SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY)
CBCS-NEW, STUDY & EVALUATION SCHEME
PROPOSED W.E.F. SESSION 2023-2024
B.Tech. IV Year (SEMESTER VII)

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	IA	ESE	SUB-TOTAL	
1.	ME207TPC13	Refrigeration & Air Conditioning	3	1	-	30	70	100	4
2.		Professional Elective	3	-	-	30	70	100	3
3.		Open Elective	3	-	-	30	70	100	3
4.	ME207MC04	Mandatory Course	-	-	-	100	-	100	-
5.	ME207THS04	Production Planning and Control	3	-	-	30	70	100	3
6.		Industry Course	1	-	-	100	-	100	1
		Total	**13**	**1**	**-**	**320**	**280**	**600**	**14**
PRACTICALS									
1.	ME207PPC01	Refrigeration & Air Conditioning Lab	-	-	2	30	20	50	1
2.	ME207PPE01	Engines and Combustion Lab	-	-	2	30	20	50	1
3.	ME207PRJ03	Minor Project	-	-	4	100	-	100	2
4.	ME207PRJ04	Seminar on Summer Training	-	-	2	100	-	100	1
		Total	**-**	**-**	**10**	**260**	**40**	**300**	**5**
GRAND TOTAL			**13**	**1**	**10**	**580**	**320**	**900**	**19**

Total Credits : **19**
Total Contact Hour : **24**
Total Marks : **900**

*INTERNAL ASSESSMENT- Two Class Test of 15 Marks each will be conducted.
L-LECTURE, T-TUTORIAL, P-PRACTICAL, ESE –END SEMESTER EXAMINATION

Professional Electives		Industry Courses	
ME207TPE51	Engines and Combustion	ME207TIC11	Innovation & Design Thinking
ME207TPE52	Non-Destructive Testing	ME207TIC12	Maintenance Engineering and Management
ME207TPE53	Theory of Vibrations		

Open Electives	
EC207TOE02	CMOS Digital VLSI Design
CE207TOE02	Green Building and Sustainable Materials
CH207TOE02	Waste to Energy
IT207TOE01	Machine Learning
ME207TOE02	Principles of Management
CS207TOE01	GIS & Remote Sensing

Course: Refrigeration & Air Conditioning (RAC)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME207TPC13	**3**	**1**	**0**	**4**	**30**	**70**	**100**	**4**

Course Objectives:

1. Learning the fundamental principles and different methods of refrigeration and air conditioning.
2. To know about aircraft refrigeration cycles.
3. Study the vapour compression refrigeration cycles and evaluate performance using P-h charts and/ or refrigerant property tables.
4. Comparative study of different refrigerants with respect to properties, applications and environmental issues.
5. Understand the basic air conditioning processes on psychometric charts, calculate cooling load for its applications in comfort air conditioning.
6. Study of the various equipment-operating principles, operating and safety controls employed in refrigeration air conditioning systems

Syllabus Contents:

UNIT-I:

Refrigeration: Introduction to refrigeration system, Methods of refrigeration, Carnot refrigeration cycle, Unit of refrigeration, Refrigeration effect & C.O.P.

Air Refrigeration cycle: Open and closed air refrigeration cycles, Reversed Carnot cycle, Bell Coleman or Reversed Joule air refrigeration cycle, Aircraft refrigeration system, Classification of aircraft refrigeration system. Boot strap refrigeration, Regenerative, Reduced ambient, Dry air rated temperature (DART).

UNIT-II:

Vapor compression refrigeration: Single stage system, Analysis of vapour compression cycle, Use of T-S and P-H charts, Effect of change in suction and discharge pressures on C.O.P, Effect of sub cooling of condensate & superheating of refrigerant vapour on C.O.P of the cycle, Actual vapour compression refrigeration cycle, Multistage vapour compression system requirement, Removal of flash gas, Intercooling, Different configuration of multistage system.

UNIT-III:

Vapor absorption refrigeration systems: Simple cycle. Actual cycle of ammonia water and lithium-bromide water systems, Electrolux system. Classification of refrigerants, Nomenclature, Desirable properties of refrigerants, Common refrigerants, Secondary refrigerants and CFC free refrigerants. Ozone layer depletion and global warming considerations of refrigerants

Production of low temperature: cascade system, Joule Thomson effect & liquefaction of gases, liquefaction of hydrogen & helium, application of cryogenics.

