**ADMISSION YEAR: 2024-25** **ACADEMIC YEAR:2024-25**

**POOJYA DODDAPPA COLLEGE OF ENGINEERING, KALABURAGI**

Scheme of Teaching and Examinations-2024

M.Tech., Thermal Power Engineering (PTP)

Choice Based Credit System (CBCS) and Outcome-Based Education (OBE)

**I -SEMESTER**

| Sl.NO. | Course type | Course Code | Course Title | Teaching Hours per Week | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Practical/ Seminar | Tutorial/ SDA | Duration in hrs | CIE-Marks | SEE-Marks | Total Marks | |
| | | | | L | P | T/SDA | | | | | |
| 1 | BSC | 24MAT11 | Computational Methods | 03 | 00 | 00 | 03 | 50 | 50 | 100 | 3 |
| 2 | IPCC/PCC/PBLC | 24PTP12 | Theory of I C Engines | 03 | 02 | 00 | 03 | 50 | 50 | 100 | 4 |
| 3 | PCC | 24PTP13 | Advanced Fluid Mechanics | 03 | 00 | 02 | 03 | 50 | 50 | 100 | 4 |
| 4 | PCC | 24PTP14 | Steam Generator and Auxiliaries | 02 | 00 | 02 | 03 | 50 | 50 | 100 | 3 |
| 5 | PCC | 24PTP15 | Energy Resources | 02 | 00 | 02 | 03 | 50 | 50 | 100 | 3 |
| 6 | PCCL | 24PTPL16 | Thermal Engineering Lab-I | 01 | 02 | 00 | 03 | 50 | 50 | 100 | 2 |
| 7 | PCCL | 24PTPL17 | Measurements Lab in Thermal Systems | 01 | 02 | 00 | 03 | 50 | 50 | 100 | 2 |
| 8 | PCC | 24SEM18 | Technical Seminar | 00 | 01 | 01 | 03 | 100 | -- | 100 | 1 |
| 9 | NCMC | 24RMI19 | Research Methodology and IPR (Online) | **Online courses (online.vtu.ac.in)** | | | | | | | PP |
| **TOTAL** | | | | **15** | **07** | **07** | **24** | **450** | **350** | **800** | **22** |

**Note: BSC**-Basic Science Courses, **PCC:** Professional core. **IPCC**-Integrated Professional Core Courses, **PCC(PB):** Professional Core Courses (Project Based), **PCCL**-Professional Core Course lab, **NCMC**- None Credit Mandatory Course, **L**-Lecture, **P**-Practical, **T/SDA**-Tutorial / Skill Development Activities (Hours are for Interaction between faculty and students) **MRMI19**- Research Methodology and IPR **(Online)** for the students who have **not studied** this course in the Undergraduate level. This course is not counted for vertical progression; Students must qualify for the award of the master's degree.

**M-** Master program **xx** – **ME** for Mechanical Engineering Stream, **CV** for Civil Engineering Stream, **EE** – Electrical & Electronics Engineering Stream, **EC**-Electronics and Communication Engineering Stream, **CS**-Computer Science and Engineering **BA -** Business Administration **AR**- Architecture

**BSC:** Basic Science Courses: Courses like Mathematics/ Science are the prerequisite courses that the concerned engineering stream board of Studies will decide. **PCC:** Professional Core Course: Courses related to the stream of engineering, which will have both CIE and SEE components, students have to qualify in the course for the award of the degree. **Integrated Professional Core Course (IPCC):** Refers to a Professional Theory Core Course Integrated with practical of the same course. The IPCC's theory part shall be evaluated by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. **Project Based Learning Course (PCC(PB):** Project Based Learning course is a professional core Course only Students have to complete a project out of learning from the course and SEE will be viva voce on project work. **PCCL: Professional Core Course Laboratory:** A Practical course whose CIE will be evaluated by the class teacher and SEE will be evaluated by the two examiners.

**Skill development activities: Under Skill development activities in a concerning course, the students should**

1. Interact with industry (small, medium, and large).

2. Involve in research/testing/projects to understand their problems and help creative and innovative methods to solve the problem.

3. Involve in case studies and field visits/ fieldwork.

4. Accustomed to the use of standards/codes etc., to narrow the gap between academia and industry.

5. Handle advanced instruments to enhance technical talent.

6. Gain confidence in the modelling of systems and algorithms for transient and steady-state operations, thermal study, etc.

7. Work on different software/s (tools) to simulate, analyse and authenticate the output to interpret and conclude.

All activities should enhance student's abilities to employment and/or self-employment opportunities, management skills, Statistical analysis, fiscal expertise, etc. Students and the course instructor/s are to be involved either individually or in groups to interact together to enhance the learning and application skills of the study they have undertaken. The students with the help of the course teacher can take up relevant technical activities that will enhance their skills. The prepared report shall be evaluated for CIE marks.

**MRMI19-Research Methodology and IPR-** None Credit Mandatory Course (NCMC) if students have not studied this course in their undergraduate program, then he /she has to take this course at **http://online.vtu.ac.in** and to qualify for this course is compulsory before completion of the minimum duration of the program (Two years), however, this course will not be considered for vertical progression.

**Technical Seminar:** Students have to finalize the technical topic for the seminar in consultation with a faculty mentor, Preparation of the seminar report, and presentation slides to be presented at the end of the semester.

| ADMISSION YEAR:2024-25 | | | | ACADEMIC YEAR:2024-25 |
|---|---|---|---|---|
| 1. | COURSE TITLE: COMPUTATIONAL METHODS | | | MTech I-Sem (TPE) |
| Course Code | 24MAT11A | BSC | CIE Marks | 50 |
| Teaching Hours/Week (L :P: SDA) | 3:0:0 | | SEE Marks | 50 |
| Credits | 3 | | Exam Hours | 03 |

**COURSE OBJECTIVES:** The objectives of this course are to make the student to learn

1. To enhance the problem-solving skills of engineering students using an extremely powerful problem-solving tool namely numerical method.
2. To understand the system of equations, non-linearities and complicated geometries that are not uncommon in engineering practice and that are often impossible to solve analytically.

| COURSE CONTENTS | Hrs |
|---|---|
| **Module-1**<br>Linear Algebra: System of Linear Algebraic equations by triangularization method, Cholesky method, Partitions method, Gauss Jacobi, Gauss- Sidsel's method and Power method for eigen values and eigen vectors. (RBT Levels: L1&L2) | 8 hrs |
| **Module-2**<br>Roots of equations: Muller method, Giraffes' root squaring method. Numerical solution of ordinary differential equation by Picard's method of successive approximation, first order simultaneous equation by Picard and Runge-Kutta method. Second order equation by Picard's method. (RBT Levels: L2&L3) | 8 hrs |
| **Module-3**<br>Partial Differential Equations: Numerical solution of one-dimensional wave equation, Heat equation, (Schmidt's explicit formula) & Laplace equation (Gauss-Seidel process) by finite difference schemes. Illustrative examples on each method. (RBT Levels: L2&L3) | 8hrs |
| **Module-4**<br>Probability distribution: Random variables, probability mass and probability distribution function, Probability distributions: Binomial, Normal and Gaussian distributions & examples. (RBT Levels: L2&L3) | 8hrs |
| **Module-5**<br>Sampling Theory: Testing of hypothesis: Chi square test and F-test. Analysis of Variance (ANOVA):one way classification, Design of experiments, RBD. (RBT Levels: L2&L3) | 8hrs |

| **COURSE OUTCOMES:** After the completion of this course, student will be able to: | |
|---|---|
| CO1 | Acquire the idea of significant figures, types of errors during numerical computation |
| CO2 | Understand statistical and probabilistic concepts required to test the hypothesis and designing the experiments using RBD. |
| CO3 | Learn various numerical methods to solve system of linear equations |
| CO4 | Understand the roots of algebraic/transcendental equations and solve PDE's numerically. |
| CO5 | Analyse and solve PDE's related to wave equation arising in vibration analysis. |

**QUESTION PAPER PATTERN (SEE)**

| Q.No. | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Module | 1 | | 2 | | 3 | | 4 | | 5 | |

1. Two full questions (each of 20 Marks) are to be set from each module.
2. Student shall answer five full questions selecting one full question from each module.

| ADMISSION YEAR: 2024-25 | | | ACADEMIC YEAR: 2024-25 |
|---|---|---|---|
| 2. | COURSE TITLE: THEORY OF I C ENGINES | | MTech I-Sem (TPE) |

| | | | | |
|---|---|---|---|---|
| Course Code | 24PTP12 | IPCC/PCC/PBLC | CIE Marks | 50 |
| Teaching Hours/Week (L :P/S: SDA) | 3:0:2 | | SEE Marks | 50 |
| Credits | 4 | | Exam Hours | 03 |

**COURSE OBJECTIVES:** The objectives of this course are to make the student to learn

1. To provide the sufficient knowledge of concept, applications, importance of IC engines
2. To familiarize the students about the IC engines systems, processes, alternative fuels etc
3. To provide the sufficient knowledge of combustion engineering apply in real engineeringproblems
4. To understand the environment aspects of IC engines

| COURSE CONTENTS | Hrs |
|---|---|
| **Module-1**<br>Introduction to IC Engines: Basic engine components and nomenclature, Applications of IC Engines, Engine characteristics, geometrical properties of reciprocating engines, specific emissions and emission index, relationships between performance parameters, Engine design and performance data. Energy flow through IC engines, Various Auxiliary systems. Environment friendly engines.<br>Fuel –Air and Actual Engines: Modelling of Fuel-Air cycle Effect of operating variables on the performance of Fuel –air Cycles, Detailed analysis of difference between Fuel-Air and Real Cycle, Combustion charts and Gas Tables | 10hrs |
| **Module-2**<br>Carburetion: Introduction, Definition, factors affecting carburetion, air-fuel mixture, requirement, principle of carburetion, simple carburettor, calculation of air-fuel ratio, essential parts of a carburettor, compensating devices, additional in modern carburettors, types of carburettors, automobile carburettors, altitude compensation.<br><br>Injection Systems: Introduction to Mechanical Injection System, Functional Requirements and classification, Fuel feed pump and Fuel Injector, Electronic injection systems: Types, Merits and Demerits, | 10hrs |
| **Module-3**<br>Combustion in S.I and C.I Engines: Review of normal and abnormal combustion in SI and CI engine cyclic variation in combustion of SI engine, analysis of cylindrical pressure data in SI and CI engine, MPFI in SI engines common rail fuel injection system in CI engines fuel spray behaviour in CI engines | 10hrs |
| **Module-4**<br>Engine emissions and their control: Air pollution due to IC engines, emission characteristics, Euro norms, engine emissions, Hydrocarbon emissions, CO emission, NOx- Photo chemical smog, Particulates, other emissions, Smoke, emission control methods – thermal converters, catalytic converters, particulate traps, Ammonia injection systems, exhaust gas recirculation, ELCD, Crank case blow by control. IC engine Noise characteristics, types, standards and control methods, Air quality emission standards | 10hrs |
| **Module-5**<br>Alternate fuels for IC engines: Vegetable oils, alcohol, LPG, CNG, Hydrogen fuels, Biogas, Dual fuels, other possible fuels<br>Measurement: Noise, Emission, Pressure, crank angle torque, valve timings, Temperature and flow measurements | 10hrs |

**SUGGESTED TEXTBOOKS & REFERENCES:**


1. V. Ganesan, –Internal Combustion Engines‖, Tata McGraw-Hill Publications, 4th Edition
2. R. K. Rajput, A Textbook of Internal Combustion Engines, Laxmi Publishers (P) Ltd, 3rd Edition, 2016, ISBN: 978813180066
3. R. P. Sharma, M. L. Mathur, Internal Combustion Engines, Dhan pat Rai Publications, 2011, New Delhi, ISBN:978-81-89928-46-9
4. John B Heywood, –IC Engines fundamentals‖, McGraw- Hill Publications,2011.
5. W.W. Pulkrabek Engineering Fundamentals of IC Engine, PHI Pvt. Ltd 2002
6. C R Ferguson, –Internal Combustion Engines: Applied d Thermos sciences‖, John Wiley & Sons.
7. Richard stone _ 'Introduction to IC Engines ''Palgrave Publication 3rd edition.
8. Charles Fayette Taylor _ 'The Internal-Combustion Engine in Theory and Practice ''MIT Press 2nd edition


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| **COURSE OUTCOMES:** After the completion of this course, student will be able to: | |
|---|---|
| CO1 | Distinguish different Fuel-air and actual cycles. |
| CO2 | Demonstrate the carburetion and working principle of different type of carburettor. |
| CO3 | Explain influence of fuel structure on combustion and the significance of thermodynamics behind combustion in SI and CI engines |
| CO4 | Identify the various types of emissions, noise and their control systems |
| CO5 | Recommend the suitable alternative fuel for IC Engine. |

**QUESTION PAPER PATTERN (SEE)**

| Q.No. | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Module | 1 | | 2 | | 3 | | 4 | | 5 | |

1. Two full questions (each of 20 Marks) are to be set from each module.
2. Student shall answer five full questions selecting one full question from each module.

| ADMISSION YEAR: 2024-25 | | | | ACADEMIC YEAR: 2024-25 |
|---|---|---|---|---|
| 3. | COURSE TITLE: ADVANCED FLUID MECHANICS | | | MTech I-Sem (TPE) |
| Course Code | 24PTP13 | PCC | CIE Marks | 50 |
| Teaching Hours/Week (L :P/S: SDA) | 3:0:2 | | SEE Marks | 50 |
| Credits | 4 | | Exam Hours | 03 |

**COURSE OBJECTIVES:** The objectives of this course are to make the student to learn

1. Fluid and its properties, laws governing fluid flow and mathematical interpretation.
2. Fluid flow concepts, velocity potential, ideal fluid flow concepts and stream functions.
3. Fluid dynamics continuity equation, Navier stokes equation and application of it.
4. Low Reynolds number flow and viscous flow.
5. Compressible flow, sonic velocity Mach number isentropic flow.

