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(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) V Semester (Mechanical Engineering)

w.e.f. Juy 2023

S.No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
				Theory			Practical						
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work		L	T	P	
1	ME51	PEC	Professional Elective Course-I	70	20	10	-	-	100	3	1	-	4
2	ME52	PCC	Internal Combustion Engines	70	20	10	30	20	150	3	-	2	4
3	ME53	PCC	Turbo Machines	70	20	10	30	20	150	3	-	2	4
4	ME54	PCC	Dynamics of Machines	70	20	10	30	20	150	3	-	2	4
5	BT53	HSMC	Entrepreneurship & Management Concepts	70	20	10	-	-	100	3	1	-	4
Total				**350**	**100**	**50**	**90**	**60**	**650**	**15**	2	**6**	**20**
6	ME56	DLC	Self-Learning Presentation (SWAYAM/NPTEL/MOOC)	-	-	-	-	-	-	-	-	-	8
7	ME57	MC	NSS/NCC/Swatchhata Abhiyan/Rural Outreach	Qualifier									
Additional Course for Honours or Minor Specialization				Permitted to opt for maximum 8 credits against additional MOOC courses in subject code ME56 for the award of Honours (Minor Specialization).									

Note: 01. Departmental BOS will decide list of three/four optional subjects those are available in MOOC as well for PEC.

02. MOOC/NPTEL subjects shall be taken with permission of HOD/Coordinator.

Professional Elective Course-I		
S.No.	**Subject Code**	**Subject Name**
1	ME51A	Instrumentation Measurement & Control
2	ME51B	Solar Energy
3	ME51C	Mechanics of Composite Materials

1 hour lecture (L) = 1 credit	1 hour Tutorial (T) = 1 credit	2 hour Practical (P) = 1 credit

PEC: Professional Elective Course, PCC: Professional Core Course, HSMC: Humanities and Social Sciences including Management Course, DLC: Distance Learning Course, MC: Mandatory Course,

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COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME51A	Instrumentation Measurement & Control	70	20	10	-	-	100	3	1	-	4

Course Objective:

1. Develop ability to understand basic concept of measurement system.
2. Develop ability to understand the mathematical modelling of measurement system.
3. Develop ability to analyze the errors in measurement system
4. Develop an ability to utilize control system
5. Appropriate selection of instruments

COURSE CONTENTS:

Module-I

Concepts of Measurement: Generalized measuring system, Classification of measuring instruments, Standards of measurements. Measurement errors: Types of error. Calibration of measuring instruments: Static calibration, dynamic calibration. Input-output configuration of measuring instrument and measurement system.

Module-II

Measuring Instrument Characteristics: Statics analysis data: Normal distribution curve and standard deviation. Least square regression analysis, Uncertainty analysis.

Static characteristics: Accuracy and Precision, Range and Span, Repeatability and Reproducibility, Drift sensitivity etc.

Dynamic characteristics: dynamic response: zero order, first order and second order system response.

Module-III

Temperature Measurement:-International practical temperature scale, types of temperature measuring instruments: Liquid in glass thermometers, Bimetallic Thermometers; pressure thermometers, Electrical resistance thermometry; Resistance Temperature Detectors. Thermocouples & thermocouple standards.

Pressure Measurement: Mechanical pressure gauges Low pressure and high pressure gauges: McLeod gauge, ionization gauges. Electrical pressure transducers: piezoelectric and photoelectric pressure transducer etc.

Module-IV

Strain, Force, Torque and Velocity Measurement: - Mechanical strain gauge, Resistance strain gauges,

Displacement measurement: Linear and variable differential transformers (LVDT), angular displacement.

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Velocity measurement: Linear and angular velocity.

Force measurement: Scale and balances.

Load cells: Piezoelectric load cells etc.

Torque measurement Methods.

Module-V

Introduction to control systems: Open loop and closed loop control systems. Block diagram of closed loop control system. Mathematical modelling of mechanical systems: fluid flow, hydraulic and thermal systems. Transfer function, steady state response analysis: First order systems, unit step and unit impulse response of first order systems, second-order systems. Hydraulic control.

Evaluation:

Evaluation will be continuous an integral part of the class followed by the final examination as well as through external assessment.