Nonconventional refrigeration system: thermo-electric refrigeration, vortextube, steam jet refrigeration system.

UNIT-IV:

Refrigeration system components: water- and air-cooled condensers, evaporative condensers, expansion devices - capillary tube, expansion valve - thermostatic expansion valve, float valve and solenoid valve evaporators, natural convection coils, flooded evaporators direct expansion coils. Reciprocating compressors - single stage and multistage compressors, optimum pressure ratio, effect of inter-cooling, volumetric efficiency, isothermal and adiabatic efficiency, Rotodynamic compressors -screw and vane type compressors, principle of operation, hermetic, semi-hermetic and open type refrigeration compressors.

UNIT-V:

Principles of air conditioning: Psychrometry and psychrometric chart, human comfort, effective temperature comfort chart. Thermal analysis of human body, Effective temperature and comfort chart, Cooling and heating load calculations, Selection of inside & outside design conditions, Internal heat gain, Sensible heat factor (SHF), By pass factor, Grand Sensible heat factor (GSHF), Apparatus dew point (ADP). Air Washers, Cooling towers & humidifying efficiency.

Course Outcomes:

After studying, the students are able to:

1. Illustrate the basic concepts of refrigeration and air conditioning system.
2. Analyze the performance of vapour compression cycle using p-h chart with respect to various refrigerants.
3. Explain the properties, applications and environmental issues of different refrigerants.
4. Evaluate the cooling/heating load based on properties of moist air for different air conditioning processes.
5. Identify the different components of basic refrigeration and air-conditioning equipment and discuss their uses.

Text/Reference Books:

1. Refrigeration and Air Conditioning C. P. Arora - TMH.
2. Refrigeration and Air Conditioning – P.L. Ballaney – Khanna Pub
3. A course in refrigeration and air conditioning -S C Arora & Domkundwar- Dhanpatrai
4. Principals of refrigeration-Dossat-Pearson education
5. Refrigeration and air conditioning- Manohar Prasad- New age.
6. Refrigeration and air conditioning - Ahmadul amen - PHI

CO-PO Mapping

COs	PROGRAM OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	-	-	-	-	-	-	-	-	1	3	1	1
CO2	2	2	1	-	-	-	-	-	-	-	-	1	2	2	1
CO3	3	1	-	-	-	1	3	-	-	-	-	1	3	1	1
CO4	2	2	1	-	-	1	-	-	-	-	-	1	1	1	1

CO5	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**1**	**1**
Average	**2.4**	**1.5**	**1**	**-**	**-**	**1**	**3**	**-**	**-**	**-**	**-**	**1**	**2.4**	**1.2**	**1**

Course: Production Planning Control (PPC)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME207THS04	3	0	0	3	30	70	100	3

Course Objectives:

1. Understand the objectives, functions as well as applications of PPC and its forecasting techniques for sustainable production.
2. Grasp the knowledge about applications MRP, charts as well as inventory control techniques.
3. Experience and solve the various routing, scheduling and facility location evaluation problems.
4. Understand different type of layouts and its design procedures and basic supply chain management and network.
5. Familiarize from the different maintenance strategies and practices to control production units.

Syllabus Contents:

UNIT-I:

Introduction: Introduction to various Types of Production System viz. Mass Production, Job Shop, Batch Production System, Continuous Production System, Concept of Production and Operation Management, Objective & functions of PPC.

Forecasting: Time Series method, moving average, weighted average, Trend, Seasonality, Regression Technique, and Delphi Method.

UNIT-II:

Aggregate Planning: Definition, Strategies, Pure and mixed strategies, methods. Master Production Schedule: objective and functions, Design of MPS, Bill of Materials. Material Requirement Planning: objectives, functions, MRP, MRP-II, limitations. Capacity Requirement Planning: Definition, Objectives, Process of CRP, Process Sheet, Rough Cut Capacity Planning, Loading, and Preparation of CRP chart.

UNIT-III:

Scheduling: Types, Single Machine Scheduling, Job shop Scheduling, Flow Scheduling; Sequencing: various priority rules; Line of Balancing: Rank and positional weight method, Kilbridgewestner method.

Facility location and facility location problems: Factors affecting plant locations, single facility locations problems and its methods.

UNIT-IV:

Types of layout- layouts design procedure such as CORELAP, CRAFT etc. Material handling system & their classification, principles, JIT&KANBAN, Depreciation& methods of depreciation. The objective, importance, decision phases.