| COURSE CONTENTS | Hrs |
|---|---|
| **Module-1**<br>Introduction and Fluid Statics: properties of fluids, viscosity, thermodynamic properties. Fluid pressure at a point, Pascal's law, Pressure variation in a static fluid, Absolute, gauge, atmospheric and vacuum pressures, Simple manometers, differential manometers, Total pressure and canter of pressure, Vertical plane surface submerged in a liquid, Horizontal plane surface submerged in a liquid, Inclined plane surface submerged in a liquid, Curved surface submerged in a liquid, Buoyancy, canter of buoyancy, metacentre and metacentric height, Conditions of equilibrium for floating and submerged bodies | 10hrs |
| **Module-2**<br>Fluid Kinematics: Introduction, Types of fluid flow, Continuity equation, continuity equation in three dimensions (Cartesian co-ordinate system only), Velocity and acceleration, Velocity potential function and stream function. Dimensional Analysis: Introduction, Derived quantities, Dimensions of physical quantities, Dimensional homogeneity, Buckingham's π theorem, Raleigh's method Dimensionless numbers | 10hrs |
| **Module-3**<br>Fluid Dynamics: Introduction, Equations of motion, Euler's equation of motion, Bernoulli's equation from Euler's equation, Bernoulli's equation for real fluids, Numerical problems.<br>Fluid flow measurements: Introduction, Venturi meter, Orifice meter and Pitot tube, Discharge over rectangular and triangular notches, Numerical problems.<br>Flow through pipes: Frictional loss in pipe flow, Darcy- Equation for loss of head due to friction in pipes, Chezy's equation for loss of head due to friction in pipes, Hydraulic gradient and total energy line, Minor loses in pipes, Sudden enlargement, Sudden contraction, Obstruction, Bend, Elbow | 10hrs |
| **Module-4**<br>Laminar flow and viscous effects: 03 Hours Reynold's number, Critical Reynold's number, Laminar flow through circular pipe-Hagen Poiseuille's equation, Laminar flow between parallel stationery plates, Numerical problems.<br>Flow past immersed bodies: Drag, Lift, Expression for lift and drag, Pressure drags, Friction drags, Boundary layer concept, Displacement thickness, Momentum thickness and energy thickness | 10hrs |
| **Module-5**<br>Compressible flow: Velocity of sound in a fluid, Velocity of sound in terms of Bulk modules, Velocity of sound for isothermal process, Velocity of sound for adiabatic process.<br>Mach number, Subsonic, Sonic and Supersonic flows, Propagation of disturbance for different Mach numbers, Mach cone, Stagnation properties, Stagnation Pressure, Stagnation temperature, Area velocity relationship for compressible flow | 10hrs |

**SUGGESTED TEXTBOOKS & REFERENCES:**


1. Foundations of fluid mechanics - S.W. Yuan, Prentice Hall of India, 1976.
2. Engineering Fluid Mechanics - P.A. Aswath Narayana& K.N. Sitharama, Narosa publications, 2005. Reference Books:
3. Fluid Mechanics - F.M. White, McGraw-Hill publications.
4. Advanced fluid mechanics - K. Muralidhar and G. Biswas, Narosa publications, 1996.
5. Introduction to fluid dynamics - Principles of analysis & design - Stanley Middleman, Wiley, 1997.
6.Fluid Mechanics and Machines/Modi and Seth/Standard Book House
7.Fluid Mechanics/Cohen and Kundu/Elsevier/5th edition
8. Fluid Mechanics / K.L Kumar /S Chand & Co.
9. Fluid Mechanics- Dr.R. K Bansal- Lakshmi Publications-2004

| **COURSE OUTCOMES:** After the completion of this course, student will be able to: | |
|---|---|
| CO1 | Apply the knowledge of fluid mechanics in selecting the types of fluids required for various engineering applications. |
| CO2 | Apply the knowledge of fluid mechanics to analyse the fluid engineering problems by the method of dimensional analysis. |
| CO3 | Apply the knowledge of fluid mechanics to analyse the fluid flow problems. |
| CO4 | Apply the knowledge of fluid mechanics to analyze viscous fluid flow problems |
| CO5 | Apply the knowledge of fluid mechanics to analyze compressible fluid flow problems |

**QUESTION PAPER PATTERN (SEE)**

| Q.No. | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Module | 1 | | 2 | | 3 | | 4 | | 5 | |

1. Two full questions (each of 20 Marks) are to be set from each module.
2. Student shall answer five full questions selecting one full question from each module.

| ADMISSION YEAR: 2024-25 | | | | ACADEMIC YEAR: 2024-25 |
|---|---|---|---|---|
| 4. | COURSE TITLE: STEAM GENERATOR AND AUXILIARIES | | | MTech I-Sem (TPE) |

| | | | | |
|---|---|---|---|---|
| Course Code | 24PTP14 | PCC | CIE Marks | 50 |
| Teaching Hours/Week (L :P/S: SDA) | 2:0:2 | | SEE Marks | 50 |
| Credits | 3 | | Exam Hours | 03 |

**COURSE OBJECTIVES:** The objectives of this course are to make the student to learn

1**.** To impart knowledge about various components and equipment used in a thermal power plant, their maintenance and performance analysis.

| COURSE CONTENTS | Hrs |
|---|---|
| **Module-1**<br>General layout of a thermal power plant, high pressure boilers, classification¸ circulation, nature of fuels and its influence on design, furnaces, PF burners, types, location in furnace, PF milling plant, oil and gas burner types and location, arrangement of coal and oil handling plant. | 8hrs |
| **Module-2**<br>Furnace circuit, steam side and waterside corrosion, pressure parts, super heater, re-heater, and economizer, desuper heater, air heater, and on-load cleaning of boilers.<br>Dust extraction equipment- bag house, electrostatic precipitator, draught systems, FD, ID and PA fans, chimneys, flue and ducts, dampers. FBC boilers and types, waste heat recovery boilers. | 8hrs |
| **Module-3**<br>Water system - impurities in water and its effects, feed and boiler water corrosion, quality of feed water, boiler drum water treatment and steam purity, water treatment- clarification, demineralization, evaporation and reverse osmosis plant. | 8hrs |
| **Module-4**<br>Instrumentation and control- steam generator measurements , temperature, pressure, flow ,level, dust , smoke, PH, dissolved oxygen, conductivity etc., super heater steam temperature control, drum level control, furnace draft control, differential pressure control, mill air flow and temperature control, combustion control, air flow and fuel flow control, SCAPH steam control, burners sequence control, load control, MODULE load control, boiler following turbine controls, integrated load control, ID, FD and PA fans. | 8hrs |
| **Module-5**<br>Operation and maintenance of steam generator and aux- pre commissioning activities, boiler start up and shut down procedures, emergencies in boiler operation, maintenance of steam generator and aux. Performance- boiler efficiency and optimization, coal mill, fans, ESP.<br>EIA study- pollutants emitted, particulate matter, Sox and NOx and ground level concentration. | 8hrs |

**SUGGESTED TEXTBOOKS & REFERENCES:**


1.Power Plant Engineering- P.K. Nag, Tata McGraw-Hill Publications, 2005

2.Power Plant Engineering-M.M. EI-Wakil, McGraw-Hill Publications, 2005

3.Modern Power Station Practice – Volume B: Boilers and Ancillary Plant: British Electricity international, London 1990

4.BHEL: Steam Generator and Auxiliaries, BHEL Tiruchirappalli

5.Babcock and Wilcox: Steam and Uses- Babcock and Wilcox

6. Modern Power Station Practice – Volume E: Chemistry and Metallurgy: British Electricity international, London 1990

7. Modern Power Station Practice – Volume F: Control and Instrumentation: British Electricity international, London 1990

8. Modern Power Station Practice – Volume G: Station Operation and Maintenance: British Electricity international, London 1990


**COURSE OUTCOMES:** After the completion of this course, student will be able to:

| | |
|---|---|
| CO1 | Apply the knowledge of power plant engineering in selecting the types of fuels and burning methods to produce steam. |
| CO2 | Explain working of different boilers and significance of mountings and accessories. |
| CO3 | Use techniques, skills, and modern engineering tools necessary for boiler performance |
| CO4 | Design and develop controls and instrumentation for effective monitoring of the process. |
| CO5 | Learn the Operation and maintenance of steam generator and aux- pre commissioning activities |

**QUESTION PAPER PATTERN (SEE)**

| Q.No. | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Module | 1 | | 2 | | 3 | | 4 | | 5 | |

1. Two full questions (each of 20 Marks) are to be set from each module.

2. Student shall answer five full questions selecting one full question from each module.

| ADMISSION YEAR: 2024-25 | | | | ACADEMIC YEAR: 2024-25 |
|---|---|---|---|---|
| 5. | COURSE TITLE: ENERGY RESOURCES | | | M.Tech I-Sem (TPE) |

| | | | | |
|---|---|---|---|---|
| Course Code | 24PTP15 | PCC | CIE Marks | 50 |
| Teaching Hours/Week (L :P/S: SDA) | 2:0:2 | | SEE Marks | 50 |
| Credits | 3 | | Exam Hours | 03 |

**COURSE OBJECTIVES:** The objectives of this course are to make the student to learn

1.To explain concept of various forms of Non-renewable and renewable energy.

2.To outline division aspects and utilization of renewable energy sources for both domestics and industrial applications.

3.To study the environmental and cost economics of using renewable energy sources compared to fossil fuels.

| COURSE CONTENTS | Hrs |
|---|---|
| **Module-1**<br>Commercial Energy-Coal, Oil, Natural gas, nuclear power and Hydro - their utilization pattern in the past, present and future projections of consumption pattern - Sector-wise energy consumption – environmental impact of fossil fuels – Energy scenario in India – Growth of energy sector and its planning in India. | 8hrs |
| **Module-2**<br>Solar energy-Solar radiation at the earth's surface – solar radiation measurements – estimation of average solar radiation - solar thermal flat plate collectors - concentrating collectors – solar thermal applications - heating, cooling, desalination, drying, cooking, etc – solar thermal electric power plant - principle of photovoltaic conversion of solar energy, types of solar cells - Photovoltaic applications: battery charger, domestic lighting, street lighting, water pumping etc - solar PV power plant | 8hrs |
| **Module-3**<br>Wind Energy-Nature of the wind – power in the wind – factors influencing wind – wind data and energy estimation - wind speed monitoring - wind resource assessment - Betz limit - site selection - wind energy conversion devices - classification, characteristics, applications – offshore wind energy - Hybrid systems - safety and environmental aspects – wind energy potential and installation in India | 8hrs |
| **Module-4**<br>Bio-Energy-Biomass resources and their classification - Biomass conversion processes – Thermo-chemical conversion - direct combustion – biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - types of biogas Plant - applications - alcohol production from biomass – bio diesel production – Urban waste to energy conversion | 8hrs |
| **Module-5**<br>Other Types of Energy-Ocean energy resources - principle of ocean thermal energy conversion (OTEC) - ocean thermal power plant - ocean wave energy conversion - tidal energy conversion – small hydro - geothermal energy - geothermal power plant – hydrogen production and storage - Fuel cell – principle of working - various types - construction and applications. | 8hrs |

**SUGGESTED TEXTBOOKS & REFERENCES:**


1.Sukhatme S.P., "Solar Energy", Tata McGraw Hill, 1984.

2.Twidell J.W. and Weir A., "Renewable Energy Sources", EFN Spon Ltd., 1986.

3.Kishore V.V.N., "Renewable Energy Engineering and Technology", Teri Press, New Delhi, 2012

4. Non-Conventional energy sources by B.H. Khan, Tata Mc-Graw Hill Co. Ltd., 2006.

5. Non-Conventional sources of energy by G.D. Rai, Khanna Publishers.

6.Renewable energy Technologies by Chetan Singh Solanki, PHI Learning Pvt. Ltd., 2009.

7. S. Rao and B.B. Parulekar, Energy Technology: Non-Conventional, Renewable and Conventional, Khanna Publishers, 2010 5. S.P. Sukatmi and J.K. Nayak, Solar Energy-Principles of Thermal Collection and Storage, TMH, 2008

8.J.A. Duffie and 6.W.A. Beckman, Solar Energy Thermal Processes, John Wiley, 2010


| **COURSE OUTCOMES:** After the completion of this course, student will be able to: | |
|---|---|
| CO1 | Understand the importance the commercial energy and renewable energy sources. For the present energy scenario and apply the principles of energy conservation to meet the present and future energy demand |
| CO2 | Analyse and evaluate the implication of renewable energy concepts in solving numerical problems pertaining to solar radiation geometry |
| CO3 | Design renewable energy systems for domestic applications |
| CO4 | Understand the energy conversion from geothermal energy, biomass, biogas, fuel cells and hydrogen |
| CO5 | Understand the concepts of the ocean thermal energy conversion systems and their applications |

**QUESTION PAPER PATTERN (SEE)**

| Q.No. | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Module | 1 | | 2 | | 3 | | 4 | | 5 | |

1. Two full questions (each of 20 Marks) are to be set from each module.

2. Student shall answer five full questions selecting one full question from each module.

| ADMISSION YEAR: 2024-25 | | | | ACADEMIC YEAR: 2024-25 |
|---|---|---|---|---|
| 6. | COURSE TITLE: THERMAL ENGINEERING LAB-I | | | M.Tech I-Sem (TPE) |
| Course Code | 24PTPL16 | PCCL | CIE Marks | 50 |
| Teaching Hours/Week (L :P/S: SDA) | 1:2:0 | | SEE Marks | 50 |
| Credits | 2 | | Exam Hours | 03 |

**COURSE OBJECTIVES:** The objectives of this course are to make the student to learn

1. To train students with hands on practice of handling IC engines and measuring the performance parameters

**COURSE CONTENTS**

**Conduct the performance test on the following experiments.**

1.Four stroke Petrol engine
2.Four stroke diesel engines
3.Multi cylinder petrol/Diesel engine – Morse Test
4.Variable Compression Ratio I C Engine
5.Performance testing of a 2-stage reciprocating Air Compressor
6.Performance testing of Centrifugal Blower
7. Performance analysis of an alternate fuel on computerized IC Engine test rig.
8.Measurement of solar radiation and calculation of solar power collection.
9. Performance evaluation of an axial fan.
10. Cascade test on a row of compressor blades.

