities.
4. To describe the energy performance evaluation of some common thermal installations and identify the energy saving opportunities
5. To analyze the data collected during performance evaluation and recommend energy saving measures

Module	Detailed Contents	Hrs
01	Energy Scenario: Present Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy Security, Energy Conservation and its Importance, Energy Conservation Act-2001 and its Features. Basics of Energy and its various forms, Material and Energy balance	04
02	Energy Audit Principles: Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution. Elements of monitoring& targeting; Energy audit Instruments; Data and information-analysis. Financial analysis techniques: Simple payback period, NPV, Return on investment (ROI), Internal rate of return (IRR)	08
03	Energy Management and Energy Conservation in Electrical System: Electricity billing, Electrical load management and maximum demand Control; Power factor improvement, Energy efficient equipments and appliances, star ratings. Energy efficiency measures in lighting system, Lighting control: Occupancy sensors, daylight integration, and use of intelligent controllers. Energy conservation opportunities in: water pumps, industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives.	10
04	Energy Management and Energy Conservation in Thermal Systems: Review of different thermal loads; Energy conservation opportunities in: Steam distribution system, Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system. General fuel economy measures in Boilers and furnaces, Waste heat recovery, use of insulation- types and application. HVAC system: Coefficient of performance, Capacity, factors affecting Refrigeration and Air Conditioning system performance and savings opportunities.	10



05	Energy Performance Assessment: On site Performance evaluation techniques, Case studies based on: Motors and variable speed drive, pumps, HVAC system calculations; Lighting System: Installed Load Efficacy Ratio (ILER) method, Financial Analysis.	04
06	Energy conservation in Buildings: Energy Conservation Building Codes (ECBC): Green Building, LEED rating, Application of Non-Conventional and Renewable Energy Sources	03

Assessment:

Internal Assessment for 20 marks:

Consisting Two Compulsory Class Tests

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions, each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved.**

REFERENCES:

1. Handbook of Electrical Installation Practice, Geofry Stokes, Blackwell Science
2. Designing with light: Lighting Handbook, By Anil Valia, Lighting System
3. Energy Management Handbook, By W.C. Turner, John Wiley and Sons
4. Handbook on Energy Audits and Management, edited by A. K. Tyagi, Tata Energy Research Institute (TERI).
5. Energy Management Principles, C.B.Smith, Pergamon Press
6. Energy Conservation Guidebook, Dale R. Patrick, S. Fardo, Ray E. Richardson, Fairmont Press
7. Handbook of Energy Audits, Albert Thumann, W. J. Younger, T. Niehus, CRC Press
8. www.energymanagertraining.com
9. www.bee-india.nic.in



Course Code	Course/Subject Name	Credits
MEDLO8041	Power Plant Engineering	4

Objectives

1. Study basic working principles of different power plants
2. Study power plant economics

Outcomes: Learner will be able to...

1. Comprehend various equipment/systems utilized in power plants
2. Demonstrate site selection methodology, construction and operation of Hydro Electric Power Plants
3. Discuss working, site selection, advantages, disadvantages of steam power plants
4. Discuss operation of Combined Cycle Power Plants
5. Discuss types of reactors, waste disposal issues in nuclear power plants
6. Illustrate power plant economics

Module	Detailed Contents	Hrs.
01	Introduction: Energy resources and their availability, types of power plants, selection of the plants, review of basic thermodynamic cycles used in power plants	06
02	Hydro Electric Power Plants : Rainfall and run-off measurements and plotting of various curves for estimating stream flow and size of reservoir, power plants design, construction and operation of different components of hydro-electric power plants, site selection, comparison with other types of power plants	10
03	Steam Power Plants: Flow sheet and working of modern-thermal power plants, super critical pressure steam stations, site selection, coal storage, preparation, coal handling systems, feeding and burning of pulverized fuel, ash handling systems, dust collection-mechanical dust collector and electrostatic precipitator	08
04	Combined Cycles: Constant pressure gas turbine power plants, Arrangements of combined plants (steam & gas turbine power plants), re-powering systems with gas production from coal, using PFBC systems, with organic fluids, parameters affecting thermodynamic efficiency of combined cycles, Problems	08
05	Nuclear Power Plants: Principles of nuclear energy, basic nuclear reactions, nuclear reactors- PWR, BWR, CANDU, Sodium graphite, fast breeder, homogeneous; gas cooled, Advantages and limitations, nuclear power station, waste disposal.	08
06	Power Plant Economics: Load curve, different terms and definitions, cost of electrical energy, tariffs methods of electrical energy, performance & operating characteristics of power plants- incremental rate theory, input-output curves, efficiency, heat rate, economic load sharing, Problems.	08

Assessment:

Internal Assessment for 20 marks:

Consisting Two Compulsory Class Tests

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)



End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions, each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**

References

1. Power Plant Engineering, A K Raja, Amit Praksh Shrivastava, Manish Dwivedi, New Age International Publishers
2. Power Plant Familiarization, Manual of Central Training Resources Unit of NTPC India, 1991
3. Power Plant Engineering, P.K. Nag, 2nd Edition, TMH, New Delhi
4. A Text Book of Power Plant Engineering, R.K. Rajput, Laxmi Publications
5. Hydro-Electric and Pumped Storage Plants, M G Jog, New Age International Publishers
6. A Course in Power Plant Engineering, Arora, Domkundwar, DhanpatRai & Co
7. Power Plant Engineering, P.C. Sharma, S.K. Kataria& Sons
8. Power Plant Engineering, G.R. Nagpal, Khanna Publishers
9. Power station Engineering and Economy by Bernhardt G.A. Skrotzki and William A. Vopat, TMH
10. Power Plant Engineering, Manoj Kumar Gupta, PHI Learning
11. Nuclear Power Plant Engineering, James Rust, Haralson Publishing Company
12. Nuclear Power Plants, Edited by Soon Heung Chang, InTech Publishers



Course Code	Course/Subject Name	Credits
MEC604	Refrigeration and Air Conditioning	4

Objectives

1. To study working and operating principles of Air Refrigeration, Vapour Compression and Vapour Absorption system
2. To study components of refrigeration and air conditioning systems
3. To study controls and applications of refrigeration and air conditioning

Outcomes: Learner will be able to...

1. Demonstrate fundamental principles of refrigeration and air conditioning
2. Identify and locate various important components of the refrigeration and air conditioning system
3. Illustrate various refrigeration and air conditioning processes using psychrometric chart
4. Design Air Conditioning system using cooling load calculations.
5. Estimate air conditioning system parameters
6. Demonstrate understanding of duct design concepts

Module	Detailed Contents	Hrs.
01	Introduction to Refrigeration: Methods of refrigeration, First and Second Law applied to refrigerating machines, Carnot refrigerator, Carnot heat pump, unit of refrigeration, Co-efficient of Performance, Energy Efficiency Ratio (EER), and BEE star rating Air refrigeration systems: Bell Coleman cycle, applications Aircraft air refrigeration systems: Need for aircraft refrigeration, Simple, Bootstrap including evaporative cooling, Reduced ambient, Regenerative air cooling system, Comparison of these systems based on DART rating.	08
02	Vapour Compression Refrigeration System: Simple vapour compression cycle, Effect of liquid sub cooling & superheating, effect of evaporator and condenser pressures, methods of subcooling, use of P-h charts, Actual VCR cycle, Use of P-h Charts, Comparison between air-cooled and water-cooled condenser based air conditioning systems, Types of condensers, evaporators, expansion devices and Compressors Cooling tower: Types of cooling towers, tower approach, tower range, tower efficiency, tower losses, tower maintenance Refrigerants: Desirable properties of refrigerants, ASHRAE numbering system for refrigerants. Thermodynamic, Chemical and Physical properties, Secondary refrigerants, ODP and GWP, Montreal protocol and India's commitment, Recent substitutes for refrigerants	12
03	Other Refrigeration Systems: Vapour Absorption Refrigeration, Importance of VAR system, COP of ideal VAR system, Ammonia-water VAR system, Lithium Bromide – Water VAR system, Single and double effect, Electrolux refrigeration system, Non-Conventional Refrigeration Systems: Thermoelectric Refrigeration, Thermo-acoustic Refrigeration, Vortex Tube Refrigeration	06
04	Psychrometry: Need for air conditioning, Principle of psychrometry, Psychrometric properties, chart and processes, air washers, requirements of comfort air conditioning, summer and Winter Air conditioning	05
05	Design of Air Conditioning Systems: Different Heat sources, - Adiabatic mixing of two air streams, Bypass factor, sensible heat factor, RSHP, GSHP, ERSHP, Room apparatus dew point and coil apparatus dew point, Ventilation and infiltration, Inside and Outside Design condition, Cooling Load estimation, Introduction to Unitary Products viz. Room/Split and Packaged Air Conditioners, Introduction to recent developments viz. Variable Refrigerant Flow systems, VAV control systems, Inverter Units. Human Comfort, Thermal exchange of body with environment, Effective temperature, Comfort chart, Comfort zone, Indoor Air Quality, Green Buildings	12



	Duct Design Friction chart for circular ducts, Equivalent diameter of a circular duct for rectangular ducts, Static pressure regain and equal pressure drop methods of duct design, Factors considered in air distribution system, Air distribution systems for cooling and heating	
06	Controls and Applications: Controls – LP/HP cutoff, Thermostats, Humidistats, Interlocking control, Electronic Controllers Applications Refrigeration & A/C Ice plant – food storage plants – dairy and food processing plants, Food preservation ,Freeze Drying, A/c in textile ,printing pharmaceutical industry and Hospitals , Liquefaction of LNG, Liquefaction of gases (cryogenics), Deep sea water air-conditioning	05