References:

1. Nakra and Chaudhry; instrumentation, Measurement and analysis; TMH
2. Figiola RS & Beasley DE; Theory and Design for Mechanical Measurements; 3e John Wiley
3. Katsuhiko Ogata; Modern Control Engineering, 4e Pearson Education, New Delhi
4. Gopal; Control Systems Principles and Design; Tata McGraw Hill, New Delhi.
5. Back-with and Buck; Mechanical Measurements.
6. Swhney; Metrology and Instrumentation.
7. A. K.Sawhney; Mechanical measurement and control, Dhanpat Rai Publications.
8. D.S- KUMAR; Mechanical measurement and control, Metropolitan Book Co. Pvt. Ltd.

Course Outcomes:

On the completion of this course, students should be able to

CO1	Define the basic concepts of measurement systems in instrumentation.
CO2	Discuss principles of mathematical modelling for measuring & control systems.
CO3	Analysis the errors and uncertainty in measurement system

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2		1									
CO2	2	1										
CO3	2	2	1									

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Instrumentation & Measurement Lab

- **List of Experiments: (Can be modified/expanded further)**

1. Study of liquid in glass thermometer.
2. Study of Bimetallic thermometer.
3. Study of radiation pyrometer.
4. Study of optical pyrometer.
5. Study of Bourdon tube pressure gauge.
6. Study of Potentiometer transducer.
7. Study of linear variable differential transducer (LVDT).
8. Study of Photoelectric transducer.
9. Study of Rotameter.
10. Study of Venturimeter.
11. Study of Orificemeter.
12. Study of open loop control system.
13. Study of closed loop control system.

Course Outcomes:

On the completion of this course, students should be able to

CO1	Define the basic concepts of measurement systems in instrumentation.
CO2	Discuss principles of mathematical modelling for measuring & control systems.
CO3	Analysis the errors and uncertainty in measurement system

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2		1									
CO2	2	1										
CO3	2	2	1									

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COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME51B	Solar Energy	70	20	10	-	-	100	3	1	-	4

Course Objective:

This course will offer

1. An introduction to various solar PV and solar thermal technologies
2. Basic parameters of solar PV panels and systems
3. Standard test conditions under which the parameters are measured
4. Design of solar PV system for electrical energy requirements, sizing of PV modules, battery, electronics, etc.
5. Design of solar thermal system for given thermal energy requirements

Course Content:

Module-I

Materials for solar energy conversion: discussion on what are different material categorization, use of semiconductors for converting sunlight into electricity and use of metals for converting sunlight into heat, basic properties of semiconductors and metal required for conversion, e.g. band gap, absorption coefficient, solar spectrum and energy of photons.

Material parameters: important material parameters of semiconductors, band gap, absorption coefficient, absorption length, mobility, and carrier drift, diffusion coefficient, carrier diffusion, Light absorption and recombination in semiconductors,

Module-II

I-V characterises of P-N junction diode: forward and reverse biasing of P-N junction, forward biased current, reverse bias current, total current of P-N junction, I-V equation and curve

Illuminated P-N Junction as solar cells: discussion on why P-N junction diode requires power, but solar cell generates power, different quadrant of operations for P-N junction, dark and illuminated behaviour of P-N junction, demonstration through shift in I-V curve, discussion on photovoltaic effect.

Module-III

I-V characteristic of solar cells: I-V characteristics of a P-N junction diode under dark (write expression), light illuminated current component, I-V characteristics of a P-N junction diode under illumination, fourth quadrant operation, explain solar cell parameters Voc, Isc, FF, Efficiency using I-V curve, write down expressions

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Standard Test Condition and PV module parameters: discussion on why there is need of STC, Converting solar cells to modules for obtaining required current, voltage and power, STC for solar energy technologies, PV modules parameters, effect of temperature and radiation on output parameters, reasons for variation in actual output of solar PV modules in real life conditions.

Module-IV

Solar PV technologies (part-I): discussion on what students have seen in market or real life installations, various material and corresponding PV technologies, thin-film and crystalline Si technologies, commercially available technologies, best efficiencies of solar modules in labs and commercial market

Solar PV technologies (part-II): discussion on what students have seen in market or real life installations, various material and corresponding PV technologies, thin-film and crystalline Si technologies, commercially available technologies, best efficiencies of solar modules in labs and commercial market.

Module-V

Typical parameters of c-Si solar cells: Parameters of commercially produced solar cells and modules, typical values of voltage, current, FF and Efficiency, typical power ratings.