**COURSE OUTCOMES:** After the completion of this course, student will be able to:

| | |
|---|---|
| CO1 | Understand the practical operation of 2 stroke and 4 stroke I.C engines |
| CO2 | Demonstrate the use of Valve timing diagram of I C Engines and use of Planimeter |
| CO3 | Conduct experiments on I C Engines to determine performance parameters |
| CO4 | Evaluate the performance of centrifugal blower to determine performance parameters |
| CO5 | Evaluate the performance of Air compressors to determine performance parameters |

| ADMISSION YEAR: 2024-25 | | | | ACADEMIC YEAR: 2024-25 |
|---|---|---|---|---|
| 7. | COURSE TITLE : MEASUREMENTS LAB IN THERMAL SYSTEMS | | | MTech I-Sem (TPE) |
| Course Code | 24PTPL17 | PCCL | CIE Marks | 50 |
| Teaching Hours/Week (L :P: SDA) | 1:2:0 | | SEE Marks | 50 |
| Credits | 2 | | Exam Hours | 03 |

**COURSE OBJECTIVES:** The objectives of this course are to make the student to learn

1. Importance/need of mechanical measurements in day-to-day practical life.
2. Different measurements systems and the errors associated with them.
3. To train the students in the calibration and use of different measuring instruments.
4. Determination of co-efficient of discharge through flow measuring devices.

**COURSE CONTENTS**

1. Calibration of LVDT (Study and calibration of LVDT transducer for displacement measurement)
2. Calibration of thermocouple for temperature measurement.
3. Calibration of pressure gauge
4. Calibration of load cell
5. Calibration of proving ring

Experiments on flow measuring devices

6. Venturi meter – Determination of coefficient of discharge (Calibration of venturi meter)
7. Orifice meter – Determination of coefficient of discharge (Calibration of orifice meter)
8. V- notch – Determination of coefficient of discharge (Calibration of V notch)
9. Rectangular notch-- Determination of co-efficient of discharge (Calibration Of rectangular notch)
10. Study and calibration of a rota meter for flow measurement.
11. To measure the local velocity at a given point in the flow stream by Pitot tube

| **COURSE OUTCOMES:** After the completion of this course, student will be able to: | |
|---|---|
| CO1 | Able to evaluate the uncertainties involved in any measurement |
| CO2 | Estimate errors during calibration of measuring instruments |
| CO3 | Able to perceive expertise on various calibration methods and measuring instruments for various applications |
| CO4 | Calibrate flow measuring devices such as Venturi meter, orifice meter and Notches and predict the coefficient of discharge for flow through pipes |
| CO5 | Analyse discharge measuring devices and hydraulic coefficients |

| ADMISSION YEAR: 2024-25 | | | | ACADEMIC YEAR: 2024-25 |
|---|---|---|---|---|
| 8. | COURSE TITLE: TECHNICAL SEMINAR | | | M.Tech I-Sem (TPE) |
| Course Code | 24SEM18 | PCC | CIE Marks | 100 |
| Teaching Hours/Week (L :P/S: SDA) | 0:1:1 | | SEE Marks | --- |
| Credits | 1 | | Exam Hours | 03 |

| ADMISSION YEAR: 2024-25 | | | | ACADEMIC YEAR: 2024-25 |
|---|---|---|---|---|
| 9. | COURSE TITLE: RESEARCH METHODOLOGY & IPR (Online)<br>Online courses (online.vtu.ac.in) | | | M.Tech I-Sem (TPE) |
| Course Code | 24RMI19 | NCMC | CIE Marks | -- |
| Teaching Hours/Week (L :P/S: SDA) | -- | | SEE Marks | -- |
| Credits | PP | | Exam Hours | -- |

**ADMISSION YEAR: 2024-25** **ACADEMIC YEAR:2024-25**

**POOJYA DODDAPPA COLLEGE OF ENGINEERING, KALABURAGI**

Scheme of Teaching and Examinations – 2024

M.Tech., Thermal Power Engineering (PTP)

Choice Based Credit System (CBCS) and Outcome-Based Education (OBE)

**II -SEMESTER**

| Sl.NO. | Course type | Course Code | Course Title | Teaching Hours per Week | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Practical/ Seminar | Tutorial/Skill Development Activities | Duration in hrs | CIE-Marks | SEE-Marks | Total Marks | |
| | | | | L | P | T/SDA | | | | | |
| 1 | IPCC | 24PTP21 | Advanced Heat Transfer | 03 | 00 | 02 | 03 | 50 | 50 | 100 | 4 |
| 2 | PCC(PB) | 24PTP22 | Alternative Fuel Technologies | 02 | 00 | 02 | 03 | 50 | 50 | 100 | 3 |
| 3 | PCC | 24PTP23 | Advanced Power Plant Engineering | 02 | 02 | 00 | 03 | 50 | 50 | 100 | 3 |
| 4 | PEC | 24PTP24X | Professional Elective-1 | 02 | 00 | 02 | 03 | 50 | 50 | 100 | 3 |
| 5 | PEC | 24PTP25X | Professional Elective-2 | 02 | 00 | 02 | 03 | 50 | 50 | 100 | 3 |
| 6 | MPS | 24MPS26 | Mini Project/ Technology-Based Societal Project | 00 | 04 | 02 | --- | 100 | --- | 100 | 3 |
| 7 | PCCL | 22PTPL27 | Thermal Engineering Lab-II | 01 | 02 | 00 | 03 | 50 | 50 | 100 | 2 |
| 8 | AEC/SEC | 24PTP281 | Ability/Skill Enhancement Course (Offline/Online) | 00 | 02 | --- | 02 | 50 | 50 | 100 | 1 |
| | | | | 01 | 00 | --- | 01 | | | | |
| **TOTAL** | | | | **13** | **10** | **10** | **21** | **450** | **350** | **800** | **22** |

**Note: BSC**-Basic Science Courses, **PCC:** Professional core. **IPCC-**Integrated Professional Core Courses, **NCMC-** None Credit Mandatory Course, **PCCL**-Professional Core Course lab

**AUD/AEC/SEC–**Audit Course / Ability Enhancement Course/Skill Enhancement Course, **L-Lecture, P-Practical, T/SDA-Tutorial / Skill Development Activities** (Hours are for Interaction between faculty and students) **PBLC**: Project Based Learning Course, **MPS:** Mini Project with Seminar/ Societal Project with Seminar

| **4.** | **Professional Elective-1** | **5.** | **Professional Elective-2** |
|---|---|---|---|
| **Course Code Under 22PTP24X** | **Course title** | **Course Code Under 22PTP25X** | **Course title** |
| 24PTP241 | Computational Fluid Dynamics | 24PTP251 | Thermodynamics and Combustion |
| 24PTP242 | Finite Elements Methods | 24PTP252 | Steam Turbine & its Auxiliaries |
| 24PTP243 | Convective Heat Transfer | 24PTP253 | Refrigeration and Cryogenics |
| 24PTP244 | Solar Energy Technologies | 24PTP254 | Nuclear Engineering in Power Generation |
| 24PTP245 | Thermal Power Station | 24PTP255 | Environmental Pollution and Control |

| Ability / Skill Enhancement Courses -(Offline/Online) | | | | |
|---|---|---|---|---|
| Course Code | Course title | L | T/SDA | P |
| 24PTP28X | Measurements Lab in Thermal Systems | 00 | -- | 02 |
| | | 01 | -- | 00 |

**Ability Enhancement Courses (AEC):** These courses are designed to help students enhance their skills in communication, language, and personality development. They also promote a deeper understanding of subjects like social sciences and ethics, culture and human behaviour, human rights, and the law. **Skill Enhancement Course (SEC):** Skill Enhancement Course means a course designed to provide value-based or skill-based knowledge and should contain both theory and lab/hands-on/training/fieldwork. The main purpose of these courses is to provide students with life skills in the hands-on mode to increase their employability.

**If AEC/SEC courses are ONLINE (MOOCs) courses** suggested by the concerned board of studies. These courses will be made available on **www. online.vtu.ac.in**, however online courses are not considered for vertical progression, but qualifying in online courses is mandatory for the award of the degree.

**Note:**

**Integrated Professional Core Course (IPCC)**: Refers to a Professional Theory Core Course Integrated with practical of the same course. The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

**Project Based Learning Course (PBLC):** Project Based Learning Course is a professional core Course only Students have to complete a project out of learning from the course and SEE will be viva voce on project work

**1 Mini Project/ Societal with Seminar:** This may be hands-on practice**,** survey report, data collection and analysis, coding, mobile app development, field visit and report preparation, modelling of system, simulation, analysing and authenticating, case studies, etc. It may be Techno Societal Project, technical Project work useful for the society.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a senior faculty of the department. Students can present the seminar based on the completed mini project/Societal Project. Participation in the seminar by all postgraduate students of the program shall be mandatory.

The CIE marks awarded for Mini/Societal Project work and Seminar, shall be based on the evaluation of Mini/ Societal Project work and Report, Presentation skill and performance in Question-and-Answer session in the ratio 50:25:25. Mini-Project with Seminar shall be considered as a head of passing and shall be considered for vertical progression as well as for the award of degree. Those, who do not take-up/complete the Mini Project and Seminar shall be declared as fail in that course and have to complete the same during the subsequent semester. **There is no SEE for this course.**

**Audit Courses /Ability Enhancement Courses Suggested by BOS (ONLINE courses): Audit Courses:** These are prerequisite courses suggested by the concerned Board of Studies. Ability Enhancement Courses will be suggested by the BoS if prerequisite courses are not required for the programs. **Ability Enhancement Courses**:

- These courses are prescribed to help students to enhance their skills in in fields connected to the field of specialisation as well allied fields that leads to employable skills. Involving in learning such courses are impetus to lifelong learning.
- The courses under this category are online courses published in advance and approved by the concerned Board of Studies.
- Registration to Audit /Ability Enhancement Course shall be done in consultation with the mentor and is compulsory during the concerned semester.
- In case a candidate fails to appear for the proctored examination or fails to pass the selected online course, he/she can register and appear for the same course if offered during the next session or register for a new course offered during that session, in consultation with the mentor.
- The Audit Ability Enhancement Course carries no credit and is not counted for vertical progression. However, a pass in such a course is mandatory for the award of the degree.

| ADMISSION YEAR:2024-25 | | | | ACADEMIC YEAR:2024-25 |
|---|---|---|---|---|
| 1. | COURSE TITLE: ADVANCED HEAT TRANSFER | | | MTech II-Sem (TPE) |
| Course Code | 24PTP21 | IPCC | CIE Marks | 50 |
| Teaching Hours/Week (L :P: SDA) | 3:0:2 | | SEE Marks | 50 |
| Credits | 4 | | Exam Hours | 03 |

**COURSE OBJECTIVES:** The objectives of this course are to make the student to learn

1. To equip the students with fundamentals and mechanism of heat transfer enabling them to develop methodologies for solving practical problems.
2. Basic principles and modes of heat transfer.
3. Energy balances and understand basic mechanism of heat transfer such as conduction convection and radiation or simultaneously.
4. Multidimensionality and time dependence of heat transfer, obtain the differential equation of heat conduction in various coordinate system.
5. Radiation intensity and clear understanding of the property's emissivity, reflectivity and transmissivity on directional and total basis

| COURSE CONTENTS | Hrs |
|---|---|
| **Module-1**<br>Introductory Concepts and definition: Modes of heat transfer; Basic laws governing conduction, Convection, and Radiation heat transfer; Thermal conductivity, convective heat transfer coefficient; Radiation heat transfer coefficient; combined heat transfer mechanism.<br>Conduction-Basic Equations: General form of one-dimensional heat conduction equation in rectangular, cylindrical and spherical coordinates. Discussion on three-dimensional conduction in rectangular, cylindrical and spherical coordinates systems (No derivation).<br>One dimensional Steady state conduction: Steady state conduction in a slab, in a cylinder and in a sphere without heat generation. | 10hrs |
| **Module-2**<br>Steady state conduction: in a slab, in a cylinder and in a sphere with heat generation (no derivation only discussion); overall heat transfer coefficient for a composite medium; thermal contact resistance; critical thickness of insulation.<br>One dimensional Transient conduction: Conduction in solids with negligible internal temperature gradients (lumped system analysis) Use of transient temperature charts (Heisler's charts) for Transient conduction in slab, long cylinder and sphere | 10hrs |
| **Module-3**<br>Forced Convection: Application of dimensional analysis for forced convection problems. Physical significance of Dimensionless numbers used. Use of various Correlations for hydro dynamically and thermally developed flows; Use of correlations for flow over a flat plate, over a cylinder. Inside the duct.<br>Free or Natural Convection: Application of dimensional analysis for free convection physical significance of dimensionless numbers. Use of correlations for free convection from or to vertical, horizontal and inclined flat plates, vertical and horizontal cylinders | 10hrs |
| **Module-4**<br>Application of heat transfer: Fins; Steady state conduction in fins of uniform cross section long fin, fin with insulated tip and fin with convection at the tip; fin efficiency & effectiveness. Boiling and Condensation; Film, drop wise condensation theory, Pool boiling regimes, Use of correlations for film and drop wise condensation on tubes.<br>Heat Exchangers: Classification of heat exchangers; Overall heat transfer coefficient, Fouling, Scaling factors; LMTD and NTU methods of analysis of heat exchangers. | 10hrs |
| **Module-5**<br>Radiation Heat transfer: Thermal radiation: Definitions of various terms used in radiation heat transfer; Stefan-Boltzmann law, Kirchhoff's law, Planck's law and Wein's displacement law, Radiation heat exchange between two parallel infinite black surfaces, between two parallel infinite grey surfaces; Effect of radiation shield; Intensity of radiation and solid angle; Lamberts Law | 10hrs |