Assessment:

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions, each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**

References

- 1 Refrigeration and air-conditioning – C P Arora, TMH
- 2 Principles of refrigeration – R J Dossat, Willey Eastern Publication
- 3 Refrigeration and air-conditioning – W F Stoeker and J W Jones, TMH
- 4 Modern Air-conditioning practice – C P Arora, TMH
- 5 Refrigeration and air-conditioning- Manohar Prasad, New Age Int (P) Ltd
- 6 Basic Refrigeration and air-conditioning- P. Ananthanarayana, TMH
- 7 ASHRAE Handbook of Fundamentals
- 8 ASHRAE Handbook of Systems
- 9 ASHRAE Handbook of Equipment
- 10 ISHRAE Air Conditioning Handbook
- 11 ISHRAE Refrigeration Handbook



Course Code	Course Name	Credits
MEC603	Heating, Ventilation, Air Conditioning and Refrigeration	03

Objectives:

1. Learning the fundamental principles and different methods of refrigeration and air conditioning
2. Study of various refrigeration cycles and evaluate performance of each cycle.
3. Study of components of refrigeration and air-conditioning systems along with the applications.

Outcomes: Learner will be able to...

1. Illustrate the fundamental principles and applications of refrigeration and air conditioning systems.
2. Identify various HVAC&R components
3. Evaluate performance of various refrigeration system
4. Estimate cooling and heating loads for an airconditioning system.
5. Select air handling unit & design air distribution system
6. Apply the knowledge of HVAC for the sustainable development of refrigeration and airconditioning systems.

Module	Details	Hrs
1.	1.1 Basic Knowledge: Carnot refrigerator, Carnot heat pump, Carnot coefficient of performance, Reversed Carnot cycle, and its limitation. Effect of temperature and pressure on COP of the cycle 1.2 Refrigerants: Classification, Designation, Selection of refrigerant, Physical and chemical properties of refrigerants, Secondary refrigerants 1.3 Air Refrigeration System: Bell Coleman cycle, Necessity of air cooling, Factors considered for the selection of air refrigeration system, Types of air refrigeration system with schematic and T-S diagram, Numerical based on simple and bootstrap air refrigeration system.	06
2.	2.1 Vapour Compression Refrigeration System: Simple system on P-h and T-s diagrams, analysis of the simple cycle, factors affecting the performance of the cycle, actual cycle, Numerical based on standard vapour compression system by using P-h chart and refrigerant table 2.2 Vapour Absorption Refrigeration System. Simple and practical, vapour absorption system. Refrigerant-adsorbent properties, COP of ideal vapour absorption system, Domestic Electrolux refrigerator, Lithium bromide absorption system. 2.3 :Heat Pump performance, Primary energy ratio, Energy efficiency Introduction, Coefficient of ratio, Heating season performance factor, Seasonal energy efficiency ratio, Classification of heat pump, Vapour compression heat pump systems Heat pump application in an industry.	08

3.	3.1 Thermal Comfort Conditions: Selection of inside design conditions, thermal comfort, heat balance equation for a human being, factors affecting thermal comfort, Effective temperature, comfort chart and factors governing effective temperature, selection of outside design conditions 3.2 Psychrometry: of Air Conditioning Processes Psychrometry properties, relations and processes, Adiabatic air mixing, process Psychrometric chart, RSHF, GSHF, ERSHF, Bypass factor, Apparatus dew point Numerical based on psychrometric chart and Classification of air conditioning system, relations 3.3 : Cooling Load Estimation Introduction, Components of cooling load Different heat sources, Various load Estimation, Design of air conditioning system Building survey and economic, aspect used in design.	10
4.	4.1 Air Distribution System: 4.1.1 : Duct Classification of ducts, duct material, pressure in ducts, Flow through duct, pressure losses in duct, Air flow through simple duct system, Equivalent diameter, Methods of duct system design: 4.1.2 : Air Handling Unit Introduction, Fan coil unit, Types of fans used air conditioning applications, Fan laws, Filters, supply and return grills, Sensors.	06
5.	5.1 HVAC & Components Working of reciprocating, screw and scroll compressors, working of air cooled, and water cooled and evaporative condensers, Working of DX, Flooded, and Forced feed evaporators, Expansion devices Capillary tube, TXV, EXV, Type of insulation materials.	06
6.	6.1 Application of HVAC & R Ice plant, Food storage plants, dairy and food processing plants, freeze drying, A/c in textile, Printing pharmaceutical industry and Hospitals, Cold chain Technology, Transport air conditioning, Solar refrigeration.	03

Assessment:

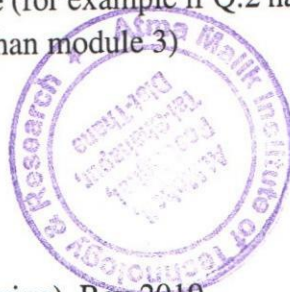
- Internal Assessment for 20 marks:**

Consisting Two Compulsory Class Tests

First test based on approximately 40% of contents and second test based on approximately 40% but excluding contents covered in Test I

- End Semester Examination:**

1. Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.
2. Question paper will comprise of total **six questions, each carrying 20 marks**
3. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
4. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
5. Only **Four questions need to be solved**



Course Code	Course Name	Credits
MEDLO8043	Renewable Energy Sources	4

Objectives:

1. To study working principles of various renewable energy sources and their utilities.
2. To study economics of harnessing energy from renewable energy sources

Outcomes: Learner will be able to...

1. Demonstrate need of different renewable energy sources
2. Discuss importance of renewable energy sources
3. Discuss various renewable energy sources in Indian context
4. Calculate and analyse utilization of solar and wind energy
5. Illustrate design of biogas plant
6. Demonstrate basics of hydrogen energy

Module	Detailed Contents	Hrs.
01	Introduction to Energy Sources: Renewable and non-renewable energy sources, Need for Renewable Energy Sources, Energy Consumption as a measure of Nation's development; Strategy for meeting the future energy requirements, Global and National scenarios, Prospects of renewable energy sources, Present status and current installations, Introduction to Hybrid Energy Systems.	07
02	Solar Energy: Merits and demerits, Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length, Methods of Solar Radiation estimation. Solar Energy collection devices and Classification: Flat plate collectors, concentrating collectors, Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond, solar water heaters, solar distillation, solar still, solar cooker, solar heating & cooling of buildings, Solar Photovoltaic systems & applications.	12
03	Wind Energy: Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of Aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.	10
04	Energy from Biomass: Biomass conversion technologies, Biogas generation plants, classification, advantages and disadvantages, constructional details, site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas.	06
05	Geothermal Energy: Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India. Energy from the ocean: Ocean Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India. Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy. Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy	08
06	Hydrogen Energy: Methods of Hydrogen production, Hydrogen Storage, Fuel Cells and Types of Fuel Cells.	05



Assessment:

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

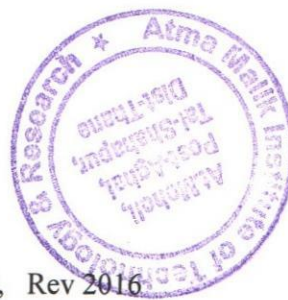
End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

- 1 Question paper will comprise of total **six questions, each carrying 20 marks**
- 2 **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
- 3 **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
- 4 Only **Four questions need to be solved**

Reference Books:

- 1 Non-conventional energy sources by G.D. Rai, Khanna Publishers
- 2 Renewable Energy: Power for a Sustainable Future, Edited by Godfrey Boyle, 3rd Edition, Oxford University Press
- 3 Solar Energy: Principles of Thermal Collection and Storage by SP Sukhatme and J K Nayak, TMH
- 4 Solar Energy: Fundamentals and Applications by H.P. Garg & Jai Prakash, Tata McGraw Hill.
- 5 Wind Power Technology, Joshua Earnest, PHI Learning, 2014
- 6 Renewable Energy Sources, J W Twidell & Anthony D. Weir. ELBS Pub.
- 7 Energy Conversion Systems, R D Begamudre, New Age International (P) Ltd., Publishers, New Delhi, 2000.
- 8 Solar Photovoltaics: Fundamentals, Technologies and Applications, C S Solanki, 2nd Edition, PHI Learning
- 9 Biomass Regenerable Energy, D. D. Hall and R. P. Grover, John Wiley, New York
- 10 Wind and Solar Power Systems, Mukund R Patel, CRC Press
- 11 Wind Energy Explained: Theory, Design and Application, J F Manwell, J.C. McGowan, A.L. Rogers, John Wiley and Sons
- 12 Magneto Hydrodynamics by Kuliovsky and Lyubimov, Addison



Course Code	Course Name	Credits
ILO8029	Environmental Management	03

Objectives:

1. Understand and identify environmental issues relevant to India and global concerns
2. Learn concepts of ecology
3. Familiarise environment related legislations

Outcomes: Learner will be able to...