Solar thermal technologies: various solar thermal technologies like solar hot water heater, solar cooker, discussion on need of concentration of light for higher temperatures, methods of sun light concentrations, solar concentration for power generation

Design of solar hot water system: discussion on what should be the solar thermal system components, use of thermosyphon effect, drawing of solar hot water system, estimate the energy required for heating water, estimation of collector area required for delivering required energy, considering typical losses in conversion, efficiency equation of solar thermal system.

Design of solar PV system: discussion on what should be the solar PV system components, block diagram of simple (no storage, no electronics) and complicated systems (grid tied with diesel and wind generators), estimating user's electrical energy requirements, sizing solar PV, battery and power conditioning units required in solar system, configuration of battery and panels, fixing input and output parameters of all system components.

Text books and other references:

1. PV system design Software ¬
   https://www.pvsyst.com/
   https://www.homerenergy.com/homer/software
   https://solargis.com/

2. Solar radiation data of any place across the world https://globalsolaratlas.info/map
3. Knowledge Centre, Ministry of New & Renewable Energy - Government of India https://mnre.gov.in/
4. O.P. Jakhar, Energy Conservations in Buildings, Khanna Publishing House, New Delhi, 2019
5. S. P. Sukhatme and J. K. Nayak, Solar Energy – Principles of Thermal Collection and Storage, Tata McGraw Hill, 2008
6. J. K. Nayak and J. A. Prajapati, Handbook On Energy Conscious Buildings, 2006
7. Central Solar Hot Water Systems Design Guide, U.S. Army Corps of Engineer Headquarters, https://www.wbdg.org/ffc/army-coe/design-guides/

8. C. S. Solanki, Solar Photovoltaic – Fundamentals, Technologies and Applications, 3rd Ed. Prentice Hall of India, 2016
9. C. S. Solanki, Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers, Prentice Hall of India, 2013

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10. Photovoltaics: Design and Installation Manual, Solar Energy International (SEI), USA https://www.solarenergy.org/

Expected outcome of course:

Possible outcomes of course are ability to:

CO1	Understand various solar energy technologies, how sun light can be converted in electrical and heat energy.
CO2	Discuss the efficiency of technologies measured under STC.
CO3	Size various components of solar PV system to fulfil given electricity requirements.
CO4	Size solar thermal system to fulfill given thermal energy requirements.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2		1									
CO2	2	1										
CO3	2	2	1									
CO4				1								

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Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME51C	Mechanics of Composite Materials	70	20	10	-	-	100	3	1	-	4

Course Objective:

To introduce the mechanics of anisotropic material and to provide insight into different failure mechanisms typical of anisotropic and heterogeneous systems.

Course Content:

Module-I

Introduction: Composite materials, characteristics, classification, advantages and typical problems.

Module-II

Unidirectional Lamina: Introduction, longitudinal strength and stiffness, transverse strength and stiffness, failure modes, thermal expansion and transport properties.
Short Fibre Composites: Theories of stress transfer, modulus and strength of short fibre composites.

Module-III

Analysis of an Orthotropic Lamina: Hook's law, stress-strain relation for lamina with an arbitrary orientation, strength of a lamina subjected to biaxial stress field.
Analysis of Laminated Composites: Classical lamination theory, thermal stress in laminates.

Module-IV

Special Design Considerations: Analysis after initial failure, inter-laminar stress, free edge effect, design of joints, elementary fracture mechanics concepts related to composite materials.

Module-V

Experimental Characterization: Uni-axial tension test, compression test, in plane shear test, three and four point bending test, determination of inter laminar shear strength.

Name of Authors / Books / Publisher Year of Publication:

1. Agarwal, B.D. and Broutman, L.J., "Analysis and Performance of Fibre Composites", 3rd 2006 Ed., John Wiley & Sons.
2. Jones, R.M., "Mechanics of Composite Materials", Taylor & Francis. 1998
3. Ashbee, K.H.G. and Ashbee, H.G., "Fundamental Principles of Fibre Reinforced Composites", 2nd 1993 Ed., CRC Press.