UNIT-V:

Maintenance Management: Types of maintenance strategies, Breakdown and Preventive Maintenance, Predictive and Total Productive Maintenance, Condition monitoring, Individual and group replacement policies. Make or Buy Decision, concept of original equipment effectiveness.

Course Outcomes:

After studying, the students are able to:

1. Frame the objectives and functions of PPC and apply forecasting techniques for attaining the goals/objectives.
2. Grasp the knowledge about applications of MRP, charts as well as inventory control techniques.
3. Experience and solve the various routing, scheduling and facility location evaluation problems.
4. Describe the different type of layouts and its design procedures.
5. Implicate the different maintenance strategies and practices to control production units.

Text/Reference Books:

- Stephen, C. (2005), 1st edition, Pearson Publication.
- Buffa, S.N. (2008) Production operations management, PHI, Publication.
- Paneerselvem, O. (2009) TMH. 2, Publication. Production and operation management.
- Charry, S.N. TMH (2015) Publication. Production and operation management, TMH, Publication.
- Adem, E., (2018) Production and operation management, Edition. 3, Publication.
- Khanna, R.B. (2019) Production and Operations management, PHI, Publication.
- https://mrcet.com/downloads/digital_notes/ME/IV%20year/PPC_3122018.pdf.

CO-PO Mapping

COs	PROGRAM OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	1	-	3	-	-	-	3		3	-	3
CO2	3	3	3	-	1	-	3	-	-	-	3		3	-	3
CO3	3	3	3	-	1	-	3	-	-	-	3		3	-	3
CO4	3	3	3	-	-	-	3	-	-	-	3		3	-	3
CO5	3	3	3	-	2	-	3	-	-	-	3		3	-	3
Average	3	2.8	3	1	1.25	-	3	-	-	-	3	-	3	-	3

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME207TPE51	3	-	-	3 hours	30	70	100	3

ENGINES AND COMBUSTION

Subject Code	Course Objectives
1	To understand air standard cycles and comparison with actual cycles,
2	To understand about the components & combustion phenomenon of SI and CI engines.
3	To understand cooling & lubrication systems in engines.
4	To understand performance parameters of IC engines.
5	To Evaluate the performance parameters of IC engines.

Syllabus Content:

UNIT-I:

Introduction of internal combustion engines: Engine classification, Air standard cycles, Otto cycle, Diesel cycle, Dual cycle, Comparison of Otto, Diesel, and Dual cycles. Two and four-stroke engines, SI and CI engines, Valve timing diagram, Fuel air cycle, factors affecting it, Actual cycle analysis, Actual Cycle.

UNIT-II:

SI Engines - Combustion in SI engine, Flame speed, Ignition delay, Abnormal combustion and it's control, Combustion chamber design for SI engines, Carburetion, Mixture requirements, Carburetor types, Theory of carburetor, Ignition system requirements, Magneto and battery ignition systems, Scavenging in 2 Stroke engines, Supercharging and its effect.

UNIT-III:

CI Engine - Combustion in CI engines, Ignition delay, Knock and its control, Combustion chamber design of CI engines.

Fuel injection in CI engines Requirements, Types of injection systems, Fuel pumps, Fuel injectors, Injection timings.

UNIT-IV:

Engine Cooling - Different cooling systems, Radiators, and cooling fans.

Lubrication - Engine friction, Lubrication principle, Type of lubrication, Lubrication oils, Crankcase ventilation,

Fuels -Fuels for SI and CI engine, important qualities of SI and CI engine fuels, Rating of SI engine and CI engine

UNIT-V:

Testing and Performance of IC Engines : Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power –

Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart.

Subject Code	Course Outcomes	Bloom's Taxonomy Level
	After successful completion of the course, the students shall be able to:-	
CO1	Demonstrate the components & combustion phenomenon of SI and CI engines.	Understand
CO2	Understand cooling & lubrication systems in engines	Understand
CO3	Calculate performance parameters of IC engines.	Apply
CO4	Evaluate the performance parameters of IC engines.	Analyze

Text/Reference Books:

1. I. C. Engines by Mathur & Sharma, Dhanpatrai
3. I. C. Engines by V.Ganeshan, Tata McGraw Hill
4. I. C. Engines by R. Yadav, Central Pub., Allahabad
5. A Text Book of Internal combustion engines by R.K. Rajput, Laxmi Pub, Pvt., 2006