1. Understand the concept of environmental management
2. Understand ecosystem and interdependence, food chain etc.
3. Understand and interpret environment related legislations

Module	Detailed Contents	Hrs
01	Introduction and Definition of Environment: Significance of Environment Management for contemporary managers, Career opportunities, Environmental issues relevant to India, Sustainable Development, the Energy scenario	10
02	Global Environmental concerns : Global Warming, Acid Rain, Ozone Depletion, Hazardous Wastes, Endangered life-species, Loss of Biodiversity, Industrial/Man-made disasters, Atomic/Biomedical hazards, etc.	06
03	Concepts of Ecology: Ecosystems and interdependence between living organisms, habitats, limiting factors, carrying capacity, food chain, etc.	05
04	Scope of Environment Management, Role and functions of Government as a planning and regulating agency Environment Quality Management and Corporate Environmental Responsibility	10
05	Total Quality Environmental Management, ISO-14000, EMS certification.	05
06	General overview of major legislations like Environment Protection Act, Air (P & CP) Act, Water (P & CP) Act, Wildlife Protection Act, Forest Act, Factories Act, etc.	03

Assessment:

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

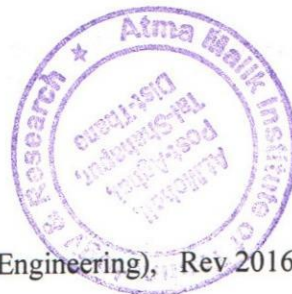
Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions, each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved.**



REFERENCES:

1. Environmental Management: Principles and Practice, C J Barrow, Routledge Publishers London, 1999
2. A Handbook of Environmental Management Edited by Jon C. Lovett and David G. Ockwell, Edward Elgar Publishing
3. Environmental Management, **T V Ramachandra and Vijay Kulkarni, TERI Press**
4. Indian Standard Environmental Management Systems — Requirements With Guidance For Use, Bureau Of Indian Standards, February 2005
5. Environmental Management: An Indian Perspective, S N Chary and Vinod Vyasulu, Macmillan India, 2000
6. Introduction to Environmental Management, Mary K Theodore and Louise Theodore, CRC Press Environment and Ecology, Majid Hussain, 3rd Ed. Access Publishing, 2015



Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract.	Tut.	Theory	Tut.	Pract.	Total	
FEC103	Engineering Chemistry-I	02	-	-	02	-	-	2	
Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract. /oral	Total
		Internal Assessment			End Sem. Exam.	Exam. Duration (in Hrs)			
		Test1	Test 2	Avg.					
FEC103	Engineering Chemistry-I	15	15	15	60	2	--	--	75

Objectives

1. The concepts developed in this course will aid in quantification as well as understand the applications of several concepts in Chemistry that have been introduced at the 10 + 2 levels in schools.

Outcomes: Learners will be able to...

1. Explain the concept of microscopic chemistry in terms of atomic and molecular orbital theory and relate it to diatomic molecules.
2. Describe the concept of aromaticity and interpret it with relation to specific aromatic systems.
3. Illustrate the knowledge of various types of intermolecular forces and relate it to real gases.
4. Interpret various phase transformations using thermodynamics.
5. Illustrate the knowledge of polymers, fabrication methods, conducting polymers in various industrial fields.
6. Analyze the quality of water and suggest suitable methods of treatment.

Module	Detailed Contents	Hrs.
01	Atomic and Molecular Structure Atomic orbitals (s,p,d,f) orbital shapes, Electronic Configuration, Molecular orbital theory (MOT), bonding and anti-bonding orbitals, Molecular orbital diagrams of Homonuclear and Heteronuclear diatomic molecules-Be ₂ , O ₂ , CO, NO their bond order and magnetic properties,	04
02	Aromatic systems & their molecular structure Define Aromaticity, Huckel's rule, Structure and bonding of benzene and pyrrole.	02
03	Intermolecular Forces & Critical Phenomena Ionic, dipolar and Vander Waal's interactions, Equations of state of real gases and critical phenomena	03
04	Phase Rule-Gibb's Phase Rule Statement of Gibbs' Phase Rule, Terms involved with examples, One Component System (Water), Reduced Phase Rule, Two Component System (Pb- Ag), Advantages and Limitations of Phase Rule. Numerical problems on Phase Rule.	05

05	Polymers Introduction: Definition- Polymer, polymerization, Properties of Polymers- Molecular weight (Number average and Weight average), Numerical problems on molecular weight, effect of heat on polymers (glass transition temperature), Viscoelasticity, Conducting Polymers, Classification- Thermoplastic and Thermosetting polymers; Compounding of plastic, Fabrication of plastic by Compression, Injection, Transfer and Extrusion moulding, Preparation, properties and uses of PMMA and Kevlar.	05
06	Water Introduction - Impurities in water, hardness of water- units (no conversions), types and numerical problems, determination of hardness of water by EDTA method and numerical problems. Softening of water by Ion Exchange process and numerical problems, BOD, COD- definition, significance and Numerical problems. Water purification-membrane technology- Electrodialysis, Reverse osmosis, and Ultra filtration.	05

Assessment

Internal Assessment Test

Assessment consists of two class tests of 15 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 35% syllabus is completed. Duration of each test shall be one hour.

End Semester Examination

In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

1. Question paper will comprise of 6 questions, each carrying 15 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total four questions need to be solved.

References

1. Engineering Chemistry - Jain & Jain (DhanpatRai)
2. Engineering Chemistry – Dara & Dara (S Chand)
3. Engineering Chemistry - Wiley India (ISBN – 9788126519880)
4. A Text Book of Engineering Chemistry – ShashiChawla (DhanpatRai)
5. Engineering Chemistry – Payal Joshi & Shashank Deep (Oxford University Press)
6. Concise Inorganic Chemistry – J D LEE
7. Essentials of Physical Chemistry—B S Bahl, Arun Bahl, G D Tuli.



Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract.	Tut.	Theory	Tut.	Pract.	Total	
FEC203	Engineering Chemistry-II	2	-	-	2	-	-	2	
Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract. /oral	Total
		Internal Assessment			End Sem. Exam.	Exam. Duration (in Hrs)			
		Test1	Test 2	Avg.					
FEC203	Engineering Chemistry-II	15	15	15	60	2	--	--	75

Objectives

The concepts developed in this course will aid in quantification as well as understand the applications of several concepts in Chemistry that have been introduced at the 10 + 2 levels in schools.

Outcomes: Learners will be able to...

1. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
2. Illustrate the concept of emission spectroscopy and describe the phenomena of fluorescence and phosphorescence in relation to it.
3. Explain the concept of electrode potential and nernst theory and relate it to electrochemical cells.
4. Identify different types of corrosion and suggest control measures in industries.
5. Illustrate the principles of green chemistry and study environmental impact.
6. Explain the knowledge of determining the quality of fuel and quantify the oxygen required for combustion of fuel.

Module	Detailed Contents	Hrs.
01	Principles of Spectroscopy: Introduction: Principle of spectroscopy, Definition, Origin of spectrum, Classification of spectroscopy – atomic and molecular, selection rules. Table of relation between electromagnetic spectrum, types of spectroscopy and energy changes.	02
02	Applications of Spectroscopy Emission spectroscopy- Principle, Instrumentation and applications (Flame Photometry) Introduction to florescence and phosphorescence, Jablonski diagram, application of fluorescence in medicine only.	04
03	Concept of Electrochemistry Introduction, concept of electrode potential, Nernst equation, types of electrochemical cells, concept of standard electrode with examples, electrochemical series, simple numericals.	02

04	Corrosion: Definition, Mechanism of Corrosion- (I) Dry or Chemical Corrosion-i) Due to oxygen ii) Due to other gases. (II) Wet or Electrochemical corrosion- Mechanism i) Evolution of hydrogen type ii) Absorption of oxygen. Types of Corrosion- Galvanic cell corrosion, Concentration cell corrosion (differential aeration principle), Pitting corrosion, Intergranular corrosion, Stress corrosion. Factors affecting the rate of corrosion- (i) Nature of metal, (ii) Nature of corroding environment. Methods of corrosion control- (I) Material selection and proper designing, (II) Cathodic protection- i) Sacrificial anodic protection ii) Impressed current method, (III) Metallic coatings- only Cathodic coating (tinning) and anodic coatings (Galvanising)	06
05	Green Chemistry and Synthesis of drugs Introduction – Definition, significance Twelve Principles of Green chemistry, numerical on atom economy, Conventional and green synthesis of Adipic acid, Indigo, Carbaryl, Ibuprofen, Benzimidazole, Benzyl alcohol, % atom economy and their numericals. Green fuel- Biodiesel.	04
06	Fuels and Combustion Definition, classification, characteristics of a good fuel, units of heat (no conversions). Calorific value- Definition, Gross or Higher calorific value & Net or lower calorific value, Dulong's formula & numerical for calculations of Gross and Net calorific values. Solid fuels- Analysis of coal- Proximate and Ultimate Analysis- numerical problems and significance. Liquid fuels- Petrol- Knocking, Octane number, Cetane number, Antiknocking agents, unleaded petrol, oxygenates (MTBE), catalytic converter. Combustion- Calculations for requirement of only oxygen and air (by weight and by volume only) for given solid & gaseous fuels.	06

Assessment

Internal Assessment Test

Assessment consists of two class tests of 15 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 35% syllabus is completed. Duration of each test shall be one hour.

End Semester Examination

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

1. Question paper will comprise of 6 questions, each carrying 15 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total four questions need to be solved.