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4. Daniel, I.M. and Ishai, O., "Engineering Mechanics of Composite Materials", 2nd 2007 Ed., Oxford University Press.
5. Christensen, R.M., "Mechanics of Composite Materials", Dover Publications. 2005
6. Kaw, A. K., "Mechanics of Composite Materials", 2nd Ed., CRC Press. 2005

Expected outcome of course:

Possible outcomes of course are ability to:

CO1	Understand various composite materials
CO2	Understand different stress, strength and properties.
CO3	Analyze the relation between stress and strain for lamina with arbitrary orientation.
CO4	Understand elementary fracture mechanics concepts and implement different design consideration

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2		1		2							
CO2	2	1			2	1						
CO3	2	2	1		2	2						
CO4				1								

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Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME52	Internal Combustion Engines	70	20	10	30	20	150	3	-	2	4

Course Objective:

1. To make students familiar with performance characteristics of I C engines.
2. To study the thermodynamics, combustion, heat transfer, friction and other factors affecting I. C engines performance.
3. To study conventional and modern system being used in I. C engines.
4. To study future fuels of engines.
5. To study different types of superchargers and supercharging methods.

COURSE CONTENTS:

MODLE I

Internal Combustion Engine: S.I. and C.I. engines of two and four stroke cycles, real cycle analysis of SI and CI engines, determination of engine dimensions, speed, fuel consumption, output, mean effective pressure, efficiency, factors effecting volumetric efficiency, heat balance, performance characteristics of SI and CI engines, cylinder arrangement, firing order, power balance for multi-cylinder engines, valve timing.

MODLE II

Combustion in SI engines: Flame development and propagation, ignition lag, effect of air density, temperature, engine speed, turbulence and ignition timings, physical and chemical aspects of detonation, effect of engine and fuel variables on knocking tendency, knock rating of volatile fuels, octane H.U.C.R., action of dopes, pre-ignition, its causes and remedy, salient features of various types of combustion chambers, valve timing and firing order.

Module-III

Combustion in C.I. Engines: Times base indicator diagrams and their study, various stages of combustion, delay period, diesel knock, octane number, knock inhibitors, salient features of various types of combustion chambers, fuel, ignition, cooling, exhaust and lubrication systems; Simple problems on fuel injection, various types of engines, their classification and salient features. Rotary I.C. engines, their principles of working.

Module- IV

I.C. Engine System: Fuels, ignition systems, cooling, exhaust/scavenging and lubrication system. Fuel metering in SI engine: Fuel injection in SI engine (MPFI & TBI). Theory of carburetion, simple problems on carburetion. Fuel metering in CI engines: Fuel injection in CI engine and simple problems, various types of

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engines, their Classification and salient features. Fuels: Conventional fuels and alternate fuels, engine exhaust. Emission, carbon monoxide, unburnt hydro carbon, oxides of nitrogen, smoke, density, measurement and control, hydrogen as alternate fuel.

Module-V

Supercharging. Effect of altitude on mixture strength and output of S.I. engines, low and high pressure super charging, exhaust, gas turbo-charging, supercharging of two Stroke engines.

Evaluation:

Evaluation will be continuous an integral part Of the class followed by the final well as through external assessrnent.

References:

1. Ganeshan V; Internal Combustion engines; IMH
2. Mathur ML & Sharma RP; A. Course in IC engines; DhanpatRai
3. Gupta HN; Fundamentals Of IC Engines; PHI
4. Srinivasan S; Automotive Engines; TN'IH
5. Halderman JD and Mitchell CD; Automotive Engines theory and servicing; Pearson
6. DomKundwar; Internal Combustion Engines ; Dhanpat Rai Publications
7. Taylor GF; Internal Combustion Engines Theory & Practice; MIT Press
8. Richard Stone; Introduction to IC Engines; Society of Automotive Engr (Palgrave McMil Ian)

Course Outcomes:

At the completion of this course, students should be able to

CO1	Discuss the working of I.C. engine and various engine systems.
CO2	Analyze the performance of SI and CI engines.
CO3	Identify I.C. engines for different engineering applications.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2		1									
CO2	1		2									
CO3	2	2	2									

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Internal Combustion Engines Lab

List of Experiments: (Can be modified/expanded further)

1. Determination of Valve timing diagram for S.I. and C.I. four stroke engines.
2. To study the performance parameters of l.c. engines and draw Heat Balance sheet.
3. 3, Study of Battery Ignition system and magneto Ignition System.
4. Study of lubricating system in CI Engines.
5. Study of Fuel Injection system in SI Engine.
6. Study of Fuel Injection system in CI Engine.
7. Study of Carburettors.
8. Study of Diesel fuel pump and fuel injectors.
9. To find the indicated power on multi-cylinder petrol engine by Morse test.
10. Study of kirloskar diesel engine.