Course Outcomes and their mapping with Programme Outcomes:

COs	PROGRAM OUTCOMES (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	I	II	III
CO1	**3**												**3**		
CO2	**3**												**3**		
CO3	**3**												**3**		
CO4	**3**	**1**											**3**		
CO5	**3**												**3**	**3**	
Average	**3**	**1**											**3**	**3**	

Course: NON – DESTRUCTIVE TESTING (NDT)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME207TPE52	**3**	**0**	**0**	**3**	**30**	**70**	**100**	**3**

Course Objectives:

1. To impart knowledge on various NDT methods.
2. To describe appropriate techniques to detect the defects in components.
3. To impart knowledge on quantification and calibration of equipment.

Syllabus Contents:

UNIT-I:

Introduction to NDT

Comparison between destructive testing and NDT, importance of NDT, scope of NDT, difficulties of NDT, Visual Inspection: Tools, applications and limitations, Fundamentals of visual testing, vision, lighting and material attributes, environmental factors, visual perception, direct and indirect methods, mirrors, magnifiers, boroscopes, fibroscopes, closed circuit television, light source and special lighting, computer enhanced systems. Liquid Penetrant Inspection (LPI): Principles, properties required for a good penetrant and developers, Types of penetrants and developers, advantage and limitations of various methods of LPI, LPI techniques, test procedures, interpretation and evaluation of penetrant test indications, false indication, safety precautions required in LPI applications, advantages and limitations.

UNIT-II:

Magnetic Particle Inspection

Magnetic Particle Inspection (MPI): Principles of MPI, basic physics of magnetism, Permeability, flux density, cohesive force, magnetizing force, retentivity, residual magnetism. Methods of magnetization, Magnetization techniques such as head shot technique, cold shot technique, central conduction testing, magnetization using products, using yokes, direct and indirect method of magnetization, Continuous testing of MPI, Residual testing of MPI, System sensitivity, Checking devices in MPI, Interpretation of MPI indications, Advantage and limitations of MPI

UNIT-III:

Ultrasonic Testing

Principle, type of waves, frequency, velocity, wavelength, reflection, divergence, attenuation, mode conversion in ultrasonics, UT testing methods: Contact testing and immersion testing, normal beam and straight beam testing, angle beam testing, dual crystal probe, Ultrasonic Testing Techniques: Resonance testing, Through transmission technique, Pulse echo testing technique, Instruments used in UT, Transducer types, Reference blocks with artificially created defects, Calibration of equipment, Acoustical Holography- Principles, types, applications, advantage and limitations.

UNIT-IV:

Radiography Testing

Principle, electromagnetic radiation sources, X-ray sources, Production of X-rays, High energy X-ray source, Gama ray source, Properties of X-rays and gamma rays, Inspection

techniques like SWSI, DWSI, DWDI, Panoramic exposure, Real time radiography, Films and screens used in radiography, Quality of radiographic film processing, interpretation, evaluation of test results, Safety aspects required in radiography, Applications, advantages and limitations of RT.

UNIT-V:

Eddy Current Testing & Thermography

Principles, Physics aspects of ECT like conductivity, permeability, resistivity, inductance, inductive reactance, impedance, Filed factor and lift off effect, edge effect, end effect, Depth of penetration of ECT, relation between frequency and depth of penetration in ECT, Equipment and accessories, Various application of ECT, advantages and limitations of eddy current testing. Thermography: Principles, Contact and non-contact inspection methods, Heat sensitive paints and papers, thermally quenched phosphors, Liquid crystals, techniques for applying liquid crystals, Non-contact thermographic inspection: advantage and limitations, Infrared radiation and infrared detectors: Instrumentations and methods, application.

Course Outcomes:

After studying, the students are able to:

1. Explain the terminology used in destructive and non-destructive testing.
2. Select appropriate testing methods and identify equipment required for the testing process.
3. Perform a dye penetrant, magnetic particle and ultrasonic test to detect surface and internal defects.
4. Build up knowledge in radiographic testing, eddy current inspection and thermography.
5. Find the internal flaws in the material by NDT and take measures to eliminate them.