Course Code	Course Name	Credits
ILO 7011	Product Life Cycle Management	03

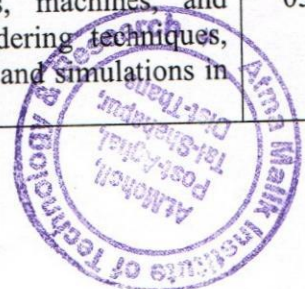
Objectives:

1. To familiarize the students with the need, benefits and components of PLM
2. To acquaint students with Product Data Management & PLM strategies
3. To give insights into new product development program and guidelines for designing and developing a product
4. To familiarize the students with Virtual Product Development

Outcomes: Learner will be able to...

1. Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.
2. Illustrate various approaches and techniques for designing and developing products.
3. Apply product engineering guidelines / thumb rules in designing products for moulding, machining, sheet metal working etc.
4. Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant

Sr. No.	Detailed Contents	Hrs
01	Introduction to Product Lifecycle Management (PLM): Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications PLM Strategies: Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy, Change management for PLM	10
02	Product Design: Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase, Methodological Evolution in Product Design, Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering and Life Cycle Approach, New Product Development (NPD) and Strategies, Product Configuration and Variant Management, The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process	09
03	Product Data Management (PDM): Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation	05
04	Virtual Product Development Tools: For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modeling and simulations in Product Design, Examples/Case studies	05



05	Integration of Environmental Aspects in Product Design: Sustainable Development, Design for Environment, Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies, End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for Product Design	05
06	Life Cycle Assessment and Life Cycle Cost Analysis: Properties, and Framework of Life Cycle Assessment, Phases of LCA in ISO Standards, Fields of Application and Limitations of Life Cycle Assessment, Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis	05

Assessment:

Internal Assessment for 20 marks:

Consisting Two Compulsory Class Tests

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions, each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved.**

REFERENCES:

1. John Stark, "Product Lifecycle Management: Paradigm for 21st Century Product Realisation", Springer-Verlag, 2004. ISBN: 1852338105
2. Fabio Giudice, Guido La Rosa, Antonino Risitano, "Product Design for the environment- A life cycle approach", Taylor & Francis 2006, ISBN: 0849327229
3. Saaksvuori Antti, Immonen Anselmie, "Product Life Cycle Management", Springer, Dreamtech, ISBN: 3540257314
4. Michael Grieve, "Product Lifecycle Management: Driving the next generation of lean thinking", Tata McGraw Hill, 2006, ISBN: 0070636265





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Professional Ethics

Course Code	Course Name	Teaching scheme			Credit assigned			
ECL504	Professional Communication & Ethics-II	Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
		--	2*+ 2 Hours (Batch-wise)	--	--	2	--	02

*Theory class to be conducted for full class.

Course Code	Course Name	Examination Scheme									
		Theory					Term work	Pract	Oral	Internal Oral	Total
		Internal Assessment			End sem	Duration (hrs)					
		Test 1	Test 2	Avg.							
ECL504	Professional Communication & Ethics-II (abbreviated PCE-II)	--	--	--	--	--	25	--	--	25	50

Course Code	Course Name	Credits
ECL504	Business Communication & Ethics	02
Course Rationale	This curriculum is designed to build up a professional and ethical approach, effective oral and written communication with enhanced soft skills. Through practical sessions, it augments student's interactive competence and confidence to respond appropriately and creatively to the implied challenges of the global Industrial and Corporate requirements. It further inculcates the social responsibility of engineers as technical citizens.	
Course Objectives	- To discern and develop an effective style of writing important technical/business documents. - To investigate possible resources and plan a successful job campaign. - To understand the dynamics of professional communication in the form of group discussions, meetings, etc. required for career enhancement. - To develop creative and impactful presentation skills. - To analyze personal traits, interests, values, aptitudes and skills. - To understand the importance of integrity and develop a personal code of ethics.	



Course Outcomes	Learner will be able to... - plan and prepare effective business/ technical documents which will in turn provide solid foundation for their future managerial roles. - strategize their personal and professional skills to build a professional image and meet the demands of the industry. - emerge successful in group discussions, meetings and result-oriented agreeable solutions in group communication situations. - deliver persuasive and professional presentations. - develop creative thinking and interpersonal skills required for effective professional communication. - apply codes of ethical conduct, personal integrity and norms of organizational behaviour.
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Module	Contents	Hours
1	ADVANCED TECHNICAL WRITING :PROJECT/PROBLEM BASED LEARNING (PBL) 1.1 Purpose and Classification of Reports: Classification on the basis of: - Subject Matter (Technology, Accounting, Finance, Marketing, etc.) - Time Interval (Periodic, One-time, Special) - Function (Informational, Analytical, etc.) - Physical Factors (Memorandum, Letter, Short & Long) 1.2. Parts of a Long Formal Report: - Prefatory Parts (Front Matter) - Report Proper (Main Body) - Appended Parts (Back Matter) 1.3. Language and Style of Reports - Tense, Person & Voice of Reports - Numbering Style of Chapters, Sections, Figures, Tables and Equations - Referencing Styles in APA & MLA Format - Proofreading through Plagiarism Checkers 1.4. Definition, Purpose & Types of Proposals - Solicited (in conformance with RFP) & Unsolicited Proposals - Types (Short and Long proposals) 1.5. Parts of a Proposal - Elements - Scope and Limitations - Conclusion	06

	1.6. Technical Paper Writing - Parts of a Technical Paper (Abstract, Introduction, Research Methods, Findings and Analysis, Discussion, Limitations, Future Scope and References) - Language and Formatting - Referencing in IEEE Format	
2	EMPLOYMENT SKILLS 2.1. Cover Letter & Resume - Parts and Content of a Cover Letter - Difference between Bio-data, Resume & CV - Essential Parts of a Resume - Types of Resume (Chronological, Functional & Combination) 2.2 Statement of Purpose - Importance of SOP - Tips for Writing an Effective SOP 2.3 Verbal Aptitude Test - Modelled on CAT, GRE, GMAT exams 2.4. Group Discussions - Purpose of a GD - Parameters of Evaluating a GD - Types of GDs (Normal, Case-based & Role Plays) - GD Etiquettes 2.5. Personal Interviews - Planning and Preparation - Types of Questions - Types of Interviews (Structured, Stress, Behavioural, Problem Solving & Case-based) - Modes of Interviews: Face-to-face (One-to one and Panel) Telephonic, Virtual	06
3	BUSINESS MEETINGS 1.1. Conducting Business Meetings - Types of Meetings - Roles and Responsibilities of Chairperson, Secretary and Members - Meeting Etiquette 3.2. Documentation - Notice - Agenda - Minutes	02

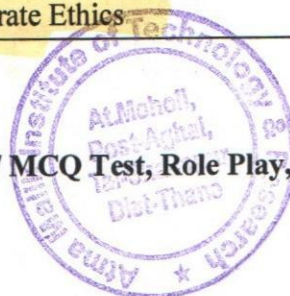


4	TECHNICAL/ BUSINESS PRESENTATIONS 1.1 Effective Presentation Strategies • Defining Purpose • Analyzing Audience, Location and Event • Gathering, Selecting & Arranging Material • Structuring a Presentation • Making Effective Slides • Types of Presentations Aids • Closing a Presentation • Platform skills 1.2 Group Presentations • Sharing Responsibility in a Team • Building the contents and visuals together • Transition Phases	02
5	INTERPERSONAL SKILLS 1.1. Interpersonal Skills • Emotional Intelligence • Leadership & Motivation • Conflict Management & Negotiation • Time Management • Assertiveness • Decision Making 5.2 Start-up Skills • Financial Literacy • Risk Assessment • Data Analysis (e.g. Consumer Behaviour, Market Trends, etc.)	08
6	CORPORATE ETHICS 6.1 Intellectual Property Rights • Copyrights • Trademarks • Patents • Industrial Designs • Geographical Indications • Integrated Circuits • Trade Secrets (Undisclosed Information) 6.2 Case Studies • Cases related to Business/ Corporate Ethics	02

List of assignments:

(In the form of Short Notes, Questionnaire/ MCQ Test, Role Play, Case Study, Quiz, etc.)

1. Cover Letter and Resume
2. Short Proposal



Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract.	Tut.	Theory	Tut.	Pract.	Total	
FEC206	Professional Communication and Ethics- I	2	--	--	2	--	--	2	
Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract. /oral	Total
		Internal Assessment			End Sem. Exam.	Exam. Duration (in Hrs)			
		Test1	Test 2	Avg.					
FEC206	Professional Communication and Ethics- I	10	10	10	40	2	--	--	50

Objectives

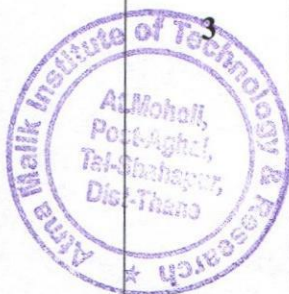
1. To demonstrate the fundamental concepts of interpersonal and professional communication.
2. To encourage active listening with focus on content, purpose, ideas and tone.
3. To facilitate fluent speaking skills in social, academic and professional situations.
4. To train in reading strategies for comprehending academic and business correspondence.
5. To promote effective writing skills in business, technology and academic arenas.
6. To inculcate confident personality traits along with grooming and social etiquettes.

Outcomes: Learners will be able to understand how to...