Course outcome of lab:

At the completion of this course, students should be able to of SI and CI engines,

CO1	Evaluate Performance parameters of SI and CI engines.
CO2	Explain various engine systems and their working.
CO3	Inspect and test engines for their performance.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1									
CO2	1		2									
CO3	2	2	1									

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		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME53	Turbo Machines	70	20	10	30	20	150	3	-	2	4

Course Objective:

During the course the student will be able to learn about:

1. Steam turbines and its application in thermal power plants
2. Gas turbines and its application in Gas Turbine power plants
3. Hydraulic Turbines and its application in Hydel power plants
4. pumps, compressors, blowers and fans and other equipments in power plants
5. Power Transmitting Turbo machines and hydraulic systems

Course Contents:

MODLE I

Steam Turbines: Classifications of steam turbines, principles of impulse and reaction machines.

Impulse Turbine: Impulse staging, velocity and pressure compounding, utilization factor, analysis for optimum utilization factor, Curtis and Rateau stage, velocity diagram, blade velocity coefficient, force, work done, blade efficiency, nozzle efficiency, gross stage efficiency, analysis for optimum efficiency, mass flow and blade height.

Reaction Turbine: Reactions staging, velocity diagram, Parson's stages, degree of reaction, nozzle efficiency, velocity coefficient, stator efficiency, carry over efficiency, stage efficiency, vane efficiency, conditions for optimum efficiency, speed ratio, axial thrust, reheat factor in turbines. Governing and performance characteristics of steam turbines.

MODLE II

Water Turbines: Classification, Pelton, Francis and Kaplan turbines, vector diagrams and work-done, Hydraulic, volumetric, mechanical and overall efficiencies, draft tubes, governing of water turbines.

Performance and Characteristics: Application Of dimensional analysis and similarity to water turbines, unit and specific quantities, selection of machines, Main and operating characteristics of the machines and cavitation.

MODULE III

Rotary Fans, Blowers And Compressors: Classification based on pressure rise, centrifugal and axial flow machines Centrifugal Blowers Vane shape, velocity triangle, degree of reactions, slip coefficient, size and speed of machine, vane shape and stresses, efficiency, characteristics, fan laws and characteristics.

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Centrifugal Compressor: - Vector diagrams, work done, temp and pressure ratio, slip factor, work input factor, pressure coefficient, Dimensions of inlet eye, impeller and diffuser.

Axial Flow Compressors: - Vector diagrams: work done factor, temp and pressure ratio, degree of reaction, Dimensional' Analysis for plotting compressor surging and choking, Polytropic and isentropic efficiencies.

MODLE IV

Centrifugal Pumps: Classification, advantage over reciprocating type, definition of manometric head, gross head, static head, velocity diagram and work done, slip factor, efficiency and sources of inefficiency, minimum starting speed of pump, net positive suction head, priming and cavitation, unit and specific quantities, performance characteristics.

Power Transmitting Turbomachines: Fluid coupling and Torque converter, their torque ratio, speed ratio, slip and efficiency, velocity diagrams and characteristics.

MODLE V

Hydrostatic Systems: hydraulic intensifier, accumulator, press and crane.

Gas Turbines: Simple cycle, modification in Simple cycle, simple cycle with heat exchanger, with reheat, with intercooler, closed cycle gas turbine, practical gas turbine cycle, optimum pressure ratio for maximum specific work output and thermal efficiency in actual turbine cycle, effect of operating variables on thermal efficiency. Jet Propulsion: types, pulse jet, Ram jet, turbo jet, efficiency and horsepower of propulsion, flying unit.