Text/Reference Books:

- Baldev Raj, Practical Non-Destructive Testing, Narosa Publishing House
- George E Dieter, Mechanical Metallurgy, McGraw Hill Book Company
- Hull B and John V. Non-Destructive Testing, McMillan
- Krautkramer Josef and Hebert Krautkramer, Ultrasonic Testing of Materials, Springer Verlag

CO-PO Mapping

COs	PROGRAM OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	3	2	-	-	-	-	-	-	-	-	3	-	-
Average	3	2	3	2	-	-	-	-	-	-	-	-	3	-	-

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME207TPE53	3	0	0	3 hours	30	70	100	3

THEORY OF VIBRATIONS

Course Objectives:

1. Understand the fundamental concepts of vibration theory, including lumped mass, stiffness, and damping, and their representation using vector notation.
2. Analyze and solve vibration problems for single degree of freedom systems using energy methods, Newton's laws, and the general solution approach.
3. Apply mathematical techniques, such as Fourier analysis and convolution integral, to analyze transient vibrations and impulse responses.
4. Analyze multi-degree of freedom systems, including co-ordinate coupling, modal analysis, and the application of Lagrange's equation.
5. Gain familiarity with numerical methods, such as Rayleigh's method, for determining natural frequencies in vibration systems with complex boundary conditions.

Syllabus Content:

UNIT – I:

Element of vibration system: lumped mass, stiffness and damping, simple harmonic motion, vector representation. Single degree of freedom system: equation of motion by energy method & Newton law of motion, general solution, free and forced vibration.

UNIT – II:

Damped and undamped motion- Equation of motion for single and two degree of freedom equivalent damping, logarithmic decrement. Damping measurement, rotating and reciprocating unbalance, vibration absorber, Seismic instruments. Transient vibration: - impulse response, Convolution integral, Fourier analysis.

UNIT- III:

Multi degree freedom system: Equation of motion, co-ordinate coupling, undamped forced vibration, principal modes, generalized co-ordinates, semi definite system, orthogonality of modes, modal analysis, Lagrange’s equation.

UNIT – IV:

Natural frequency numerical solution: Rayleigh`s method

UNIT – V:

Continuous system: Vibration of stretched cord, torsional vibration, longitudinal vibration of slender rod, lateral vibration of beams, Shear deformation and rotary inertia effect, Rayleigh`s quotient, Rayleigh`s-Ritz method.

Text/ Reference Books:

1. "Mechanical vibrations theory and applications' Tse.S,Morse R Rolland T . Hinkle. Ivan E. Published by Alllyn and Bacon ,Tne.
2. "Theory of vibrations with applications" Thomson T. William ,Prentice Hall of India.
3. "Mechanical vibrations" ,HartogDen , J.P. Tata McGraw Hills, 4th edition 1954.

Course Outcome:

At the end of this course, students will demonstrate the ability to:

1. Demonstrate a clear understanding of the basic principles and terminology of vibration theory.
2. Apply the appropriate equations of motion and solution techniques to analyse and solve vibration problems for single degree of freedom systems.
3. Utilize mathematical techniques, such as Fourier analysis and convolution integral, to analyze transient vibrations and determine system responses.
4. Analyze and interpret the behavior of multi-degree of freedom systems, including the identification of principal modes and the application of modal analysis techniques.
5. Apply numerical methods, specifically Rayleigh's method, to estimate natural frequencies in vibration systems with complex boundary conditions and assess their accuracy.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	1	2	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	1	2	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	1	2	-	-	-	-	-	-	-	-	3	-	-
CO5	3	2	1	2									3		
AVG	3	1.8	1	1.8									3		

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Course: Refrigeration & Air Conditioning (RAC) Lab

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME207PPC01	**0**	**0**	**2**	**3 hrs.**	**30**	**20**	**50**	**1**

Course Objectives:

The objective of this lab is to understand the basic principles in the areas of Refrigeration and air conditioning systems through a series of experiments. In this lab the experiments are performed to measure performance parameters of the systems such as Refrigeration effect, heating load, Heating and cooling C.O.P.