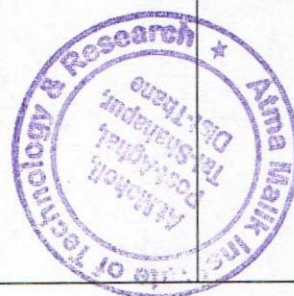
1. Eliminate barriers and use verbal/non-verbal cues at social and workplace situations.
2. Employ listening strategies to comprehend wide-ranging vocabulary, grammatical structures, tone and pronunciation.
3. Prepare effectively for speaking at social, academic and business situations.
4. Use reading strategies for faster comprehension, summarization and evaluation of texts.
5. Acquire effective writing skills for drafting academic, business and technical documents.
6. Successfully interact in all kinds of settings, displaying refined grooming and social skills.

Module	Detailed Contents	Hrs.
1	FUNDAMENTALS OF COMMUNICATION	12
	1.1. Introduction to Theory of Communication	
	• Definition • Objectives • Postulates/Hallmarks • The Process of Communication • Organizational Communication ○ Formal (Upward, Downward and Horizontal) ○ Informal (Grapevine)	
	1.2. Methods of Communication	
	• Verbal (Written & Spoken) • Non-verbal ○ Non-verbal cues perceived through the five senses: (Visual, Auditory, Tactile, Olfactory and Gustatory cues) ○ Non-verbal cues transmitted through the use of: (The Body, Voice, Space, Time and Silence)	
	1.3. Barriers to Communication	
	• Mechanical/External	

	- Physical/Internal - Semantic & Linguistic - Psychological - Socio-Cultural 1.4. Communication at the Workplace - Corporate Communication - Case Studies - Listening Tasks with Recordings and Activity Sheets - Short Speeches as Monologues - Informative Speeches that Center on People, Events, Processes, Places, or Things - Persuasive Speeches to Persuade, Motivate or Take Action - Special Occasion Speeches for Ceremonial, Commemorative, or Epideictic purposes - Pair-work Conversational Activities (Dialogues) - Short Group Presentations on Business Plans	
2	VERBAL APTITUDE FOR EMPLOYMENT 2.1. Vocabulary Building - Root words (Etymology) - Meaning of Words in Context - Synonyms & Antonyms - Collocations - Word Form Charts - Prefixes & Suffixes - Standard Abbreviations 2.2. Grammar - Identifying Common Errors - Subject - Verb Agreement - Misplaced Modifiers - Articles - Prepositions - Tautologies - Pleonasm (Redundancies) - Idioms - Cliches	02
	DEVELOPING READING AND WRITING SKILLS 3.1. Reading Comprehension - Long Passages - Short Passages - MCQs on Inferential Questions with 4 Options 3.2. Summarization of reading passages, reports, chapters, books - Graphic Organizers for Summaries - Radial Diagrams like Mind Maps - Flow Charts - Tree Diagrams - Cyclic Diagrams - Linear Diagrams like Timelines - Pyramids - Venn Diagrams - Point-form Summaries - One-sentence Summaries of Central Idea 3.3. Paraphrasing - Understanding Copyrights - Running a Plagiarism Check on Paraphrased Passages - Generating Plagiarism Reports	02



	• Basic APA and MLA Referencing Style and Format	
4	BUSINESS CORRESPONDENCE 4.1. Seven Cs of Business Correspondence • Completeness • Conciseness • Consideration • Concreteness • Clarity • Courtesy • Correctness 4.2. Parts of a Formal Letter and Formats • Parts/Elements of a Formal Letter ○ Letterheads and/or Sender's Address ○ Dateline ○ Inside Address ○ Reference Line (Optional) ○ Attention Line (Optional) ○ Salutation ○ Subject Line ○ Body ○ Complimentary Close ○ Signature Block ○ Enclosures/Attachments • Complete/Full Block Format 4.3. Emails • Format of Emails • Features of Effective Emails • Language and style of Emails 4.4. Types of Letters in Both Formal Letter Format and Emails • Claim & Adjustment Letters • Request/Permission Letters • Sales Letters	06
5	BASIC TECHNICAL WRITING 5.1. Introduction • What is Technical Writing? • Importance and Principles of Technical Writing • Difference between Technical Writing & Literary Writing • Framing Definitions • Difference between Technical Description & Instructions 5.2. Description of a Technical Object • Definition • Diagram • Discussion of Parts/Characteristics Working 5.3. Writing User Instructions • User Instructions • Special Notices (Note, Warning, Caution and Danger) • Styles of Presentation ○ Impersonal ○ Indirect ○ Direct • Imperative 5.4. Description of a Technical / Scientific Process	02



	• Definition • Diagram • Tools/ Apparatus/Software/ Hardware Used • Working • Result	
6	PERSONALITY DEVELOPMENT AND SOCIAL ETIQUETTES 6.1. Personality Development • Introducing Self and/or a Classmate • Formal Dress Code 6.2. Social Etiquettes • Formal Dining Etiquettes • Cubicle Etiquettes • Responsibility in Using Social Media • Showing Empathy and Respect • Learning Accountability and Accepting Criticism • Demonstrating Flexibility and Cooperation • Selecting Effective Communication Channels	02

Assessment:

Internal Assessment Test:

Assessment consists of two class tests of 10 marks each.

TEST I -Public speech on general topics (Maximum 5 mins. per student)

TEST II - Written test covering modules 1 - 6

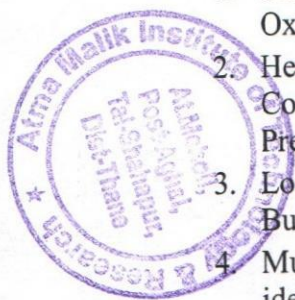
The second test should be based on theory and application exercises as mentioned in the syllabus. (Note: Summarization should be a compulsory question in Test II and not in the End Semester Theory Examination.)

End Semester Theory Examination:

1. Question paper will comprise of total 06 questions, each carrying 15marks.
2. Total 04 questions need to be solved.
3. Question No: 01 will be compulsory and based on entire syllabus wherein sub-questions of 2 to 5 marks will be asked.
4. Remaining questions will be mixed in nature.(e.g. Suppose Q.2 has part (a) from module3 then part (b) will be from any module other than module 3)
5. In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus
6. The first module (Fundamentals of Communication) will carry 40 % weightage.

Text Books.

1. Sanjay Kumar & Pushp Lata (2018). Communication Skills with CD. New Delhi: Oxford University Press.
2. Hemphill, P.D., McCormick, D. W., & Hemphill, R. D. (2001). Business Communication with writing improvement exercises. Upper Saddle River, NJ: Prentice Hall.
3. Locker, Kitty O. Kaczmarek, Stephen Kyo. (2019). Business Communication: Building Critical Skills. Place of publication not identified: Mcgraw-hill.
4. Murphy, H. (1999). Effective Business Communication. Place of publication not identified: Mcgraw-Hill.
5. Raman, M., & Sharma, S. (2016). Technical Communication: Principles and practice. New Delhi: Oxford University Press.



Course Code	Course Name	Credits
MEL703	Industrial Skills	01

Course Rationale: This course has been designed to prepare final year mechanical engineering students for placements, as well as to build computer skills and advanced soft skills to make them ready for a career in the industry.

Objectives:

1. To familiarise mechanical engineering students with basic computer/IT skills in the industry.
2. To practise soft skills and communication to be industry-ready.
3. To inculcate critical thinking and problem-solving abilities for efficient team and project outcomes.
4. To be prepared for campus placements by practising aptitude, logical reasoning, Group discussion and personal interview rounds.

Outcomes: At the end of the course, the learners will be able to

1. Skilfully prepare and edit documents and slides on MS Word and MS PowerPoint etc.
2. Execute functions on MS Excel.
3. Learn how to navigate tasks and execute functions in G-suite.
4. Understand and practice metacognitive skills of creativity and problem solving.
5. Hone team building and leadership skills.

Perform well in campus placement rounds by practising Aptitude, Logical reasoning, Group Discussion and Personal Interviews.

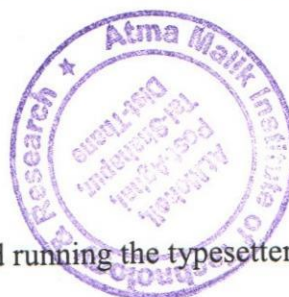
Module	List of Experiments and Activities	No. of La sessions (*2hrs)
1	Computer/IT skills	6
1.1	Basics of Computers- Desktop/Laptop operations	
1.2	Microsoft Office	
1.2.1	• MS Word- Assignment to Create and use various commands in a Word document (Page setup, text formatting, templates, SmartArt, Title and Ribbon bar, Editing etc.)	
1.2.2	• MS Excel- Assignment to Create and tabulate a spreadsheet (Excel- data analysis, charts, pivot tables, VBA, etc.)	
1.2.3	• MS- Power point- Assignment to design and use a Presentation Software(MSPPT, Prezi, etc. – Presentation	



1.2.4	design, templates, custom slides, animation, graphs, charts, troubleshooting etc.) • MS Outlook (Navigation, archiving, tasks distribution, filters, scheduling etc.)	
1.3	• G-Suite (Gmail, G-Meet, Calendar, Sheets, Docs, Slides etc.)	
1.4	• An introduction to the typesetting package LATEX.	
2	Aptitude and Logical Reasoning	2
2.1	Aptitude – Aptitude training, types of questions, mock tests	
2.2	Logical Reasoning – Verbal and Non-verbal reasoning, Types of questions, Mock tests	
3	Developing Metacognitive skills	2
3.1	Task orientation and Goal setting (can be based on Final year Project):	
3.2	Creativity and Problem-solving	
4	Collaborative Techniques: Team building skills	1
4.1	Activities on Team building	
4.2	Case studies on Leadership, Decision making and Team building	
5	GD – PI	2
5.1	Group Discussion – Factual, Strategic, Abstract, Case study, Picture based	
5.2	Personal Interview–Types of Interview Questions, Strategies, Sample answers, Mock Interviews	

Assignments: Assignments and activities should enable a steady progress in developing the aforementioned skills. A record of the conducted activities can be attached in journal as image printouts, and write up of case studies.