Evaluation:

Evaluation will be continuous an integral part of the class followed by he final examination well as through external

References:

1. Venkanna BK; turbomachinery, PHI
2. . Shepherd DG; Turbo machinery
3. Csanday; Turbo machines.
4. Kadambi V Manohar Prasad; An introduction to EC Vol. Ill-Turbo machinery; Wiley Eastern Delhi
5. Bansal R. K; Fluid Mechanics & Fluid Machines;
6. Rogers Cohen & Sarvan Multo Gas Turbine Theory
7. Kearton W. J; Steam Turbine: Theory & Practice.
8. S. J. k. Jain; gas turbine theory and jet propulsion.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Illustrate the working of different types of turbo machines.
CO2	Classify the engineering applications of different turbo machines.
CO3	Estimate the performance parameter of turbo machines.
CO4	Design the Turbo machines for specified parameters.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1									
CO2	1	1										

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CO3	1		2	2								
CO4	2	2	1									

Turbo Machines Lab

List of Experiments: (Can be modified/expanded further)

1. Performance analysis and plotting main characteristic curves of pelton turbine.
2. Performance analysis and plotting operating characteristic curves of peltcn turbine.
3. Performance analysis and plotting main characteristic curves of reaction turbine.
4. Performance analysis and plotting operating characteristic curves of reaction turbine.
5. Performance analysis and plotting main characteristics curves of centrifugal pump.
6. Performance analysis and plotting operating characteristic curves of centrifugal pump.
7. Performance analysis of centrifugal blower.

Lab Course Outcomes:

At the completion of this course, students should be able to-

CO1	Determine the performance and their operating characteristics of different types of turbines.
CO2	Elaborate the characteristic curves and its applications of different types of turbines.
CO3	Estimate the working parameters of pumps.
CO4	Develop the concept of characteristic curves and use of power Transmitting Turbo Machines.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1											
CO2	1	2										
CO3	2	3										
CO4	1	2	3	2								

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Jabalpur Engineering College, Jabalpur (M.P)

(Declared Autonomous by MP Govt., Affiliated to RGPV, Bhopal)

(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) V Semester (Mechanical Engineering)

COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME54	Dynamics of machines	70	20	10	30	20	150	3	-	2	4

Course objective:

At the completion of the course the students will be able:

1. To determine the velocity and acceleration of piston in a reciprocating engine mechanism and calculation of flywheel rim dimensions.
2. To illustrate the working of speed control mechanisms.
3. To demonstrate the concepts of balancing of rotors of heavy machines.
4. To distinguish the principles of clutches, brakes and dynamometers and calculate the brake power.

Course Contents:

Module-I

Dynamics of Engine Mechanism: Displacement, velocity and acceleration of piston; turning moment on crankshaft, turning moment diagram; fluctuation of crankshaft Speed, analysis of flywheel.

Module-II

Governor Mechanisms: Types of governors, characteristics of centrifugal governors, gravity and spring controlled centrifugal governors, hunting of centrifugal governors, effort and power of governor.

Module-III

Balancing of Inertia Forces and Moments in Machines: Balancing of rotating masses, two plane balancing. Determination of balancing masses (graphical and analytical methods). Balancing of rotor. Balancing of reciprocating masses.

Module-IV

Friction: Frictional torque in pivots and collars by uniform pressure and uniform wear rate criteria.
Friction Clutches: Single plate clutch and multi plate clutch, Cone clutch.

Module-V

Brakes: Band brake, block brakes, Internal expanding shoe brakes.
Dynamometer: Different types and their applications.

Evaluation:

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Evaluation will be continuous an integral part of the class followed by the final examination as well as through external assessment.

References:

1. Ambekar, AG; Mechanism and Machine Theory, PHI
2. Rattan SS; Theory of machines; TMH
3. Sharma and Purohit; of Machine elements; PHI
4. Bevan; Theory of machines;
5. Ghosh and Theory Of Mechanisms and Machines; Affiliated East-West press, Delhi
6. Norton RL; kinematics and dynamics of machinery; TMH
7. Grover; Mechanical Vibrations/
8. Balaney, Theory of Machines
9. Theory of Vibrations by Thomson
10. Theory of machines through solved problems by J .S.RAO.

Course Outcomes:

At the completion of this Course, students should be able to-

CO1	Illustrate the working of flywheel, governor, clutch, brake and dynamometer.
CO2	Examine the turning moment diagrams, characteristic curve of governors, unbalanced forces and couple, failure of clutches and brakes.
CO3	Assess the motion of piston, hunting, effort and power of governor, balancing masses, frictional torque.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2										
CO2	2	3		1								
CO3	1	2										

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Dynamics of machines Lab

List of Experiments: (Can be modified/expanded further)

1. Study of various models of governors.
2. To study working of different types of brakes using models.
3. To study working of friction clutches using models
4. To study working of different types of dynamometer.
5. To study static and dynamic balancing machines.