Syllabus Contents:

Module no.	Experiment description	No. of hours
1	Determination of C.O. P on vapour compression system	3
2	Determination of C.O. P on Cascade Refrigeration system	3
3	Performance test on Air conditioning test rig (Window type)	3
4	Performance test on Air conditioning test rig (Duct type)	3
5	Determination of C.O.P of ice plant	3
6	Determination of C.O.P of Water –water Heat Pump	3
7	Determination of C.O.P of Air –water Heat Pump	3
8	Performance analysis in an experimental cooling tower.	3
COURSE TOTAL		21

List of Equipment/Instruments/Machines/Software Required:

1. Air-water heat pump test rig.
2. Water-water heat pump test rig.
3. Vapour compression refrigeration test-rig. (water chilling plant)
4. Window air-conditioning cycle. (Window type) Test rig.
5. Air conditioning cycle test rig (Duct type)
6. Cascade refrigeration test rig.
7. Mini cold storage plant.
8. Cooling tower

Course Outcomes:

After studying, the students are able to:

1. Demonstrate a refrigeration system and identify its important components.
2. Find the refrigeration effect and C.O.P. of a vapor compression refrigeration system.
3. Find the heating effect and C.O.P. of a heat pump.
4. Find the properties of moist air and identify different air conditioning processes.
5. Illustrate the components of a basic air conditioning system and to analyze its performance.
6. Understand the functioning of cascade refrigeration system.

CO-PO Mapping

COs	PROGRAM OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	1	-	-	1	2	1	1
CO3	2	1	-	-	-	-	-	-	1	-	-	1	2	1	1
CO4	2	1	-	-	-	-	-	-	1	-	-	1	2	1	1
CO5	1	-	-	-	-	-	-	-	1	-	-	1	2	1	1
CO6	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Average	1.5	1	-	-	-	-	-	-	1	-	-	1	2	1	1

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME207PPE01	-	-	2	2 hours	30	20	50	1

ENGINES AND COMBUSTION

Subject Code	Course Objectives
1	To understand about the components & combustion phenomenon of SI and CI engines.
2	To understand cooling, lubrication & Carburation systems in engines.
3	To Evaluate the performance parameters of IC engines.

List of Experiments:

S. No.	Experiment Details
1	To Study about Ignition System of SI Engine
2	To Study of Carburetion system in SI Engine
3	To Study about working of Single Cylinder 4 Stroke Petrol Engine with Test Rig
4	To Study about Working Model of Lubricating System
5	Single Cylinder 4 Stroke Diesel Engine Test Rig with Dynamometer
6	To Study about 4 stroke diesel Engine Components with Cut Section model
7	To Study about 4 stroke petrol engine with Cut Section model
8	To Study about 2 stroke petrol engine with Cut Section model
9	To Study about working of 4 Stroke Diesel Engine with Test Rig

Subject Code	Course Outcomes	Bloom's Taxonomy Level
	After successful completion of the course, the students shall be able to:-	
CO1	Demonstrate the components & combustion phenomenon of SI and CI engines.	Understand
CO2	understand cooling & lubrication systems in engines	Understand
CO3	calculate performance parameters of IC engines.	Apply
CO4	Evaluate the performance parameters of IC engines.	Analyze

Text/Reference Books:

1. I. C. Engines by Mathur & Sharma, Dhanpatrai
3. I. C. Engines by V.Ganeshan, Tata McGraw Hill
4. I. C. Engines by R. Yadav, Central Pub., Allahabad
5. A Text Book of Internal combustion engines by R.K. Rajput, Laxmi Pub, Pvt., 2006

Course Outcomes and their mapping with Programme Outcomes:

COs	PROGRAM OUTCOMES (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	I	II	III
	3	**10**	**10**	**11**	**1**	**5**	**3**	**3**	**12**	**5**	**12**	**12**	**3**	**1**	**1**
CO1	**3**												**3**		
CO2	**3**												**3**		
CO3	**3**												**3**		
CO4	**3**	**1**											**3**		
CO5	**3**												**3**	**3**	
Average	**3**	**1**											**3**	**3**	

MINOR PROJECT: DESIGN AND FABRICATION

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME207PRJ03	**0**	**0**	**4**	**--**	**100**	**--**	**100**	**2**

Course Objective:

- To enhance the ability to apply theoretical knowledge and engineering principles to design and develop mechanical systems or components for real-world applications
- To improve technical competence in areas such as Computer Aided Design, Manufacturing, prototyping, material selection, and fabrication techniques
- To develop project management skills, including planning, scheduling, resource allocation, and coordination, to successfully execute design and fabrication projects within given constraints
- Encourage effective communication and collaboration skills through teamwork and project presentations.
- To enhance oral and written communication skills, including the ability to present design concepts, project progress, and final outcomes effectively.

GUIDELINE FOR REVIEW AND EVALUATION

The students may be grouped into 2 to 4 and work under a project supervisor. The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

Course Outcome:

Upon the completion of this course the students will be able to

CO1 Apply engineering principles and design methodologies to conceptualize, analyze, and develop a mechanical system or component that meets specified requirements and constraints.