1. Application of MS Office skills (Individual)
 - Create and edit Word documents
 - Create and execute MS Excel functions
 - Create and enhance MS PPT
2. Writing a simple document in LATEX editor and running the typesetter program to produce finished document
3. Aptitude and Logical reasoning tests/practice sheets



4. Team building skills: Activities/Tasks to be performed as a team of 3 or 4 students.
5. Group Discussions

Case studies on problem-solving to be done as a team activity.

Personal Interview questions log book

Assessment: Total – 50 Marks

Marks distribution will be as follows:

FINAL TERM WORK – 25 Marks

Assignments (Journal) – 20 Marks

Attendance - 05 Marks

ORALS/Written – 25 Marks

1. Aptitude Test (Written) - 15 Marks
2. Mock Interview (Orals) – 10 Marks

Books recommended/References/ Resources:

1. Meenakshi Raman, Prakash Singh. *Business Communication*, Oxford University Press, 2012
2. Claudyne Wilder. *The Presentations Kit: 10 steps for Selling Your Ideas*, John Wiley & Sons, 1994.
3. Lesikar, Flatley. *Basic Business Communication: Skills for Empowering the Internet Generation*, Tata McGraw Hill, 2008.
4. Flavell, J. H. *Cognitive development: Past, present, and future*. 1992.
5. Thorpe, Edgar and Showick Thorpe. *Objective English*, Pearson, 2013. (7th edition Amazon)
6. Thorpe, Edgar. *Test of Reasoning: for All Competitive Examination*. 7th edition., Amazon
7. Sinha, Nishit K., *Reasoning*, Pearson.
8. Aggarwal, R.S., *A Modern Approach to Logical Reasoning*, S. Chand.
9. Weblinks - <https://cambridge-community.org.uk/professional-development/gswmeta/index.html>
10. Various Quantitative aptitude books and websites list <https://eduly.in/best-quantitative-aptitude-books/>
<https://prepinsta.com/learn-aptitude/>
<https://www.simplilearn.com/learn-ms-excel-free-training-course-skillup>

NPTEL

Creativity <https://nptel.ac.in/courses/109101017>

Course Era

MS Excel <https://www.coursera.org/projects/introduction-microsoft-excel>

G-suite <https://www.coursera.org/projects/collaborating-g-suite-apps>

Problem solving <https://www.coursera.org/learn/problem-solving>

Udemy

G-suite <https://www.udemy.com/course/learn-gsuite/>



Course Code	Course Name	Credits
ILO 7013	Management Information System	03

Objectives:

1. The course is blend of Management and Technical field.
2. Discuss the roles played by information technology in today's business and define various technology architectures on which information systems are built
3. Define and analyze typical functional information systems and identify how they meet the needs of the firm to deliver efficiency and competitive advantage
4. Identify the basic steps in systems development

Outcomes: Learner will be able to...

1. Explain how information systems Transform Business
2. Identify the impact information systems have on an organization
3. Describe IT infrastructure and its components and its current trends
4. Understand the principal tools and technologies for accessing information from databases to improve business performance and decision making
5. Identify the types of systems used for enterprise-wide knowledge management and how they provide value for businesses

Sr. No.	Detailed Contents	Hrs
01	Introduction To Information Systems (IS): Computer Based Information Systems, Impact of IT on organizations, Importance of IS to Society. Organizational Strategy, Competitive Advantages and IS	4
02	Data and Knowledge Management: Database Approach, Big Data, Data warehouse and Data Marts, Knowledge Management Business intelligence (BI): Managers and Decision Making, BI for Data analysis and Presenting Results	7
03	Ethical issues and Privacy: Information Security. Threat to IS, and Security Controls	7
04	Social Computing (SC): Web 2.0 and 3.0, SC in business-shopping, Marketing, Operational and Analytic CRM, E-business and E-commerce – B2B B2C. Mobile commerce.	7
05	Computer Networks Wired and Wireless technology, Pervasive computing, Cloud computing model.	6
06	Information System within Organization: Transaction Processing Systems, Functional Area Information System, ERP and ERP support of Business Process. Acquiring Information Systems and Applications: Various System development life cycle models.	8



Assessment:

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions, each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved.**

REFERENCES:

1. Kelly Rainer, Brad Prince, Management Information Systems, Wiley
2. K.C. Laudon and J.P. Laudon, Management Information Systems: Managing the Digital Firm, 10th Ed., Prentice Hall, 2007.
3. D. Boddy, A. Boonstra, Managing Information Systems: Strategy and Organization, Prentice Hall, 2008



Course Code	Course Name	Credits
ILO 7016	Cyber Security and Laws	03

Objectives:

1. To understand and identify different types cybercrime and cyber law
2. To recognize Indian IT Act 2008 and its latest amendments
3. To learn various types of security standards compliances

Outcomes: Learner will be able to...

1. Understand the concept of cybercrime and its effect on outside world
2. Interpret and apply IT law in various legal issues
3. Distinguish different aspects of cyber law
4. Apply Information Security Standards compliance during software design and development

Sr. No.	Detailed Contents	Hrs
01	Introduction to Cybercrime: Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, Cybercrime and the Indian ITA 2000, A global Perspective on cybercrimes.	4
02	Cyber offenses & Cybercrime: How criminal plan the attacks, Social Engg, Cyber stalking, Cyber café and Cybercrimes, Botnets, Attack vector, Cloud computing, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops	9
03	Tools and Methods Used in Cyberline Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft)	6
04	The Concept of Cyberspace E-Commerce , The Contract Aspects in Cyber Law ,The Security Aspect of Cyber Law ,The Intellectual Property Aspect in Cyber Law , The Evidence Aspect in Cyber Law , The Criminal Aspect in Cyber Law, Global Trends in Cyber Law , Legal Framework for Electronic Data Interchange Law Relating to Electronic Banking , The Need for an Indian Cyber Law	8
05	Indian IT Act. Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments	6
06	Information Security Standard compliances SOX, GLBA, HIPAA, ISO, FISMA, NERC, PCI.	6



Assessment:

Internal Assessment for 20 marks:

Consisting Two Compulsory Class Tests

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions, each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. **Only Four questions need to be solved.**

REFERENCES:

1. Nina Godbole, Sunit Belapure, *Cyber Security*, Wiley India, New Delhi
2. The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi
3. The Information technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.
4. Cyber Law & Cyber Crimes By Advocate Prashant Mali; Snow White Publications, Mumbai
5. Nina Godbole, *Information Systems Security*, Wiley India, New Delhi
6. Kenneth J. Knapp, *Cyber Security & Global Information Assurance* Information Science Publishing.
7. William Stallings, *Cryptography and Network Security*, Pearson Publication
8. Websites for more information is available on : The Information Technology ACT, 2008- TIFR : <https://www.tifrh.res.in>
9. Website for more information , A Compliance Primer for IT professional : <https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer-professionals-33538>



Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ECCILO 8011	Project Management	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme						
		Theory Marks			Exam Duration (Hrs.)	Term Work	Practical and Oral	Total
		Internal Assessment		End Sem. Exam.				
		Test1	Test2	Avg.				
ECCILO 8011	Project Management	20	20	20	80	03	--	100

Objectives:

1. To familiarize the students with the use of a structured methodology/approach for each and every unique project undertaken, including utilizing project management concepts, tools and techniques.
2. To appraise the students with the project management life cycle and make them knowledgeable about the various phases from project initiation through closure.

Outcomes: Learner will be able to...

1. Apply selection criteria and select an appropriate project from different options.
2. Write work break down structure for a project and develop a schedule based on it.
3. Identify opportunities and threats to the project and decide an approach to deal with them strategically.
4. Use Earned value technique and determine & predict status of the project.
5. Capture lessons learned during project phases and document them for future reference

Module	Detailed Contents	Hrs
01	Project Management Foundation: Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical) Project phases and stage gate process. Role of project manager. Negotiations and resolving conflicts. Project management in various organization structures. PM knowledge areas as per Project Management Institute (PMI).	5
02	Initiating Projects: How to get a project started, Selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter; Project proposal. Effective project team, Stages of team development & growth (forming, storming, norming & performing), team dynamics.	6
03	Project Planning and Scheduling: Work Breakdown structure (WBS) and linear responsibility chart, Interface Co-ordination and concurrent engineering, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques. PERT, CPM, GANTT chart. Introduction to Project Management Information System (PMIS).	8
04	Planning Projects:	6

	Crashing project time, Resource loading and leveling, Goldratt's critical chain, Project Stakeholders and Communication plan. Risk Management in projects: Risk management planning, Risk identification and risk register. Qualitative and quantitative risk assessment, Probability and impact matrix. Risk response strategies for positive and negative risks	
05	5.1 Executing Projects: Planning monitoring and controlling cycle. Information needs and reporting, engaging with all stakeholders of the projects. Team management, communication and project meetings. 5.2 Monitoring and Controlling Projects: Earned Value Management techniques for measuring value of work completed; Using milestones for measurement; change requests and scope creep. Project audit. 5.3 Project Contracting Project procurement management, contracting and outsourcing,	8
06	6.1 Project Leadership and Ethics: Introduction to project leadership, ethics in projects. Multicultural and virtual projects. 6.2 Closing the Project: Customer acceptance; Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report; doing a lessons learned analysis; acknowledging successes and failures; Project management templates and other resources; Managing without authority; Areas of further study.	6
Total		39

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six question
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

REFERENCES:

1. Jack Meredith & Samuel Mantel, Project Management: A managerial approach, Wiley India, 7th Ed.
2. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 5th Ed, Project Management Institute PA, USA
3. Gido Clements, Project Management, Cengage Learning.
4. Gopalan, Project Management, , Wiley India
7. Dennis Lock, Project Management, Gower Publishing England, 9 th Ed.