**SUGGESTED TEXTBOOKS & REFERENCES:**

1. M. N. Ozick, "Heat Transfer A basic approach", McGraw Hill International, 1988.

2. Yunus A Congel, "Heat Transfer a Practical approach", TATA McGraw Hill 2002.

3. Mahesh M. Rathore, "Engineering Heat and Mass transfer", Laxmi Publications, 2nd edition, 2006.

4. R. C. Sachdeva, "Fundamentals of Engineering Heat and Mass transfer", Wiley Eastern Ltd., 1995.

**Data Handbook:** Heat Transfer data handbook by C P Kothandaraman, S Subramanyan, 8th edition, New Age International Publisher Delhi

**COURSE OUTCOMES:** After the completion of this course, student will be able to:

| | |
|---|---|
| CO1 | Explain basic concepts of different modes of heat transfer and governing equations. |
| CO2 | Solve steady and unsteady state heat transfer problems in conduction |
| CO3 | Apply convection and radiation principles to solve heat transfer problems including dimensional analysis |
| CO4 | Determine performance parameters of different heat exchangers. |
| CO5 | Understand the principles thermal radiation heat transfer; develop expressions for net radiation between various types of bodies |

**QUESTION PAPER PATTERN (SEE)**

| Q.No. | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Module | 1 | | 2 | | 3 | | 4 | | 5 | |

1. Two full questions (each of 20 Marks) are to be set from each module.

2. Student shall answer five full questions selecting one full question from each module.

| ADMISSION YEAR: 2024-25 | | | | ACADEMIC YEAR: 2024-25 |
|---|---|---|---|---|
| 2. | COURSE TITLE: ALTERNATIVE FUEL TECHNOLOGIES | | | MTech II-Sem (TPE) |

| | | | | |
|---|---|---|---|---|
| Course Code | 24PTP22 | PCC(PB) | CIE Marks | 50 |
| Teaching Hours/Week (L :P: SDA) | 2:0:2 | | SEE Marks | 50 |
| Credits | 3 | | Exam Hours | 03 |

**COURSE OBJECTIVES:** The objectives of this course are to make the student to learn

1. To understand the need of alternative fuels, environment impact, types of alternative fuels, preparation of alternative fuels
2. To familiarize the students about engine alteration to use alternative fuels
3. To understand the status of alternative fuels

| COURSE CONTENTS | Hrs |
|---|---|
| **Module-1**<br>Introduction: Need for alternate fuel, availability and properties of alternate fuels, general use of alcohols, LPG, hydrogen, ammonia, CNG and LNG, vegetable oils and biogas, merits and demerits of various alternate fuels, introduction to alternate energy sources. Like Electric vehicle, hybrid, fuelcell and solar cars. | 8hrs |
| **Module-2**<br>Alcohols: Properties as engine fuel, alcohols and gasoline blends, performance in SI engine, methanol and gasoline blends, combustion characteristics in CI engines, emission characteristics, DME, DEE properties performance analysis, performance in SI &CI Engines. | 8hrs |
| **Module-3**<br>CNG, LPG, Hydrogen and Biogas: Availability of CNG, properties, modification required to use in engines, performance and emission characteristics of CNG, LPG and Biogas using in SI & CI engines, Hydrogen; storage and handling, performance and safety aspects. | 8hrs |
| **Module-4**<br>Vegetable Oils: Various vegetable oils for engines, trans esterification, biodiesel and its properties, performance, emission and combustion characteristics of engine.<br>Fuel cell vehicles, specifications, system components, selection of fuel cell, thermal management, maintenance, advantage and limitations | 8hrs |
| **Module-5**<br>Electric and Hybrid Vehicle: Layout of an electric vehicle, advantage and limitations, specifications, system components,electronic control system, high energy and power density batteries, hybrid vehicle Solar powered vehicles, specifications, system components, advantage and limitations, | 8hrs |

**SUGGESTED TEXTBOOKS & REFERENCES:**


1. M.K. Gajendra Babu, K.A. Subramanian, Alternative Transportation Fuels: Utilization inCombustion Engines, CRC Press, 2013.
2. Richard L. Beechford, Alternative Fuels Guidebook - SAE International Warrendale1997.
3. B. P. Pundir, Engine Emissions, Alpha Science International Limited, 2007
4. B. P. Pundir, IC Engines Combustion and Emissions, Alpha Science International Limited,2010.
5. Nagpal, Power Plant Engineering, Khanna Publishers - 1991.


**COURSE OUTCOMES:** After the completion of this course, student will be able to:

| | |
|---|---|
| CO1 | Demonstrate Structure of petroleum, refining process, Products of refining process, Select suitable fuels for use in SI engines. Understand various performances rating in SI engines. |
| CO2 | Illustrate properties of petroleum products and classify them on their characteristic. |
| CO3 | Describe and analyze Need for alternative fuels such as Ethanol, Methanol, LPG, CNG, Hydrogen and their manufacturing procedure |
| CO4 | Calculate and estimate performance and emission characteristics of alternative fuels |
| CO5 | Analyse environmental effects of combustion of various fuels, suggest modification in their usage |

**QUESTION PAPER PATTERN (SEE)**

| Q.No. | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Module | 1 | | 2 | | 3 | | 4 | | 5 | |

1. Two full questions (each of 20 Marks) are to be set from each module.
2. Student shall answer five full questions selecting one full question from each module.

| ADMISSION YEAR:2024-25 | | | ACADEMICYEAR:2024-25 |
|---|---|---|---|
| 3. | COURSE TITLE: ADVANCED POWER PLANT ENGINEERING | | MTech II-Sem (TPE) |

| | | | | |
|---|---|---|---|---|
| Course Code | 24PTP23 | PCC | CIE Marks | 50 |
| Teaching Hours/Week (L :P: SDA) | 2:2:0 | | SEE Marks | 50 |
| Credits | 3 | | Exam Hours | 03 |

**COURSE OBJECTIVES:** The objectives of this course are to make the student to learn

1**.** Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

2. To acquaint students with both steam generation and electricity production and to present some of the engineering calculations encountered in practice.

| COURSE CONTENTS | Hrs |
|---|---|
| **Module-1**<br><br>Coal Based Thermal Power Plants- Rankine cycle —Layout of modern coal power plant, Super Critical Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants — Fuel and ash handling, Draught system, Feed water treatment. | 8hrs |
| **Module-2**<br><br>Diesel, Gas Turbine Power Plants- Diesel power plant- Layout of a diesel power plant. Advantages and disadvantages of the diesel power plant. Method of starting diesel engines, cooling and lubrication system for the diesel engine. Intake and exhaust system. Gas Turbine Power Plant- Open & closed cycle turbine plants with the accessories. Advantages & Disadvantages of the gas turbine plant, Multistage expansion and multistage compression Different methods of improving efficiency (Reheat regeneration and inter cooling) | 8hrs |
| **Module-3**<br><br>Nuclear Power Plants- Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors: Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium- Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants. | 8hrs |
| **Module-4**<br><br>Power from renewable Energy-- Hydro Electric Power Plants — Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, Solar Photo Voltaic (SPV), Solar Thermal, Geothermal, Biogas and Fuel Cell power systems. | 8hrs |
| **Module-5**<br><br>Energy, Economic and Environmental Issues of Power Plants- Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants. | 8hrs |

**SUGGESTED TEXTBOOKS & REFERENCES:**

1. A course in Power Plant Engineering /Arora and Domkundwar/Dhan Patrai & Co.
2. Power Plant Engineering /P.C. Sharma / S.K. Kataria Pub
3. Power Plant Engineering: P.K. Nag/ II Edition /TMH.
4. Power station Engineering – El Wakil / McGraw-Hill.
5. An Introduction to Power Plant Technology / G.D. Rai/Khanna Publishers

| **COURSE OUTCOMES:** After the completion of this course, student will be able to: | |
|---|---|
| CO1 | The students will learn the operating procedure of a thermal power plant and the details of different machineries used in such power plant |
| CO2 | know the basic working principles of gas turbine and diesel engine power plants, Define the performance characteristics and components of such power plants, |
| CO3 | The operating procedure of a nuclear power plant and the details of different machineries used in such power plant |
| CO4 | Gives Knowledge of the various types of non-conventional power plant, hydroelectric Power plant, along with the principal components of these Plants |
| CO5 | Basics of power and Energy, define terms and factors associated with power plant economics, calculate present worth depreciation and cost of different types of power plants, and estimate the cost of producing power per kW along with the awareness of pollution |

**QUESTION PAPER PATTERN (SEE)**

| Q.No. | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Module | 1 | | 2 | | 3 | | 4 | | 5 | |

1. Two full questions (each of 20 Marks) are to be set from each module.
2. Student shall answer five full questions selecting one full question from each module.

## PROFESSIONAL ELECTIVES-1

| ADMISSION YEAR: 2024-25 | | | | ACADEMIC YEAR:2024-25 |
|---|---|---|---|---|
| 4. | 1-COURSE TITLE : COMPUTATIONAL FLUID DYNAMICS | | | MTech II-Sem (TPE) |
| Course Code | 24PTP241 | PEC-1 | CIE Marks | 50 |
| Teaching Hours/Week (L :P: SDA) | 2:0:2 | | SEE Marks | 50 |
| Credits | 3 | | Exam Hours | 03 |

**COURSE OBJECTIVES:** The objectives of this course are to make the student to learn

1. To understand the fundamentals of CFD and fluid flow equations in conservation forms.
2. To understand the various methods of solving linear algebraic equations.
3. To know the discretization methods and understand how it can be used in heat conduction problems.
4. To know the equations related to convection and diffusion and understand the methods to solve these equations.
5. To understand the Navier Stokes equations and turbulent modelling.

| COURSE CONTENTS | Hrs |
|---|---|
| **Module-1**<br>Introduction to Computational Fluid Dynamics-- Computational Fluid Dynamics: CFD Applications, Experimental investigations, theoretical calculations, advantages and disadvantages of theoretical calculations, Fundamental principles of conservation, Reynolds transport theorem, Conservation of mass, Conservation of momentum, Conservation of Energy equations, Navier-Stokes equation, Time-average equations for turbulent flow, the turbulent kinetic energy equation, the general differential equations, Nature of coordinates: Independent variables, choice of coordinates, one way and two-way coordinates. | 8hrs |
| **Module-2**<br>Solution of Systems of Linear Algebraic Equations--Criteria for unique solution, infinite number of solutions and no solution, Solution techniques for systems of linear algebraic equations: Elimination, Iteration and Gradient Search method, Elimination method: Forward elimination and backward substitution, Assessment of number of computations, L-U decomposition technique, Tridiagonal matrix algorithm (TDMA): Thomas algorithm Iteration methods: Jacobi's method and Gauss Siedel method, Generalized analysis of the iterative methods, Sufficient condition for convergence, Rate of convergence, Scarborough criteria of sufficient condition for convergence in Gauss Siedel Method, Illustrative examples of Jacobi's method and Gauss Siedel method. | 8hrs |
| **Module-3**<br>Discretisation Methods and Heat Conduction--The Discretization concept, the structure of Discretization equation, Methods of deriving the Discretization equation: Taylor series formulation, variation formulation, method of Weighted residuals, Control Volume formulations. Illustrative examples, Four basic rules, Numerical problems. Heat conduction: Steady one-dimensional Conduction: The basic Equation, the grid Spacing, the interface conductivity, non-linearity, Source term Linearization, Boundary conditions, Unsteady one dimensional Conduction: the general Discretization equation,<br>Explicit, Crank Nicolson and fully implicit schemes, Two dimensional and three-dimensional situations, Over relaxation and Under relaxation Methods. Problems. | 8hrs |
| **Module-4**<br>Convection and Diffusion--Steady one dimensional Convection and diffusion, the primary derivation, the upwind scheme, the exact solution, The Exponential scheme, The Hybrid scheme, The power law scheme, consequences of various scheme, Discretization equation for Two dimension, details of derivation, final Discretization equation, Discretization equation for Three dimension, one way space coordinates, outflow boundary conditions, False diffusion: common and proper view of False diffusion. | 8hrs |
| **Module-5**<br>Navier Stokes Equations and Turbulent Modelling--Discretization of the Momentum Equation: Stream Function-Vorticity approach and Primitive variable approach, Staggered grid and Collocated grid, SIMPLE Algorithm, SIMPLER Algorithm<br>Important features of turbulent flow, Vorticity transport equation, Statistical representation of turbulent flows: Homogeneous turbulence and isotropic turbulence, General Properties of turbulent quantities, Reynolds average Navier stokes (RANS) equation, Closure problem in turbulence: Necessity of turbulence modelling, Different types of turbulence model: Eddy viscosity 2 models, Mixing length model, Turbulent kinetic energy and dissipation, The κ-ε model, Advantages and disadvantages of κ -ε . | 8hrs |

**SUGGESTED TEXTBOOKS & REFERENCES:**

1. Computational Fluid Dynamics: The Basics with Applications, John D. Anderson, Jr., McGraw-Hill International Editions, 1995.
2. Computational Fluid Flow and Heat Transfer, K. Murali Dhar and Sundararajan (Editors), 2nd Edition, Narosa Publishing House, 2003.
3. Introduction to Computational Fluid Dynamics: H.K. Versteeg and W. Malalasekera, Pearson Education Limited, 2nd Edition, 2007.
4. Computational Fluid Methods for Fluid Dynamics, J.H. Furzier and M. Peric, Springer (India) Pvt. Ltd., 3rd Edition, 2002.
5.Introduction to Computational Fluid Dynamics, Pradip Niyogi, S.K. Chakrabarty, M.K. Laha, Pearson Education, 2011.
6. Numerical Heat Transfer and Fluid Flow, Suhas V. Patankar, Hemisphere Publishing Corporation, 1980.