CO2 Execute a comprehensive project plan, including defining project scope, setting objectives, creating a work breakdown structure, allocating resources, and adhering to a timeline for successful project completion.

CO3 Utilize appropriate fabrication techniques, tools, and equipment to manufacture and assemble mechanical components or systems based on design specifications, ensuring accuracy and quality.

CO4 Communicate project progress, design considerations, analysis results, fabrication processes, and final outcomes through written reports, technical drawings, and oral presentations.

CO5 Demonstrate effective teamwork, communication, and presentation skills by working collaboratively on a group project and presenting project outcomes to peers and faculty members

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	1	1			2	1		1	3	2	1
CO2	3	3	2	2	1	1			2	1		1	3	2	1
CO3	3	3	2	2	2	1	1	1	3	3	2	1	3	2	1
CO4	3	3	3	2	3			1	3	3	1	1	3	2	
CO5	3	3	3	2	3			1	3	3	1	1	3	2	
	3	3	3	2	2	1	1	1	2.6	2.2	1.33	1	3	2	1

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Course: Seminar on Summer Training (Practical)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME07LSC02	0	0	3	-	50	-	50	1.5

Course Objectives:

- Prepare the graduates with practical knowledge in the various architectures of Mechanical Engineering & Technology such as design, analysis, manufacture, test, and assembly.
- Build the graduates professional in nature and the efficient, productive workers and professionals.
- Prepare the graduates for healthy communication skills and to work as team member.

Course Outcomes:

After acting on summer training, the students are able to:

- Utilize the gained practical knowledge of Mechanical Engineering & Technology to develop the innovative and creative production process and practices.
- Perform the efficient and productive work.
- Communicate well and perform the given assignment as a team.

CO-PO Mapping

COs	PROGRAM OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	3	-	3	-	-	-	3	-	3	-	3
CO2	3	2	2	-	3	-	3	-	-	-	3	-	3	-	3
CO2	-	-		-	-	-	3	-	3	3	3	-		-	-
Average	3	2	2	-	3	-	3	-	3	3	3	-	3	-	3

COs and POs and COs and PSOs on the scale of 0 to 3

1. **0** being **no correlation**
2. **1** being the **low correlation**
3. **2** being **medium correlation**
4. **3** being **high correlation**
5. **0** – **0** ≤ $\boldsymbol{C}$ ≤ 5% – No correlation
6. **1** – 5 < $\boldsymbol{C}$ ≤ 40% – Low/Slight
7. **2** – 40 % < $\boldsymbol{C}$ < 60% – Moderate
8. **3** – 60% ≤ $\boldsymbol{C}$ < 100% – Substantial/High.

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME207TIC11	1	0	0	--	100	--	100	1

Innovation and Design Thinking (One Credit Course)

Course Objectives:

- To understand the concept of innovation and its importance in today's business world
- To identify the different categories of innovation and their applications in various industries
- To develop the skills required for creative problem-solving and idea generation
- To apply design thinking techniques and tools to identify, define, and solve complex problems in various contexts

Course Content:

CONCEPT OF INNOVATION - Why Innovation is important for businesses, What is Innovation, Difference between Innovation and Invention, Types of Innovation, Product Innovation, Process Innovation, and Business Model Innovation (2)

SKILL & PERSONALITY TRAITS FOR INNOVATION -Personality traits for innovation, Organisational Structure for Innovation. (1)

SPECIAL CATEGORIES OF INNOVATIONS - Disruptive Innovation, Reverse Innovation. (2)

TOOLS FOR FOSTERING INNOVATION - Value Chain Analysis, The 3 Box Approach to Innovation, Focus Groups and other tools, Software tools for Innovation. (3)

DESIGN THINKING - Design Thinking Mindset, Process of Design Thinking, Idea generation, Understanding the current situation, What if - alternatives, Prototyping, Testing, Cases of application of Design Thinking. (4)

Design Thinking & Innovation Projects in Groups. (4)

Total - 15

References:

1. Govindarajan, Vijay. The Three-Box Solution, Harvard Business Review Press, 2016.
2. Brown, Tim. "Design Thinking." Harvard Business Review, vol. 86, no. 6, 2008,
3. Larson, Chris. "Disruptive Innovation Theory: What It Is & 4 Key Concepts." Harvard Business School Online, January 26, 2021, https://online.hbs.edu/blog/post/disruptive-innovation-theory.
4. Christensen, Clayton M. The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail. Harvard Business Review Press, 1997
5. Soni, Pavan. Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-solving. Notion Press, 2018

Course outcomes: At the end of the course, Students will be able to

CO1 define and explain the concept of innovation, its importance and role in modern businesses.