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ECCILO 8015	Professional Ethics and CSR	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme								
		Theory Marks					Exam Duration (Hrs.)	Term Work	Practical and Oral	Total
		Internal Assessment			End Sem. Exam.					
		Test1	Test2	Avg.						
ECCILO 8015	Professional Ethics and CSR	20	20	20	80	03	--	--	100	

Objectives:

1. To understand professional ethics in business
2. To recognized corporate social responsibility

Outcomes: Learner will be able to...

1. Understand rights and duties of business
2. Distinguish different aspects of corporate social responsibility
3. Demonstrate professional ethics
4. Understand legal aspects of corporate social responsibility

Module	Detailed Contents	Hrs
01	Professional Ethics and Business: The Nature of Business Ethics; Ethical Issues in Business; Moral Responsibility and Blame; Utilitarianism: Weighing Social Costs and Benefits; Rights and Duties of Business	04
02	Professional Ethics in the Marketplace: Perfect Competition; Monopoly Competition; Oligopolistic Competition; Oligopolies and Public Policy Professional Ethics and the Environment: Dimensions of Pollution and Resource Depletion; Ethics of Pollution Control; Ethics of Conserving Depletable Resources	08
03	Professional Ethics of Consumer Protection: Markets and Consumer Protection; Contract View of Business Firm's Duties to Consumers; Due Care Theory; Advertising Ethics; Consumer Privacy Professional Ethics of Job Discrimination: Nature of Job Discrimination; Extent of Discrimination; Reservation of Jobs.	06
04	Introduction to Corporate Social Responsibility: Potential Business Benefits—Triple bottom line, Human resources, Risk management, Supplier relations; Criticisms and concerns—Nature of business; Motives; Misdirection. Trajectory of Corporate Social Responsibility in India	05
05	Corporate Social Responsibility: Articulation of Gandhian Trusteeship Corporate Social Responsibility and Small and Medium Enterprises (SMEs) in India, Corporate Social Responsibility and Public-Private Partnership (PPP) in India	08

06	Corporate Social Responsibility in Globalizing India: Corporate Social Responsibility Voluntary Guidelines, 2009 issued by the Ministry of Corporate Affairs, Government of India, Legal Aspects of Corporate Social Responsibility—Companies Act, 2013.	08
Total		39

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six question
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

REFERENCES:

1. Business Ethics: Texts and Cases from the Indian Perspective (2013) by Ananda Das Gupta; Publisher: Springer.
2. Corporate Social Responsibility: Readings and Cases in a Global Context (2007) by Andrew Crane, Dirk Matten, Laura Spence; Publisher: Routledge.
3. Business Ethics: Concepts and Cases, 7th Edition (2011) by Manuel G. Velasquez; Publisher: Pearson, New Delhi.
4. Corporate Social Responsibility in India (2015) by Bidyut Chakrabarty, Routledge, New Delhi.





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Human Values

Subject Code	Subject Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ECCILO 7019	Development Engineering	03	--	--	03	--	--	03

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical & Oral	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test2	Avg. Of Test 1 and Test 2					
ECCILO 7019	Development Engineering	20	20	20	80	--	--	--	100

Course objectives:

- To understand the characteristics of rural Society and the Scope, Nature and Constraints of rural Development.
- To study Implications of 73rd CAA on Planning, Development and Governance of Rural Areas
- An exploration of human values, which go into making a 'good' human being, a 'good' professional, a 'good' society and a 'good life' in the context of work life and the personal life of modern Indian professionals
- To understand the Nature and Type of Human Values relevant to Planning Institutions

Course outcomes:

After successful completion of the course student will be able to

- Apply knowledge for Rural Development.
- Apply knowledge for Management Issues.
- Apply knowledge for Initiatives and Strategies
- Develop acumen for higher education and research.
- Master the art of working in group of different nature.
- Develop confidence to take up rural project activities independently



Module No.	Unit No.	Topics	Hrs.
1.0			08
	1.1	Introduction to Rural Development Meaning, nature and scope of development; Nature of rural society in India; Hierarchy of settlements; Social, economic and ecological constraints for rural development Roots of Rural Development in India Rural reconstruction and Sarvodaya programme before independence; Impact of voluntary effort and Sarvodaya Movement on rural development; Constitutional direction, directive principles; Panchayati Raj - beginning of planning and community development; National extension services.	
2.0			04
	2.1	Post-Independence rural Development Balwant Rai Mehta Committee - three tier system of rural local Government; Need and scope for people's participation and Panchayati Raj; Ashok Mehta Committee - linkage between Panchayati Raj, participation and rural development	
3.0			06
	3.1	Rural Development Initiatives in Five Year Plans Five Year Plans and Rural Development; Planning process at National, State, Regional and District levels; Planning, development, implementing and monitoring organizations and agencies; Urban and rural interface - integrated approach and local plans; Development initiatives and their convergence; Special component plan and sub-plan for the weaker section; Micro-eco zones; Data base for local planning; Need for decentralized planning; Sustainable rural development.	
4.0			04
	4.1	Post 73rd Amendment Scenario 73rd Constitution Amendment Act, including - XI schedule, devolution of powers, functions and finance; Panchayati Raj institutions - organizational linkages; Recent changes in rural local planning; Gram Sabha - revitalized Panchayati Raj; Institutionalization; resource mapping, resource mobilization including social mobilization; Information Technology and rural planning; Need for further amendments.	
5.0			10



	5.1	Values and Science and Technology Material development and its values; the challenge of science and technology; Values in planning profession, research and education. Types of Values Psychological values — integrated personality; mental health; Societal values — the modern search for a good society; justice, democracy, rule of law, values in the Indian constitution; Aesthetic values — perception and enjoyment of beauty; Moral and ethical values; nature of moral judgment; Spiritual values; different concepts; secular spirituality; Relative and absolute values; Human values— humanism and human values; human rights; human values as freedom, creativity, love and wisdom.	
6.0			04
	6.1	Ethics Canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility; Work ethics; Professional ethics; Ethics in planning profession, research and education	
		Total	36

References :

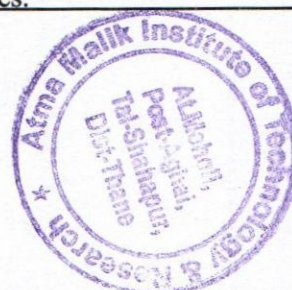
1. ITPI, Village Planning and Rural Development, ITPI New Delhi
2. Thooyavan, K.R. Human Settlements: A 2005 MA Publication, Chennai
3. GoI, Constitution (73rd GoI, New Delhi Amendment) Act, GoI, New Delhi
4. Planning Commission, Five Year Plans, Planning Commission
5. Planning Commission, Manual of Integrated District Planning, 2006, Planning Commission New Delhi
6. Planning Guide to Beginners
7. Weaver, R.C., The Urban Complex, Doubleday.
8. Farmer, W.P. et al, Ethics in Planning, American Planning Association, Washington.
9. How, E., Normative Ethics in Planning, Journal of Planning Literature, Vol.5, No.2, pp. 123-150.
10. Watson, V. , Conflicting Rationalities: -- Implications for Planning Theory and Ethics, Planning Theory and Practice, Vol. 4, No.4, pp.395 – 407

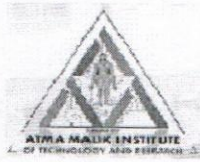
Internal Assessment:

Assessment consists of two class tests of 20 marks each. The first class test is to be conducted when approximately 40% syllabus is completed and second class test when additional 40% syllabus is completed. The average marks of both the test will be considered for final Internal Assessment. Duration of each test shall be of one hour.

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3. Question No.1 will be compulsory and based on entire syllabus.
4. Remaining question (Q.2 to Q.6) will be selected from all the modules.





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B] Cross Cutting issues integration through various Activities.