| **COURSE OUTCOMES:** After the completion of this course, student will be able to: | |
|---|---|
| CO1 | Understand the fundamental concepts of computational fluid dynamics and explain Reynolds transport theorem. |
| CO2 | Demonstrate the different methods of solving a system of linear algebraic equations. |
| CO3 | Understand the concept of Discretization and its methods; Discretize the heat conduction equations and solve numerical problems |
| CO4 | Derive the one-dimensional steady convection and diffusion equation; Discretize these equations using different methods. |
| CO5 | Discretize the momentum equation and understand the various turbulent models. |

**QUESTION PAPER PATTERN (SEE)**

| Q.No. | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Module | 1 | | 2 | | 3 | | 4 | | 5 | |

1. Two full questions (each of 20 Marks) are to be set from each module.
2. Student shall answer five full questions selecting one full question from each module.

| ADMISSION YEAR: 2024-25 | | | | ACADEMIC YEAR: 2024-25 |
|---|---|---|---|---|
| 4. | 2-COURSE TITLE : FINITE ELEMENT METHODS | | | MTech II-Sem (TPE) |
| Course Code | 24PTP242 | PEC-1 | CIE Marks | 50 |
| Teaching Hours/Week (L :P: SDA) | 2:0:2 | | SEE Marks | 50 |
| Credits | 3 | | Exam Hours | 03 |

**COURSE OBJECTIVES:** The objectives of this course are to make the student to learn

1. To impart structures analysis for stress, strain & dynamic loading knowledge
2. To enable formulation of the dimensional structure, mechanical and thermal problems into FEA.
3. To comprehend the basic concepts and enhance capabilities for solving 2 D complex problems.
4. To introduce the concepts of elastic and static analysis problems

| COURSE CONTENTS | Hrs |
|---|---|
| **Module-1**<br>Introduction-General description of Finite Element Method, Geometry, Elements, Node Numbering Schemes, Application and limitations. Equilibrium equations in elasticity. Definitions of FEA and FDM. Interpolation and One – Dimensional Problems--Euler – Lagrange's equation for bar, beam (cantilever / simply supported fixed) Principle of virtual work, principle of minimum potential energy, Raleigh's Ritz method and Gale kin's method boundary conditions. Interpolation polynomials- Linear, quadratic and cubic, 2D PASCAL's triangle. CST elements-Shape functions. Solutions of bars and stepped bars for displacements, reactions and stresses by using penalty approach and elimination approach. Guass-elimination technique. | 8hrs |
| **Module-2**<br>Higher Order Elements-Lagrange's interpolation, Higher order one dimensional elements-Quadratic and cubic element and their shape functions. Shape function of 2-D quadrilateral element-linear, quadric element Iso-parametric, Sub parametric and Super parametric elements. | 8hrs |
| **Module-3**<br>Trusses-2D truss Elements Stiffness matrix of Truss element. Examples illustrating how to obtain various internal force diagrams for different types of structural member like trusses Numerical problems. | 8hrs |
| **Module-4**<br>Beams-Governing Differentia Equation for beam bending Hermite shape functions for beam element, Derivation of stiffness matrix. Numerical problems of beams carrying concentrated, UDL and linearly varying loads. | 8hrs |
| **Module-5**<br>Thermal Analysis-Steady state Heat Transfer, One Dimensional Heat Conduction – Governing Equation – Boundary Condition. Temperature Gradient & B matrix functional approach to Heat Conduction – Element Conductivity Matrix. Assembly & Boundary Conditions, Heat Flux Boundary Conditions, Forced and Natural Boundary Conditions. | 8hrs |

**SUGGESTED TEXTBOOKS & REFERENCES:**


1. Finite Elements in Engineering, T.R. Chandrupatla, A.D Belegunde, 3rd Ed PHI.
2. Finite Element Method in Engineering, S.S. Rao, 4th Edition, Elsevier, 2006.
3. Fundamentals of Finite Element Method by Dr. S. M. Murigendrappa, International Publication – 2nd Edition 2009.
4. Finite Element Methods by S.B. Halesh, Sapna Book House - Bangalore.
5. "Finite Element Methods for Engineers" U.S. Dixit, Cengage Learning, 2009.
6. Concepts and applications of Finite Element Analysis, R.D. Cook D. S Maltus, M. E Plesha, R.J. Witt, Wiley 4th Ed, 2009
7. Finite Element Methods, Daryl. L. Logon, Thomson Learning 3rd edition, 2001.
8. Finite Element Method, J.N. Reddy, McGraw -Hill International Edition.

| **COURSE OUTCOMES:** After the completion of this course, student will be able to: | |
|---|---|
| CO1 | Understand the fundamental concepts of FEM and develop an ability to generate the governing FE equations for systems governed by partial differential Equations. |
| CO2 | Understand the concept of shape and interpolation function for higher order elements. |
| CO3 | Understand and analyse the structural applications of trusses. |
| CO4 | Gain the knowledge and able to do analysis of beam structure subjected to different loading conditions. |
| CO5 | Obtain the ability to understand heat conduction, heat flux and apply the boundary conditions with analysis to solve numerical problems. |

**QUESTION PAPER PATTERN (SEE)**

| Q.No. | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Module | 1 | | 2 | | 3 | | 4 | | 5 | |

1. Two full questions (each of 20 Marks) are to be set from each module.
2. Student shall answer five full questions selecting one full question from each module.

| ADMISSION YEAR:2024-25 | | | | ACADEMIC YEAR: 2024-25 |
|---|---|---|---|---|
| 4. | 3-COURSE TITLE : CONVECTIVE HEAT TRANSFER | | | MTech II-Sem (TPE) |
| Course Code | 24PTP243 | PEC-1 | CIE Marks | 50 |
| Teaching Hours/Week (L :P: SDA) | 2:0:2 | | SEE Marks | 50 |
| Credits | 3 | | Exam Hours | 03 |

**COURSE OBJECTIVES:** The objectives of this course are to make the student to learn

1. To Understand the concept of fluid mechanics in the background of Convection heat transfer
2. To understand the analysis of convective heat transfer
3. To familiarize the students about the convective heat, transfer mathematical analysis of various situations

| COURSE CONTENTS | Hrs |
|---|---|
| **Module-1**<br>Introduction to Forced, free & combined convection – convective heat transfer coefficient – Application of dimensional analysis to convection – Physical interpretation of dimensionless numbers.<br>Equations of Convective Heat Transfer: Continuity, Navier-Strokes equation & energy equation for steady state flows – similarity – Equations for turbulent convective heat transfer – Boundary layer equations for laminar, turbulent flows – Boundary layer integral equations. | 8hrs |
| **Module-2**<br>External Laminar Forced Convection: Similarity solution for flow over an isothermal plate– integral equation solutions – Numerical solutions – Viscous dissipation effects on flow over a flat plate.<br>External Turbulent Flows: Analogy solutions for boundary layer flows – Integral equation solutions.<br>Internal Laminar Flows: Fully developed laminar flow in pipe, plane duct & ducts with other cross-sectional shapes – Pipe flow & plane duct flow with developing temperature field – Pipe flows & plane duct flow with developing velocity & temperature fields.<br>Internal Turbulent Flows: Analogy solutions for fully developed pipe flow –Thermally developing pipe & plane duct flow | 8hrs |
| **Module-3**<br>Natural Convection: Boussin eq approximation – Governing equations – Similarity – Boundary layer equations for free convective laminar flows – Numerical solution of boundary layer equations. Free Convective flows through a vertical channel across a rectangular enclosure Horizontal enclosure Turbulent natural convection. | 8hrs |
| **Module-4**<br>Combined Convection: Governing parameters & equations – laminar boundary layer flow over an isothermal vertical plate – combined convection over a horizontal plate correlation for mixed convection effect of boundary forces on turbulent flows – internal flows- internal mixed convective flows – Fully developed mixed convective flow in a vertical plane channel & in a horizontal duct. | 8hrs |
| **Module-5**<br>Convective Heat Transfer Through Porous Media: Area weighted velocity, Darcy flow model, energy equation, boundary layer solutions for 2, D forced convection, fully developed duct flow, Natural convection in porous media, filled enclosures, stability of horizontal porous layers. | 8hrs |

**SUGGESTED TEXTBOOKS & REFERENCES:**


1. Convective Heat & Mass Transfer /Kays & Crawford/TMH
2. Introduction to Convective Heat Transfer Analysis/ Patrick H. Oosthuizen& David Naylor, MGH.
3. Convection Heat Transfer / Adrian Bejan / Wiley
4. Principles of Convective Heat Transfer / Kavi any, Massoud /Springer
5. Bejan, Convective heat transfer

| **COURSE OUTCOMES:** After the completion of this course, student will be able to: | |
|---|---|
| CO1 | Describe Applications of Convective Heat transfer in various thermal systems. |
| CO2 | Formulate and solve Navier-Stokes equations and energy equations in for various flow patterns and systems. |
| CO3 | Categorize and distinguish convective heat transfer through laminar and turbulent boundary layer |
| CO4 | Analyse natural and combined convection for flows through various channel by using numerical techniques |
| CO5 | Categorize and illustrate flows through porous media with applying energy equation for fully developed flows |

**QUESTION PAPER PATTERN (SEE)**

| Q.No. | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Module | 1 | | 2 | | 3 | | 4 | | 5 | |

1. Two full questions (each of 20 Marks) are to be set from each module.
2. Student shall answer five full questions selecting one full question from each module.

| ADMISSION YEAR: 2024-25 | | | | ACADEMIC YEAR: 2024-25 |
|---|---|---|---|---|
| 4. | 4-COURSE TITLE : SOLAR ENERGY TECHNOLOGIES | | | MTech II-Sem (TPE) |
| Course Code | 24PTP244 | PEC-1 | CIE Marks | 50 |
| Teaching Hours/Week (L :P: SDA) | 2:0:2 | | SEE Marks | 50 |
| Credits | 3 | | Exam Hours | 03 |

**COURSE OBJECTIVES:** The objectives of this course are to make the student to learn

1. To provide the sufficient knowledge of concept, applications, importance of solar energy
2. To enable them to understand the measurement of solar radiation using various instruments.
3. To familiarize the students about the solar energy and its applications in real life situations
4. To enable them to know photovoltaic cell operation and economics of solar systems

| COURSE CONTENTS | Hrs |
|---|---|
| **Module-1**<br>Introduction: energy sources, Renewable energy sources, potential, Achievements in India, energy alternatives, Solar energy option, overview, devices for thermal collection and storage, Thermal applications, Water and space heating, Power generation, Space cooling and refrigeration, Distillation, Drying, cooking and Grid connected solar pumping system. | 8hrs |
| **Module-2**<br>Solar Radiation: Solar radiation outside atmosphere, Solar radiation at earth's surface, Instruments for measuring solar radiation and sunshine recorder, solar radiation data, Solar radiation geometry, Empirical equations, prediction of availability of solar radiation, solar radiation on tilted surfaces | 8hrs |
| **Module-3**<br>Liquid flat plate collectors: Performance analysis, Transmissivity of cover, transmissivity-absorptivity product, Overall loss coefficient, hear transfer correlations, Collector efficiency factor, Collector heat removal factor, Numerical problems, Effect of various parameters on performance, Analysis of collectors, transient analysis, testing procedures, Alternative to conventional collectors | 8hrs |
| **Module-4**<br>Concentrating Collectors: Introduction, Flat plate collectors with plane reflectors, cylindrical parabolic collector, compound parabolic collectors, and parabolic dish collector. Central receiver collector, tracking, numerical problems.<br>Solar air heaters: performance analysis, types, testing procedures. | 8hrs |
| **Module-5**<br>Photo-Voltaic Conversion: Solar cell, working principles, conversion efficiency, commercial solar cells, applications<br>Economics: Principles of Economic Analysis – Discounted cash flow – Solar system – life cycle costs – cost benefit analysis and optimization – cost-based analysis of water heating and photo voltaic applications. | 8hrs |

**SUGGESTED TEXTBOOKS & REFERENCES:**


1. Solar Energy-Principles of energy conversion and storage, S P Sukatmi, Tata McGraw hill co., New Delhi.
2. Solar Energy Utilisation, G. D. Rai, Khanna publishers, New-Delhi
3. Solar engineering of Thermal processes, Duffy J A and Beckman, W. A. John Wiley & Sons, New York.
4. Solar energy: Principles of Thermal Collection and Storage/Sukatmi/TMH/2nd edition
5. Solar energy/Garg/TMH
6. Solar energy/Magal/McGraw Hill
7. Solar Thermal Engineering Systems /Tiwari and Suneja/Narosa
8. Power plant Technology/ El Wakil/TMH

| **COURSE OUTCOMES:** After the completion of this course, student will be able to: | |
|---|---|
| CO1 | Identify the significance and applications of various solar energy devices and instrument for measuring solar radiation. |
| CO2 | Understand the concept of solar radiation geometry and empirical equation for solar radiation |
| CO3 | Analyse the performance by conducting research on flat plate collector, air heater and concentrating type collector |
| CO4 | Analyse the overall loss coefficient, heat transfer correlation, collector efficiency factors in collectors and propose necessary solutions. |
| CO5 | Evaluate the issue related to photovoltaic conversion efficiency and economical aspects |

**QUESTION PAPER PATTERN (SEE)**

| Q.No. | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Module | 1 | | 2 | | 3 | | 4 | | 5 | |

1. Two full questions (each of 20 Marks) are to be set from each module.
2. Student shall answer five full questions selecting one full question from each module.