CO2 identify and differentiate between various types of innovation and their applications in different industries.

CO3 explain the principles and concepts of design thinking and apply them to real-world problems.

CO4 develop creative and innovative solutions to complex problems, and evaluate the feasibility and potential impact of these solutions.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1									1	1		
CO2	2	1	1									1	1		
CO3	2	1	1	1	1							1	1		
CO4	2	1	1	1	1							1	1		
	2	1	1	1	1							1	1		

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Proposed Evaluation system

Industry Integrated course / one credit courses will be evaluated by the course instructor / department faculty concerned and will carry a total of 100 marks for internal assessment such as assignments, seminars, quiz, projects, etc.

Course developed by

Alok K Tripathi, BE, MBA, PhD

General Manager, NTPC (Regional Learning Institute)

Maintenance Engineering and Management
(ONE CREDIT COURSE)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ME207TIC12	1	0	0	--	100	--	100	1

Course objectives:

• To understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
• To provide the concept of the Horizons of Maintenance Management and strategies used in industries.
• To impart the knowledge in Maintenance of Mechanical Equipment / Items used in Mining industries.
• To understand the conceptual description of Equipment, Methods & Mechanical Maintenance procedures.

1.0 Organization and Management of the Maintenance Function. (3 HRS)

1.1. – Redefining Maintenance- Delivery Reliability.
1.2.- Effective Maintenance Organization.
1.3.- Operating Policies of effective Maintenance.
1.4.- Six Sigma Concept in Maintenance- Application of Quality Management Principles.

2.0 The Horizons of Maintenance Management (5 HRS)

2.1.- Corrective Maintenance
2.2.- Reliability based Preventive Maintenance.
2.3.- Predictive Maintenance.
2.4.- Condition Monitoring based Maintenance.
2.5.- Computer based Maintenance Management System (CMMS).
2.6.- Total Productive Maintenance (TPM).

3.0 Maintenance of Mechanical Equipment / Items used in Mining (For indicative purpose). (4 HRS)

3.1.- Bearings.
3.2.- Flexible Coupling for power transmission.
3.3.- Cranes: Overhead& Gantry.
3.4.- Lifting and Pulling device (Chain Pulley Block)
3.5.- Belt Drives.
3.6.- Mechanical Variable Speed Drives.
3.7.- Gear Drives and Speed Reducers.
3.8.- Pumps.
3.9.- Introduction to Underground Mining Machineries in operation in SECL- Side Discharge Loader / Load Haul Dumper/ Continuous Miner/ High Wall Mining Equipment / Long wall Mining **Equipment – Conceptual description of Equipment, Methods & Mechanical Maintenance procedures.**
3.10.- Case Studies.

4.0 Tools of Maintenance Engineering (3 HRS)
4.1.- Root Cause Analysis.
4.2.- Plant Maintenance Module in System Application Product (SAP) in ERP Platform.

After studying this course, the students will be able to:

CO1 Implement the principles, functions and practices adapted in industry for the successful management of maintenance activities.
CO2 Evaluate the concept of the Horizons of Maintenance Management and strategies used in industries.
CO3 Explain the knowledge in Maintenance of Mechanical Equipment / Items used in Mining industries.
CO4 Analyze the conceptual description of Equipment, Methods & Mechanical Maintenance procedures.

Reference:

1. Maintenance Engineering and Maintenance by Sri R C Mishra & Sri K Pathak
2. Maintenance Engineering and Management by Sri D R Kiran
3. Computerized Maintenance Management system made easy by Sri Kishan Bagadia.
4. Modern ERP by Marianne Bradford.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1										1		
CO2	1	1	1									1	1		
CO3	1	1	1	1								1	1		
CO4	1	1	1	1								1	1		
	1.25	1	1	1								1	1		

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Evaluation system

Industry Integrated course / one credit courses will be evaluated by the course instructor / department faculty concerned and will carry a total of 100 marks for internal assessment such as assignments, seminars, quiz, projects, etc.

Course Prepared by
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