Sr. No.	Name of the Activity	Cross cutting Issues
1	Celebration of Yoga Day	Human Values
2	Social Outreach program to visit "OLD AGE home"	Human Values
3	Social Extension activity nearby Village to create awareness regarding Seasonal Diseases.	Human Values
4	Blood Donation Camp	Human Values
5	Extension Activity-Awareness Session on personal hygiene and self-esteem	Human Values
6	Celebration of National Youth Day	Human Values & Professional Ethics
7	Awareness Session on Har Ghar Tiranga	Human Values & Professional Ethics
8	Session on Importance of Soft Skills and Aptitude	Professional Ethics
9	Outreach activity under EDP "Cornell Maha 60Orientation Program for Start-ups/ Incubation"	Professional Ethics
10	Aptitude and Reasoning session	Professional Ethics
11	Session on Rally for River	Environment & Sustainability
12	Visit to IIT Bombay: Climate clock assembly	Environment & Sustainability
13	Energy Literacy Training program	Environment & Sustainability
14	Activity on "Swachh Bharat Abhiyan"	Environment & Sustainability
15	Extension Activity: Plastic Awareness Session	Environment & Sustainability
16	Student orientation about "Gender Equity" during induction program	Gender Sensitization
17	Celebration of Women's Day	Gender Sensitization



1.3.1 Cross cutting Issues addressed In Curriculum

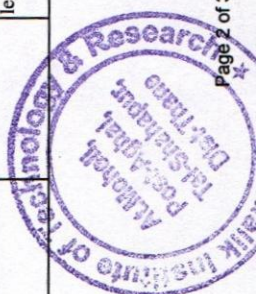
Sr. No.	Description of Cross Cutting Issue	Title of Course wherein the issue is addressed	Course Code	Unit no.	Remarks
1	Environment & Sustainability	Environmental Engineering	CEC604	Unit I: Quality of Water Unit II: Treatment of Water UNIT III: Drainage & Rainwater Harvesting UNIT IV: Domestic sewage and Sewerage System UNIT V: Sewage Treatment Unit VI : Air Pollution, Noise pollution and Solid waste management	Rationale behind this course is to make every civil engineer to be acquainted with the principles of Public health engineering, purification of water, design of sewage treatment and to develop rational approach towards sustainable waste management. The course also lays emphasis on the knowledge of Air and Noise pollution.
2	Environment & Sustainability	Engineering Geology	CEC303	Unit I: Introduction & Physical Geology Unit VI: Geological Disasters and Control Measures	To explain the concepts of Geology and its application for safe, stable and economic design of any civil engineering structure and Interpret the causes of geological hazards and implement the knowledge for their prevention
3	Environment & Sustainability	Water Resource Engineering	CEC602	Unit IV: Dams & Spillways Unit V: Irrigation Channels	This course helps students to analyze and design gravity dams and earthen dams with spillways for sustainable development.
4	Environment & Sustainability	Solid and Hazardous Waste Management	CEDLO7022	Unit I: Municipal Solid Waste Management Unit II: Waste Segregation, storage, collection & Transport Unit III: Waste processing techniques and Energy Recovery Unit IV: Landfills for disposal of waste Unit V: Hazardous waste management Unit VI: Assorted Solid Waste	To achieve sustainable development proper solid waste management should be subjected to various types of waste treatments for obtaining value added products. Robust implementation of planned facilities for reuse, recycling, maximum resource recovery from various waste facilities, combined with safe residual waste disposal through sanitary landfills, incineration and novel methods of composting is initiated.
5	Environment & Sustainability	Green Building Constructions	CEDLO7024	Unit I : Environmental impact of buildings and concept of sustainable development Unit III: Water Conservation and Energy Efficiency Unit IV: Green building materials and Indoor Environmental Quality Unit VI: Green audit and Green retrofitting	Green building construction practices aim to reduce the environmental impact of building as the building sector has the greatest potential to deliver significant cuts in emissions at little or no cost. As civil engineering graduates, it is of utmost importance to have a deep understanding of the concepts and technologies involved in the sustainable development with respect to the construction industry. It is also further desirable for the graduates to have an in-depth knowledge of the green rating systems as well as green auditing & green retrofitting – which will have tremendous scope in the future.



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6	Environment & Sustainability	Industrial Waste Treatment	CEDLO8015	Unit I: Introduction to industrial waste and treatments Unit III: Waste minimization Unit IV: Wastewater Treatments for Industries Unit VI: Environmental Impact assessment	Industrial wastewater is much more polluted than the domestic wastewater and hence has to be treated with the efficient choice of treatment units by preventing pollution of natural streams and rivers. The rationale behind this course is to enable students to understand the impact of industrial wastewater on natural streams. To enable the students to understand legislative framework for the remediation of industrial wastewater through environmental audit, environmental impact assessment and common effluent treatment plant.
7	Environment & Sustainability	Internal combustion engine	MEC501	UNIT V: Exhaust emission & Fuels	Role of Mechanical Engineers Understand the study & analysis of engine performance characteristics and engine emission
8	Environment & Sustainability	Energy Audit & Management	ILO7018	Unit II: Energy audit principles Unit III: Energy Conservation in Electrical System Unit IV: Energy Management and Energy Conservation in Thermal Systems	To study general aspects of energy management, economics & auditing. To Identify and describe basic principles and methodologies adopted in energy audit of an utility.
9	Environment & Sustainability	Power Plant engineering	MEDLO8041	Unit II:-Hydro electric power plant Unit III:-Steam Power plant Unit V:- Nuclear power plant Unit VI:- Power plant economics	To study Discuss types of reactors, waste disposal issues in nuclear power plants & Illustrate power plant economics
10	Environment & Sustainability	Refrigeration & air conditioning	MEC604	Unit II:-Vapour compression refrigeration system	To study working and operating principles of Vapour Compression and Vapour absorption systems.
11	Environment & Sustainability	Heating Ventilation Air Conditioning and Refrigeration	MEC603	Unit II: Vapour Compression and Absorption refrigeration Unit VI: Application of HVAC&R	To study working and operating principles of Vapour Compression and Vapour absorption systems and apply the knowledge of HVAC for the sustainable development of refrigeration and air conditioning systems.
12	Environment & Sustainability	Renewable Energy Systems	MEDLO8043	Unit I: Introduction to Energy Sources Unit II: Solar Energy Unit III: Wind Energy Unit IV: Energy from Biomass Unit V: Geothermal Energy and Ocean Unit VI: Hydrogen Energy	Role of Mechanical Engineer will be able to demonstrate need of different renewable energy sources, discuss importance of renewable energy sources, discuss various renewable energy sources in Indian context, calculate and analyse utilization of solar and wind energy, illustrate design of biogas plant, demonstrate basics of hydrogen energy.
13	Environment & Sustainability	Environmental Management	ILO8019	Unit II: Global Environmental concerns Unit III: Concepts of Ecology Unit IV: Environment Quality Management Unit VI: General overview of major legislations	Learner will be able to understand the concept of environmental management, understand ecosystem and interdependence, food chain etc., understand and interpret environment related legislations.



14	Environment & Sustainability	Engineering Chemistry -I	FEC103	Unit VI: Water	Analyze the quality of water and suggest suitable methods of treatment.
15	Environment & Sustainability	Engineering Chemistry -II	FEC203	Unit V : Green Chemistry and Synthesis of Drugs Unit VI : Fuels and Combustion	Illustrate the principles of green chemistry and study environmental impact. Explain the Knowledge of determining the quality of fuel and quality the Oxygen required for combustion of fuel.
16	Environment & Sustainability	Product Life cycle management	ECCIO7011	Unit V: Integration of Environmental Aspects in Product Design	This course covers issues such as Sustainable Development, Design for Environment, Need for Life Cycle Environmental Strategies.
17	Professional Ethics	Professional communication and Ethics-II	ECL 504	Unit V: Interpersonal Skills Unit VI: Corporate Ethics	Learners would be able to develop creative thinking and interpersonal skills required for effective professional communication and would be able to apply codes of ethical conduct, personal integrity and norms of organizational behaviour.
18	Professional Ethics	Professional communication and Ethics-I	FEC206	Unit I: Communication at Workplace Unit IV: Personality development and social etiquettes	This Course helps learner to demonstrate the fundamental concepts of interpersonal and professional communication. It also helps to inculcate confident personality traits and to learn social etiquettes. To learn responsibility in using social media, showing empathy and respect, learning accountability and accepting criticism.
19	Professional Ethics	Industrial Skills	MEL703	Unit II: Aptitude and Logical Reasoning Unit III: Developing Metacognitive skills Unit IV: Collaborative Techniques: Team building skills Unit V: GD – PI	Role of Mechanical engineer will be able to learn how to navigate tasks and execute functions in G-suite, understand and practice metacognitive skillsof creativity and problem solving, hone team building and leadership skills.
20	Professional Ethics	Management Information Systems	ECCIO 7013	Unit III: Ethical issues and Privacy	This module helps to inculcate professional ethics to maintain security of Information.
21	Professional Ethics	Cyber Security & Laws	ECCIO7016	Unit I: Introduction to Cybercrime Unit II: Cyber offenses & Cybercrime	This course aware learner about issues of cybercrime and the related Indian act. It helps to develop a sense of ethics too.
22	Professional Ethics	Project Management	ECCIO8011	Unit VI: Project Leadership and Ethics	This course gives Introduction to project leadership, ethics in projects, Multicultural and virtual projects.
23	Professional Ethics	Professional Ethics & CSR	ECCIO8015	Unit I: Professional Ethics & Business Unit II: Professional Ethics in the Marketplace and Environment Unit III: Professional Ethics of Consumer Protection and Job Discrimination	This course helps learner to demonstrate professional ethics and understand its importance in business
24	Human Values	Development Engineering	ECCIO7019	Unit I: Introduction to Rural Development Unit III: Sustainable Rural development Unit V: Values in Planning Profession	This course is an exploration of human values, to understand the nature and type of human values relevant to planning institutions. Learners will be able to develop confidence to take up rural projects activities independently



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