| ADMISSION YEAR: 2024-25 | | | | ACADEMIC YEAR: 2024-25 |
|---|---|---|---|---|
| 4. | 5-COURSE TITLE :THERMAL POWER STATION | | | MTech II-Sem (TPE) |
| Course Code | 24PTP245 | PEC-1 | CIE Marks | 50 |
| Teaching Hours/Week (L :P: SDA) | 2:0:2 | | SEE Marks | 50 |
| Credits | 3 | | Exam Hours | 03 |

**COURSE OBJECTIVES:** The objectives of this course are to make the student to learn

1. Providing an overview of Power Plants and detailing the role of Engineers in their operation and maintenance
2. To acquaint students with both steam generation and electricity production and to present some of the engineering calculations encountered in practice

| COURSE CONTENTS | Hrs |
|---|---|
| **Module-1**<br>Introduction: Layout of modern steam power plant, Selection of site for steam power station Steam Power Plant: Different types of fuels used for steam generation, Coal handling, Requirements of good coal handling plant, Coal handling systems, Equipment for burning coal in lump form, Strokers, Different types of stokers, Advantages and disadvantages of using pulverized fuel, Equipment for preparation and burning of pulverized coal, Unit system and bin system, Coal burners | 8hrs |
| **Module-2**<br>Ash and dust handling: Ash handling equipment and ash handling systems, Dust collection, Removal of smoke and dust, Dust collectors, Efficiency of dust collectors, Uses of ash and dust, General layout of ash and dust collection systems, Fly ash.<br>Chimney draught: Classification, Natural draught, Chimney height and diameter, Condition for maximum discharge through chimney, Efficiency of chimney, Draught losses, Artificial draught, Forced, Induced and Balanced draught, Advantages of mechanical draught, Numerical problems on chimney draught. | 8hrs |
| **Module-3**<br>Boilers: Classification and comparison, Selection of a boiler, Essentials of good boiler, Generation of steam using forced circulation, High and supercritical pressures, L Mont, Benson, Velox, Schmidt, Loeffler<br>Accessories: Accessories for the Steam Generator such as super-heaters, Desuperheater, Control of super heaters, Economisers, Air Pre-heaters and re-heaters, Feed water heaters and evaporators. | 8hrs |
| **Module-4**<br>Steam turbines: Steam nozzles, Nozzle efficiency, Compounding of steam turbines, Difference between impulse and reaction steam turbines, Turbine efficiencies. Steam condensers; Classification, Comparison between jet and surface condensers, Numerical problems on steam turbines.<br>Cooling ponds and Cooling towers: Introduction, Natural and artificial ponds, Cooling ponds, Spray ponds. Cooling towers: Introduction, Natural and forced draft cooling towers, Comparison between natural and forced draft cooling towers. | 8hrs |
| **Module-5**<br>Energy, Economic and Environmental Issues of Power Plants- Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal Power Plants. | 8hrs |

**SUGGESTED TEXTBOOKS & REFERENCES:**


1. Power Plant Technology- M.M. EL-Wakil-McGraw Hill, International. 1994.
2. Power Plant Engineering- P.K Nag-Tata McGraw Hill, 3rd Ed. 2001
3. Power Plant Engineering- R.K. Rajput-Laxmi Publications, 4th Ed. 2008
4. Power Plant Engineering- Domakundawar-Dhanpath Rai sons, 2003

| **COURSE OUTCOMES:** After the completion of this course, student will be able to: | |
|---|---|
| CO1 | Apply the knowledge of power plant engineering in selecting the types of fuels and burning methods to produce steam. |
| CO2 | Apply the knowledge of power plant engineering in selecting ash, dust handling and chimney draught for a steam power plant. |
| CO3 | Apply the knowledge of power plant engineering to analyse boilers, boiler accessories and performance of boilers. |
| CO4 | Apply the knowledge of power plant engineering to analyse steam turbines, cooling ponds, towers |
| CO5 | Basics of power and Energy, define terms and factors associated with power plant economics, calculate present worth depreciation and cost of different types of power plants, and estimate the cost of producing power per kW along with the awareness of pollution |

**QUESTION PAPER PATTERN (SEE)**

| Q.No. | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Module | 1 | | 2 | | 3 | | 4 | | 5 | |

1. Two full questions (each of 20 Marks) are to be set from each module.
2. Student shall answer five full questions selecting one full question from each module.

# PROFESSIONAL ELECTIVES-2

| ADMISSION YEAR: 2024-25 | | | | ACADEMIC YEAR: 2024-25 |
|---|---|---|---|---|
| 5. | 1-COURSE TITLE : THERMODYNAMICS AND COMBUSTION | | | MTech II-Sem (TPE) |
| Course Code | 24PTP251 | PEC-2 | CIE Marks | 50 |
| Teaching Hours/Week (L :P: SDA) | 2:0:2 | | SEE Marks | 50 |
| Credits | 3 | | Exam Hours | 03 |

**COURSE OBJECTIVES:** The objectives of this course are to make the student to learn

1. To enrich the knowledge of students in thermodynamics.
2. To predict the availability and irreversibility associated with the thermodynamic processes.
3. To analyse the properties of ideal and real gas mixtures, Behaviour of pure substances and to understand the basic concepts of combustion, flame propagation and types of flames.

| COURSE CONTENTS | Hrs |
|---|---|
| **Module-1**<br>Work and heat interaction, first law of thermodynamics, steady and unsteady flows with energy transaction. Second law of thermodynamics, reversibility, corollaries of the second law and entropy. Available energy, availability analysis of open and closed systems | 8hrs |
| **Module-2**<br>Properties of pure substances, properties of gases and gas mixtures, combined first and second laws of thermodynamics. Phase and reaction equilibrium, equilibrium constants, calculation of equilibrium composition of multi component gaseous mixtures. | 8hrs |
| **Module-3**<br>Equation of state and calculation of thermodynamics and transport properties of substances. Reaction rates and first, second and higher order reaction, in gaseous, liquid and solid phases | 8hrs |
| **Module-4**<br>Combustion and flame velocities, laminar and turbulent flames, premixed and diffusion flames, their properties and structures | 8hrs |
| **Module-5**<br>Theories of flame propagation, thermal, diffusion and comprehensive theories, problems of flame stability, flashback and blow off. Combustion of solid, liquid and gaseous fuels. Combustion of fuel droplets and sprays. Combustion system combustion in closed and open systems, application to boiler, gas turbine combustors and rocket motors. | 8hrs |

**SUGGESTED TEXTBOOKS & REFERENCES:**


1. Engineering Thermodynamics - P.K. Nag, Tata McGraw-Hill Publications.
2. Fundamentals of Classical Thermodynamics - G. Van Wylen and R.E. Sonntag, Wiley, 1986
3. Energy. Combustion and Environment - N.A. Chigier, McGraw-Hill, 1981.
4. Introduction to combustion phenomena - A. Murthy Kanuri, Gordon and Breach, 1975.
5. Fuels and combustion - S.P. Sharma and Chandra Mohan, Tata McGraw-Hill, 1984.
6. Engineering Thermodynamics - Onkar Singh. New age International Publications.


**COURSE OUTCOMES:** After the completion of this course, student will be able to:

| | |
|---|---|
| CO1 | Able to state analyse and apply laws of thermodynamics to solve the problems. |
| CO2 | Analyse the behaviour of pure substances using thermodynamic data. |
| CO3 | Evaluate thermodynamic properties of ideal and real gas mixtures using various relations. |
| CO4 | knowledge of fuel thermo-chemistry and fuel quality effects on emissions, engine technologies, engine combustion-related emissions and control technologies |
| CO5 | Extend their knowledge of fuels and engines to different situations of engineering context and professional practice. |

**QUESTION PAPER PATTERN (SEE)**

| Q.No. | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Module | 1 | | 2 | | 3 | | 4 | | 5 | |

1. Two full questions (each of 20 Marks) are to be set from each module.
2. Student shall answer five full questions selecting one full question from each module.

| ADMISSION YEAR: 2024-25 | | | ADEMIC YEAR: 2024-25 |
|---|---|---|---|
| 5. | 2-COURSE TITLE: STEAM TURBINE & ITS AUXILIARIES | | MTech II-Sem (TPE) |

| | | | | |
|---|---|---|---|---|
| Course Code | 24PTP252 | PEC-2 | CIE Marks | 50 |
| Teaching Hours/Week (L :P: SDA) | 2:0:2 | | SEE Marks | 50 |
| Credits | 3 | | Exam Hours | 03 |

**COURSE OBJECTIVES:** The objectives of this course are to make the student to learn

1. To provide the sufficient knowledge of working, construction and control of ST and GT
2. To learn the working principle, operations and analysis of nozzles, diffusers, steam and gas turbines

| COURSE CONTENTS | Hrs |
|---|---|
| **Module-1**<br>Turbine blading, casing, rotors and vibration and couplings, bearings pedestals, turning gears, lubrication system, jacking oil system, gland sealing, flange heating, LP exhaust cooling system, drain system, bypass system. Feed heating system-HP feed heating, deaerator system; LP feed heating, auxiliary steam system, Condenser, different pumps, cooling towers. | 8hrs |
| **Module-2**<br>Steam turbine-introduction, classification of turbines, as to flow passages and arrangement, as to use and operating conditions, other classifications and recapitulation of classification. Gas-turbine types-introduction, gas turbine engine and its components, classification according to application, cycle, and fuel, combined steam and gas turbine power plants, advantages of gas turbine. Nozzles-introduction, construction, critical pressure ratios, losses, divergence and position angles, wet and supersaturated steam, shock waves in nozzles, discharge coefficients, and nozzle calculations. Energy interchange in fluid machinery- introduction, momentum principles, streamlines theory, momentum and circulation, energy changes in fluid | 8hrs |
| **Module-3**<br>Impulse turbine: introduction, forces, relative velocity, blade velocity, work and efficiency, ideal blades, velocity diagram, theoretical analysis of stage work and efficiency, combined nozzle and blade efficiency, staging, velocity ratio, mixed staging. Reaction turbine introduction, velocity diagrams, theoretical work and efficiency symmetrical reaction stage, comparison of energy-absorbing abilities of various stages. Turbine flow passages: introduction, isentropic velocity ratio, energy distribution, carry-over effect. Impulse turbine flow passage blade profiles, pitch, width, and height, entrance/exit angels, efflux angles, and losses in passages. Reaction turbine flow passage- blade angles, profiles | 8hrs |
| **Module-4**<br>Mechanical aspects of turbine design: introduction, losses, disc friction, windage losses, leakage, preventive measures to reduce leakage, carbon-ring seals, water, steam, and air seals, special sealing devices, leakage efficiency, bearing losses, radiation losses, miscellaneous losses, stage output and efficiency, turbine output. Centrifugal compressor- introduction, description and operation, energy transfers and relations, losses, adiabatic efficiency, effect of compressibility, the diffuser, pre-whirl, performance characteristics, pressure coefficient and slip factor, surging, centrifugal compressor design calculations. Axial-flow compressor- introduction, stage characteristics, blading efficiency, design coefficients, blade loading, lift coefficient and solidity, blade angles, Mach number and Reynolds number | 8hrs |
| **Module-5**<br>Instrumentation and control- TG instruments, controls, boiler following turbine and turbine following boiler control. Steam turbine Control and Performance-introduction, control and supervisory instruments, principles of governing, direct-acting speed-responsive governors, characteristics of the simple speed-responsive governor, speed-responsive governors, hydraulic speed-responsive governor, pressure | 8hrs |

| | |
|---|---|
| regulators, speed regulation and parallel operation, emergency governors. Performance - introduction, effect of throttle governing, effect of initial pressure and temperature changes, effect of nozzle governing, Parsons number and quality factor, performance of automatic extraction turbines. Operation of TG-start up and shut down procedure. | |

**SUGGESTED TEXTBOOKS & REFERENCES:**


1. Raj Mohan Gupta, "Steam Turbine", Oxford & IBH Publishing Co. Pvt. Ltd.
2. P. K. Nag, "Power Plant Engineering", Tata McGraw Hill Publications.
3. R. Yadav, "Steam Turbine", Khanna Publishers.
4. Modern Power Station Practice – Volume C: Turbines, Generators and Associated Plant: British Electricity international, London 1990
5. John F Lee: Theory and Design of Steam and Gas Turbines- McGraw Hill Book Co 1954
6. Modern Power Station Practice – Volume F: Control and Instrumentation: British Electricity international, London 1990
7. HIH Saravanan, GFC Rogers, H Cohen: Gas Turbine Theory Pearson Education 2005
8. W.J. Kearton- Steam Turbine Theory and Practice-C.B. S Publishers New Delhi 2003


| **COURSE OUTCOMES:** After the completion of this course, student will be able to: | |
|---|---|
| CO1 | Summarize the working principles of steam turbines |
| CO2 | Use the principles of thermodynamics to determine the performance of steam and gas turbines. |
| CO3 | Distinguish and demonstrate the working principle and performance of impulse and reaction turbines |
| CO4 | Explain the concepts of axial flow and centrifugal compressors |
| CO5 | Design and develop controls and instrumentation for effective monitoring of the process. |

**QUESTION PAPER PATTERN (SEE)**

| Q.No. | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Module | 1 | | 2 | | 3 | | 4 | | 5 | |

1. Two full questions (each of 20 Marks) are to be set from each module.
2. Student shall answer five full questions selecting one full question from each module.

| ADMISSION YEAR:2024-25 | | | | ACADEMIC YEAR:2024-25 |
|---|---|---|---|---|
| 5. | 3-COURSE TITLE : REFRIGERATION AND CRYOGENICS | | | MTech II-Sem (TPE) |
| Course Code | 24PTP253 | PEC-2 | CIE Marks | 50 |
| Teaching Hours/Week (L :P: SDA) | 2:0:2 | | SEE Marks | 50 |
| Credits | 3 | | Exam Hours | 03 |