Course Outcomes:

At the completion of this Course, students should be able to-

CO1	Illustrate the working of flywheel, governor, clutch, brake and dynamometer.
CO2	Examine the turning moment diagrams, characteristic curve of governors, unbalanced forces and couple, failure of clutches and brakes.
CO3	Assess the motion of piston, hunting, effort and power of governor, balancing masses, frictional torque.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2										
CO2	2	3		1								
CO3	1	2										

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COURSE CONTENTS w.e.f. July 2023

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
BT53	Entrepreneurship & Management Concepts	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work	100	L	T	P	4
		70	20	10	-	-		3	1	-	

Course Objective:

To familiarize .the students with the concepts and applications of Management, Marketing Productivity & Entrepreneurship in competitive world.

COURSE CONTENTS:

Module-I

System Concepts: Types, definition & characteristics; supra & subsystems, key component; boundary interface complexity; feedback (pull) & feed (push) controls, open flexible-adaptive system, computer as closed system, law of requisite variety; system coupling, stresses and entropy; functional & cross functional system; Steven Alters' nine element work system model and its comparison with IPO (input-processing-output) model, structure and performance of work systems leading to customer delight.

Module-II

Management: Importance, definition and schools of theories, knowledge driven learning organization and e-business; environment, uncertainty and adaptability; corporate culture, difficulties and levels of planning, BCG matrix, SWOT analysis, steps in decision making,, structured and unstructured decision; dimensions of organizations, size/specialization, behaviour formalization, authority centralization, departmentalization, span and line of control, technology and Minzberg organization typology, line, staff & matrix organization, coordination by task forces business process reengineering and process of change management, HR planning placement and training, NTIS; attitude.- 2nd personality trait, overlap and differences between leader & manager, leadership grid, motivation, Maslow's need hierarchy and Herzberg two factor theory, expectation theory, learning process, team work and stress management.

Module-III

Marketing: Importance, definition, core concepts of need want and demand, exchange & relationships, product value, cost and satisfaction- (goods and services) marketing environment; selling, marketing and marketing concepts; four P's, product, price, placement, promotion; consumer, business and industrial market, market targeting, advertising, publicity, CRM and market research.

Finance: Nature and scope, forms of business ownerships, balance sheet, profit and loss account, fund flow arid cash flow statements, breakeven point (BEP) and financial ratio analysis, pay-back period, NPV and capital budgeting.

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Module-IV

Productivity and Operations: Productivity, standard of living and happiness, types Of productivity, operations (goods and services) Vs project management, production processes and layouts, steps in method improvement, time measurement, rating and various allowances; standard time and its utility, predetermined motion and time method, product and process specifications, TQM, cost of quality, introduction to-lean manufacturing (JIT), QED, TPM & six sigma quality.

Module-V

Entrepreneurship: Definition and concepts, characteristics, comparison with manager, classifications theories of entrepreneur, socio, economic, cultural and psychological; entrepreneur traits and behavior, roles in economic growth, employment, social stability, export promotion and Indigenization, creating a venture, opportunity analysis cornpetitive and technical factors, sources of filnds, entrepreneur development program. Sustainability of entrepreneurship, sustainable product, sustainability & operations management.

Evaluation:

Evaluation will be continuous and integral part of the class followed by the final examination.

References:

1. Daft R; The new era of management; Cengage.
2. Bhat Anil, Arya kumar; Management: Principles,Processes and Practices; Oxford higheredu.
3. Davis & Olson; Management Information System; TMH.
4. Steven Alter; Information systems, Pearson, vv.vw.stevenalter.com
5. Kotler P; Marketing management; 6- Khan, Jain; Financial Management; 7- ILO; Work study;ILO.
6. Mohanty SK; Fundamental of Entrepreneurship; PHI.

Course Outcomes:
At the completion of this course, students should be able to

CO1	Illustrate the concepts of Work system model.
CO2	Analyze the concepts & theories of management applied to the Entrepreneurship.
CO3	Estimate capital budget and market research for a given product/service.
CO4	Evaluate productivity rating and various allowances; standard time in work

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2		1									
CO2	2	2		1								
CO3	2	2		1								
CO4	2		1	1								

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