**COURSE OBJECTIVES:** The objectives of this course are to make the student to learn

1. To provide the knowledge to students about various refrigeration cycles.
2. To make the student understand the effect of various refrigerants on the environment.
3. To enable the students, understand the wide application of cryogenics in science and technology.
4. To make the student understand manufacture process of liquid gases and how to contain them.
5. To enable student, understand process of liquefaction.

| COURSE CONTENTS | Hrs |
|---|---|
| **Module-1**<br>Vapour Compression Refrigeration Systems: Analysis of vapour compression refrigeration cycle. Compound Vapour Compression System: Removing of flash gas inter cooling compound compression ultra-water inter cooler - liquid flash cooler flash inlet cooler, multiple evaporator and compression systems, one compressor system individual compressors compound compression cascade systems. | 8hrs |
| **Module-2**<br>Absorption Refrigeration System with Multiple Evaporators: Three fluid absorption systems-the Lithium Bromide water absorption system, Steam jet water vapour systems thermoelectric refrigeration systems vortex refrigeration system pulse tube refrigeration. Desirable properties of refrigerants designation of refrigerants inorganic, halo carbon refrigerants inorganic halo carbon reactions- secondary refrigerants reaction of refrigerants with moisture and oil properties of mixtures of refrigerants | 8hrs |
| **Module-3**<br>Cryogenics: Introduction necessity of low temperature - Multistage Refrigeration system -Cascade system. Manufacture of dry ice-Joule Thompson coefficient, Liquefaction of air, Lined system- Analysis- Dual pressure cycle analysis-Liquefaction of Hydrogen and Helium-problems. | 8hrs |
| **Module-4**<br>Application of Lower Temperatures: Effects on the properties of metals-strength-Thermal properties-super conductivity-super fluidity. Applications like expansion fitting cryobiology-cryosurgery - space research-computers underground power lines. | 8hrs |
| **Module-5**<br>Low Temperature Insulation: Reflective Insulation-Evacuated Powders-Rigid Foams-Super insulation, cooling by adiabatic demagnetization - Gas separation and cryogenic systems separation of gases-Rectifying columns- Air separating- single and double columns Air separation plant, Storage and handling of cryogenic liquids | 8hrs |

**SUGGESTED TEXTBOOKS & REFERENCES:**


1. C.P. Arora, Refrigeration & Air-Conditioning by TMH, 5th Edition.
2. R.F Barron, Cryogenic Systems, Oxford University Press, 3rd Edition.
3. Refrigeration & Air-Conditioning, Jones, J.W., McGraw Hill, 4th Edition
4. Refrigeration & Air-Conditioning, Manohar Prasad, New Age, 8th Edition
5. Refrigeration & Air-Conditioning Domkonduwar, & Arora, Dhan Patrai & Sons, 7thEdition


**COURSE OUTCOMES:** After the completion of this course, student will be able to:

| | |
|---|---|
| CO1 | Analyse the vapour compression refrigeration systems and Vapour absorption system |
| CO2 | Select the refrigerant based on the load requirement. |
| CO3 | Explain the effect of Joule-Thompson Coefficient and liquefaction of various gases. |
| CO4 | Evaluate the effect of low temperatures on various properties |
| CO5 | Discuss about the liquid gasses' container. |

**QUESTION PAPER PATTERN (SEE)**

| Q.No. | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Module | 1 | | 2 | | 3 | | 4 | | 5 | |

1. Two full questions (each of 20 Marks) are to be set from each module.
2. Student shall answer five full questions selecting one full question from each module.

| ADMISSION YEAR:2024-25 | | | | ACADEMIC YEAR:2024-25 |
|---|---|---|---|---|
| 5. | 4-COURSE TITLE : NUCLEAR ENGINEERING IN POWERGENERATION | | | MTech II-Sem (TPE) |
| Course Code | 24PTP254 | PEC-2 | CIE Marks | 50 |
| Teaching Hours/Week (L :P: SDA) | 2:0:2 | | SEE Marks | 50 |
| Credits | 3 | | Exam Hours | 03 |

**COURSE OBJECTIVES:** The objectives of this course are to make the student to learn

1. To expose the students the various aspects of nuclear energy.
2. To provide the sufficient knowledge of concept, applications, importance of NuclearEnergy
3. Reactor principles, nuclear safety, and reactor dynamic behaviour.
4. To understand the environment impact and policies about the Nuclear Power plant

| COURSE CONTENTS | Hrs |
|---|---|
| **Module-1**<br>Introduction to Nuclear Engineering: Introduction, Nuclear Power for Developing Countries, Atomic Nuclei, Atomic Number and Mass Number, Isotopes, Atomic Mass Unit, Radioactivity and Radioactive Change Rate of Radioactive Decay, Mass – Energy Equivalence, Binding Energy, Release of Energy by Nuclear Reaction, types of Nuclear Reactions, Initiation of Nuclear Reaction, Nuclear Cross – section, Nuclear Fission, The Fission Chain Reaction, moderation, Fertile Materials and Breeding. | 8hrs |
| **Module-2**<br>Nuclear Reactors: Introduction, General Components of Nuclear Reactor, General Problems of Reactor Operation, Different Types of Reactors, Pressurised Water Reactors (PWR), Boiling Water Reactors (BWR), Heavy Water – cooled and Moderated CANDU (Canadian Deuterium Uranium) Type Reactors, Gas-cooled Reactors, Breeder Reactors, Reactor Containment Design, Location of Nuclear Power Plant, Nuclear Power Station in India, India's 3-stage Programme for Nuclear Power Development, Comparison Nuclear Plants with Thermal Plants. | 8hrs |
| **Module-3**<br>Nuclear Materials: Introduction, Fuels, Cladding and Structural Materials Coolants, Moderating and Reflecting Materials, Control Rod Materials, Shielding Materials.<br>Power plant instrumentations: classification, pressure measuring instrument, temperature measurement and flow measurement | 8hrs |
| **Module-4**<br>Nuclear Waste & Its Disposal: Introduction, Unit of Nuclear Radiation, Types of Nuclear Waste, Effects of Nuclear Radiation, Radioactive Waste Disposal System, Gas Disposal System. | 8hrs |
| **Module-5**<br>Safety Rules: Personal Monitoring, Radiation Protection (Radiation Workers, Non-Radiation Workers, Public at large), Radiation Dose (Early effect, Late effect hereditary effect) | 8hrs |

**SUGGESTED TEXTBOOKS & REFERENCES:**


1. Thomas J. Connolly," Fundamentals of nuclear Engineering" John Wiley 1978.
2. Collier J.G., and Hewitt G.F," introduction to Nuclear power", Hemisphere publishing, New York, 1987.
3. LaMarsh J.R., "Introduction to Nuclear Reactor" Theory, Wesley, 1966.
4. Duderstadt J.J and Hamilton L.J., "Nuclear Reactor Analysis" John Wiley 1976.
5. Walter A.E.and Reynolds A.B., Fast Breeder Reactor, Pergamon Press, 1981.
6. Glass tone S. and Sisonke A., Nuclear Reactor Engineering, 3rd Edition, Von Nostrand, 1981.
7. Winterton R.H.S., Thermal Design of Nuclear Reactors – Pergamon Press, 1981.
8. Wakil M.M.El., "Power Plant Technology", McGraw Hill International, 1984.

| **COURSE OUTCOMES:** After the completion of this course, student will be able to: | |
|---|---|
| CO1 | Identify various energy sources, Indian Power Scenario, Nuclear Power Scenario in the World, Nuclear Power Scenario in India, Scope |
| CO2 | Describe Nuclear physics, reactor, classification and types of nuclear reactor, economics of power plant. |
| CO3 | Discuss nuclear reactions radiations with matter. |
| CO4 | Identify the environmental effects due to nuclear radiation. |
| CO5 | Illustrate effect of nuclear radiation on health, safety and licensing |

| **QUESTION PAPER PATTERN (SEE)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Q.No. | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 |
| Module | 1 | | 2 | | 3 | | 4 | | 5 | |
| 1. Two full questions (each of 20 Marks) are to be set from each module. | | | | | | | | | | |
| 2. Student shall answer five full questions selecting one full question from each module. | | | | | | | | | | |

| ADMISSION YEAR:2024-25 | | | | ACADEMIC YEAR:2024-25 |
|---|---|---|---|---|
| 5. | 5-COURSE TITLE: ENVIRONMENTAL POLLUTION AND CONTROL | | | MTech II-Sem (TPE) |
| Course Code | 24PTP255 | PCC | CIE Marks | 50 |
| Teaching Hours/Week (L :P: SDA) | 2:0:2 | | SEE Marks | 50 |
| Credits | 3 | | Exam Hours | 03 |

**COURSE OBJECTIVES:** The objectives of this course are to make the student to learn

1. To impart knowledge on the atmosphere and its present condition, global warming and eco-legislations.
2. To understand the need of pollution control, its impact, control
3. To familiarize the students about the pollution control techniques

| COURSE CONTENTS | Hrs |
|---|---|
| **Module-1**<br><br>Impact of industrialization and modernization - pollution and pollutants. Air pollution and its effects - air pollution - sources - pollutants – organic and inorganic pollutants - gaseous pollutants– nitrogen oxides - particulate pollutants - effect of pollutants on plants – animals and human beings | 10hrs |
| **Module-2**<br><br>Water pollution and its effects structure - water pollution - sources -Pollutants industrial effluents domestic wastes - agrochemicals -Heavy metals - effect of pollutants on plants animals and human beings Bod - eutrophication - waste water treatment - indicator organisms -Oxidation Pond water pollution analysis and monitoring – drinking Water standards. | 10hrs |
| **Module-3**<br><br>Soil pollution and its effects - soil pollution - sources - solid waste Disposal and their effects - pesticides - types and effect of pollutants on Plants - animals and human beings bio magnification - fertilizers and its Effect of pollutants on plants - animals and human beings<br><br>Soil pollution Control measures - soil microbes and function - bio fertilizer. Noise pollution and its effects - noise pollution - sources – noise Exposure level and standards - impacts - noise control and abatement Measures. | 10hrs |
| **Module-4**<br><br>Photochemical oxidants - photochemical smog – acid Rain - Greenhouse effect - ozone depletion - global warming -Environmental pollution techniques for air pollution – monitoring and Control measures of air pollution - dust control equipment - Electrostatic precipitators and scrubbers.<br><br>Marine pollution - sources and control of marine pollution – criteria Employed for disposal of pollutants in marine system – coastal Management. Radioactive pollution and its impacts - radioactive - sources - effect of Pollutants of plants - animals and human beings - prevention and control Measures of radioactive pollution. | 10hrs |
| **Module-5**<br><br>Assessment and control of pollution - environmental standards - Assessment of pollution effects due to air - water - soil and radioactive Pollution - biotechnology in pollution control - microbial role in Pollution control - bio monitoring and bioremediation - pollution control Legislations for air - water - land etc. Biotechnology in pollution control - bioremediation (organic and Inorganic pollutants) - bioleaching and bio mineralization | 10hrs |

**SUGGESTED TEXTBOOKS & REFERENCES:**

1. Environmental Pollution Analysis: Khopkar.
2.Environmental Science – A study of Inter relationships, E. D. Enger, B. E. Smith, 5th ed., W C B publication.
3. Environmental Pollution Control Engineering: C. S. Rao
4. Bruce Rittman, Perry L. McCarty. Environmental Biotechnology: Principles and Applications, 2nd Edition, McGraw-Hill, 2000.
5. J.N.B. Bell (2002) Air Pollution and Plant Life, 2nd Edition, John Wiley and Sons, New Delhi.

| **COURSE OUTCOMES:** After the completion of this course, student will be able to: | |
|---|---|
| CO1 | Identify effects of industrialization on environmental pollution in various fields. |
| CO2 | Describe photochemical smog, acid rain, Greenhouse effect, ozone depletion, global warming. |
| CO3 | Suggest pollution control techniques for vehicles, refrigeration, industries, chemical and power plant |
| CO4 | Do Case study on any industry and analyse carbon exertion rate, water pollution, soil pollution etc. |
| CO5 | Design pollution control devices for vehicle, analyse and find out replacement CFC refrigerant with HC refrigerant |

| **QUESTION PAPER PATTERN (SEE)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Q.No. | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 |
| Module | 1 | | 2 | | 3 | | 4 | | 5 | |
| 1. Two full questions (each of 20 Marks) are to be set from each module. | | | | | | | | | | |
| 2. Student shall answer five full questions selecting one full question from each module. | | | | | | | | | | |

| ADMISSION YEAR:2024-25 | | | | ACADEMIC YEAR:2024-25 |
|---|---|---|---|---|
| **6.** | **COURSE TITLE: MINI PROJECT/ TECHNOLOGY-BASED SOCIETAL PROJECT** | | | MTech II-Sem (TPE) |
| Course Code | 24MPS26 | MPS | CIE Marks | 100 |
| Teaching Hours/Week (L :P: SDA) | 0:4:2 | | SEE Marks | --- |
| Credits | 3 | | Duration | --- |

| ADMISSION YEAR:2024-25 | | | | ACADEMIC YEAR:2024-25 |
|---|---|---|---|---|
| 7. | COURSE TITLE : THERMAL ENGINEERING LAB-II | | | MTech II-Sem (TPE) |
| Course Code | 24PTPL27 | PCCL | CIE Marks | 50 |
| Teaching Hours/Week (L :P: SDA) | 1:2:0 | | SEE Marks | 50 |
| Credits | 2 | | Exam Hours | 03 |

**COURSE OBJECTIVES:** The objectives of this course are to make the student to learn

1. To understand the basic conduction, convection and radiation heat transfers.
2. To study combined conduction and convection states of heat transfer.
3. To determine emissivity of a grey body and verify Stefan Boltzmann constant.
4. To determine effectiveness of parallel flow and counter flow heat exchangers.
5. To determine coefficient of discharge of orifice meter, venturi meter and V-notch.
6. To conduct experiment to determine major loss of head in flow through a pipe.
7. To conduct performance test on Pelton, Francis and Kaplan turbines and evaluate the efficiency of these turbines.
8. Students analyse the characteristics curves and evaluate the performance of various pumps.

## COURSE CONTENTS

Tests conducted are listed below

**A. Conduct the following Experiments**

1. Determination of thermal conductivity of insulating materials using lagged pipe apparatus.
2. Determination of thermal conductivity of materials using Composite wall apparatus.
3. Determination of heat transfer coefficient using Natural convection apparatus.
4.Determination of heat transfer coefficient using Forced convection apparatus
5. Determination of emissivity of surfaces using Emissivity apparatus.
6. Determination of effectiveness of parallel flow heat exchanger.
7. Determination of Stefan Boltzmann constant.
8. Determination of condensation heat transfer coefficient

**B. Conduct the performance test on the following experiments.**

1. Conduct the following Experiments

i)Determination of Coefficient of Friction of flow in a pipe.
ii)Determination of Minor Losses of flow through pipes.
iii)Determination of Force developed by impact of jet on Vanes.
iv)Determination of Coefficient of discharge of Flow measuring devices

2.Determination of performance testing of Hydraulic Turbines:

i) Pelton wheel.
ii) Franci's turbine.
iii) Kaplan turbine.

3.Determination of performance testing Hydraulic Pumps:

i) Single stage centrifugal pump.
ii) Reciprocating pump.

4. Performance test on a two stage Reciprocating air compressor.
5. Performance test on a centrifugal air blower.
6. Performance test on oil gear pump.
7. Cascade test on a row of turbine blades

**COURSE OUTCOMES:** After the completion of this course, student will be able to:

| | |
|---|---|
| CO1 | To analyse and solve practical problems in various modes of heat transfer. |
| CO2 | To determine the thermal conductivity, heat transfer coefficient and Stefan Boltzmann constant |
| CO3 | Demonstrate the knowledge of flow measuring devices and calibrate the discharge under various condition |
| CO4 | Identify the various turbines and determine the performance parameters |
| CO5 | Analyse the characteristics curves and evaluate the performance of various pumps |

| ADMISSION YEAR:2024-25 | | | | | ACADEMIC YEAR:2024-25 |
|---|---|---|---|---|---|
| 8 | COURSE TITLE : ABILITY/SKILL ENHANCEMENT COURSE (OFFLINE/ONLINE) | | | | MTech II-Sem (TPE) |
| Course Code | 24PTP281 | | AEC/SEC | CIE Marks | 50 |
| Teaching Hours/Week (L :P: SDA) | 00 | 02 | --- | SEE Marks | 50 |
| | 01 | 00 | --- | | |
| Credits | 1 | | | Exam Hours | 03 |

| ADMISSION YEAR:2024-25 | | | | | ACADEMIC YEAR:2024-25 |
|---|---|---|---|---|---|
| 8 | COURSE TITLE : FUELS AND LUBRICANTS LAB (OFFLINE) | | | | MTech II-Sem (TPE) |
| Course Code | 24PTP281 | | AEC/SEC | CIE Marks | 50 |
| Teaching Hours/Week (L :P: SDA) | 00 | 02 | --- | SEE Marks | 50 |
| Credits | 1 | | | Exam Hours | 03 |

**COURSE OBJECTIVES:** The objectives of this course are to make the student to learn

1. To understand the fuel and lubricants properties
2. To develop an idea of fuel properties and their variation with temperature.
3. To determine kinematic viscosity and calorific value of fuels.

**COURSE CONTENTS**

**Conduct the following Experiments**

1. Determination of Flash and Fire points of Liquid fuels/Lubricants using Abels Apparatus.
2. Carbon residue test: Liquid fuels.
3. Determination of Viscosity of Liquid lubricants and Fuels using Saybolt Viscometer
4. Determination of Viscosity of Liquid lubricants and Fuels using Redwood Viscometer-
5. Determination of Viscosity of Liquid lubricants and Fuels using Engler Viscometer.
6. Determination of Calorific value of Gaseous fuels using Junkers Gas Calorimeter
7. Determination of Calorific value of Solid/Liquid fuels using Bomb Calorimeter.
8. Drop and Penetration Apparatus for Grease.
9. Cloud and Pour point Apparatus.
10. Valve, Timing/ port opening diagram of an I C Engine (4 strokes/ 2 strokes).

**COURSE OUTCOMES:** After the completion of this course, student will be able to:

| | |
|---|---|
| CO1 | Illustrate the viscosity of liquid lubricants. |
| CO2 | Understand the calorific values of solid and gaseous fuels. |
| CO3 | Analyse the flash and fire points of liquid fuels. |
| CO4 | Observe the carbon residue for fuels. |
| CO5 | Compare the depth penetration for different lubricants |

# A) For the students who are willing to take up a two-semester duration Industry/Research Internship Leading to Project work /start-up

**ADMISSION YEAR:2024-25** **ACADEMIC YEAR:2024-25**

**POOJYA DODDAPPA COLLEGE OF ENGINEERING, KALABURAGI**
**Scheme of Teaching and Examinations – 2024**
**M.Tech., Thermal Power Engineering (PTP)**
**Choice Based Credit System (CBCS) and Outcome-Based Education (OBE)**

## III-SEMESTER (A)

| Sl.NO. | Course type | Course Code | Course Title | Teaching Hours per Week | | | Examination | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Practical/ Mini-Project/Internship | Tutorial/Skill Development Activities | Duration in hrs. | CIE-Marks | SEE-Marks | Total Marks | Credits |
| | | | | L | P | SDA | | | | | |
| 1 | PEC | 24PTP311 | Professional Elective 3 (Online Courses) | 03 | 00 | 00 | 03 | 50 | 50 | 100 | 3 |
| 2 | PEC | 24PTP321 | Professional Elective 4 (Online Courses) | 03 | 00 | 00 | 03 | 50 | 50 | 100 | 3 |
| 3 | INT | 24INT33 | Research Internship /Industry-Internship leading to project work/ Start up | Two-semester duration, SEE in the IV semester which leads to project work /start-up | | | 03 | 100 | --- | 100 | 4 |
| 4 | PROJ | 24PROJ34 | | | | | 03 | 100 | --- | 100 | 2 |
| **TOTAL** | | | | **06** | **00** | **00** | **12** | **300** | **100** | **400** | **12** |

Note: **PEC**: Professional Elective Courses, L**-Lecture, P-Practical, T/SDA-Tutorial / Skill Development Activities** (Hours are for Interaction between faculty and students). **INT**: Internship: Research Internship / Industry Internship Leading to the project work /start-up, **PROJ: Project Phase-I**: Problem statement out of undergone Internship (Industry /Research) report submission Only CIE.

**ADMISSION YEAR: 2024-25** **ACADEMIC YEAR:2024-25**

**POOJYA DODDAPPA COLLEGE OF ENGINEERING, KALABURAGI**
**Scheme of Teaching and Examinations – 2024**
**M.Tech., Thermal Power Engineering (PTP)**
**Choice Based Credit System (CBCS) and Outcome-Based Education (OBE)**

## IV SEMESTER (A)

| Sl.NO. | Course type | Course Code | Course Title | Teaching Hours per Week | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Practical /Field work | Duration in hrs. | CIE-Marks | SEE-Marks | Total Marks | |
| | | | | L | P | | | | | |
| 1 | INT | 24INT41 | Research Internship / Industry Internship Leading to Project Work/Start-up | Two Semester Duration | | 03 | 100 | 100 | 200 | 12 |
| | | | | | | 03 | 100 | 100 | 200 | 12 |
| 2 | PROJ | 24PROJ42 | Project Phase-II | | | | | | | |
| | | | **TOTAL** | | | **06** | **200** | **200** | **400** | **24** |

**INT:** Industry/ Research Internship leading to the project work /start up **PROJ:** Project work outcome of Internship (Project Phase-II is Viva voce SEE)

Taking up a two-semester Industry/Research Internship that leads to project work or a start-up can be a highly rewarding experience for students. It allows them to apply theoretical knowledge in practical settings, gain valuable industry or research experience, and potentially develop innovative solutions or business ideas. Here are some key steps and considerations for students pursuing such an internship:

**Industry Internship:** The main objective of the industry internship is to ensure that the intern is exposed to a real-world environment and gain practical experience. Often, it may be a practical exposure to the theory that has been learned during the academic period. The industry internship helps students understand of analytical concepts and tools, hone their skills in real-life situations, and build confidence in applying the skills learned.

**Research Internship:** A research internship is an opportunity for students or early career professionals to gain hands-on experience in conducting research under the guidance of a mentor or within a research team. These internships can take place in academic institutions, research organizations, government agencies, or private companies

**Research /Industry Internship:** In the third-semester Students have to be in touch with a guide/mentor/coordinator and regularly submit the report referred to the progress internship. Based on the progress report the Guide/Mentor/coordinator has to enter the CIE marks at the end of the 3rd semester. At the beginning of the 4th semester, students have to define the project topic out of the learning due to the Internship, upon completion of the project work he/she has to attend the SEE at the parent Institute.

**Internship Leading to Start-up:** An internship that leads to a start-up is an exciting pathway, blending real-world experience with entrepreneurial ambition. Here's a comprehensive guide to transitioning an internship experience into launching your start-up: 1) Maximize your internship experience, 2) Identifying Viable Business Ideas, 3) Research and Validation 4) Building a Business Plan 5) Networking and Mentorship 6) Securing Funding 7) Establishing start-up 8) Launching and Marketing. By following these steps, you can effectively transition from an internship to launching a successful start-up. This journey requires dedication, resilience, and a willingness to learn and adapt.

**MOOC courses of 12 weeks duration are the courses suggested by the Board of Studies of the University and will be displayed on www.online.vtu.ac.in**. The online courses selected should not be the same as those studied in the first and second semesters of the program. The student will not be eligible to get their degree if they unintentionally select online courses that match previously finished courses. These courses are not considered for the vertical progression; however, qualifying for these courses and earning the credits is a must for the award of the degree. It is permitted to complete these online MOOC courses either in 3rd semester or in 4th semester.

# B) For the students who are willing to take an Industry Internship for one semester duration and independent project work next semester

**ADMISSION YEAR:2024-25** **ACADEMIC YEAR:2024-25**

**POOJYA DODDAPPA COLLEGE OF ENGINEERING, KALABURAGI**
**Scheme of Teaching and Examinations – 2024**
**M.Tech., Thermal Power Engineering (PTP)**
**Choice Based Credit System (CBCS) and Outcome-Based Education (OBE)**

## III-SEMESTER - (B)

| Sl.NO. | Course type | Course Code | Course Title | Teaching Hours per Week | | | Examination | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Practical/ Mini-Project/Internship | Tutorial/Skill Development Activities | Duration in hrs. | CIE-Marks | SEE-Marks | Total Marks | Credits |
| | | | | L | P | SDA | | | | | |
| 1 | PEC | 24PTP311 | Professional Elective 3 (Online Course) (12 weeks courses) | 03 | 00 | 00 | 03 | 50 | 50 | 100 | 3 |
| 2 | PEC | 24PTP321 | Professional Elective4 (Online Courses) (12-week course) | 03 | 00 | 00 | 03 | 50 | 50 | 100 | 3 |
| 3 | INT | 24INT33 | Industry Internship | One semester Duration | | | 03 | 100 | 100 | 200 | 10 |
| **TOTAL** | | | | **06** | **00** | **00** | **09** | **200** | **200** | **400** | **16** |

Note: PCC: Professional core courses, PEC: Professional Elective Courses, IPCC-Integrated Professional Core Courses. MPS-Mini Project With Seminar; AUD/AEC; Audit Courses / Ability Enhancement Courses (Mandatory), PCCL-Professional Core Course lab, **L-Lecture, P-Practical, T/SDA-Tutorial / Skill Development Activities** (Hours are for Interaction between faculty and students)

**ADMISSION YEAR: 2024-25** **ACADEMIC YEAR:2024-25**

**POOJYA DODDAPPA COLLEGE OF ENGINEERING, KALABURAGI**
**Scheme of Teaching and Examinations – 2024**
**M.Tech., Thermal Power Engineering (PTP)**
**Choice Based Credit System (CBCS) and Outcome-Based Education (OBE)**

## IV SEMESTER -(B)

| Sl.NO. | Course type | Course Code | Course Title | Teaching Hours per Week | | Examination | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Practical /Field work | Duration in hrs. | CIE-Marks | SEE-Marks | Total Marks | Credits |
| | | | | L | P | | | | | |
| 1 | Project | 24PROJ41 | Project work | -- | 08 | 03 | 100 | 100 | 200 | 16 |
| 2 | PEC/OEC | 24PTP42 | Online courses (16-week course) | 04 | 0 | 03 | 50 | 50 | 100 | 04 |
| | | | | **04** | **08** | **06** | **150** | **150** | **300** | **20** |

**PROJECT WORK (24PROJ41):** The objective of the Project work is

- To encourage independent learning and the innovative attitude of the students.
- To develop an interactive attitude, communication skills, organization, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire teamwork.
- To expand intellectual capacity, credibility, judgment, and intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instill responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involved in group discussions to present and exchange ideas.

**CIE procedure for Project Work:**

**(1) Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

**(2) Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

**SEE procedure for Project Work:** SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

**Online Course:** These are the MOOC courses that the relevant stream's Board of Studies has recommended; you can access them at www.online.vtu.ac.in. To qualify for those courses, the students must complete 12 to 16-week courses. The courses chosen have not to be the same as that of the coursework subjects covered in the preceding semesters. Depending on the needs of the degree program, the BoS may recommend interdisciplinary courses. It is required to pass the course and qualify.