ADMISSION YEAR: 2022-23 **ACADEMICYEAR:2022-23**

POOJYA DODDAPPA COLLEGE OF ENGINEERING, KALABURAGI
SchemeofTeachingandExaminations–2022
M.Tech.,Thermal Power Engineering(PTP)
ChoiceBasedCreditSystem(CBCS)andOutcome-BasedEducation (OBE)

I -SEMESTER

Sl.NO.	Course	Course Code	Course Title	Teaching Hours per Week			Examination				
				Theory	Practical/ Seminar	Skill Development Activities (Hours are for interaction between faculty and students)	Duration in hrs	CIE-Marks	SEE-Marks	Total Marks	Credits
				L	P	SDA					
1	BSC	22MAT11	Computational Methods	03	00	00	03	50	50	100	3
2	IPCC	22PTP12	Theory of I C Engines	03	02	00	03	50	50	100	4
3	PCC	22PTP13	Fluid Dynamics	03	00	02	03	50	50	100	4
4	PCC	22PTP14	Steam Generator and Auxiliaries	02	00	02	03	50	50	100	3
5	PCC	22PTP15	Energy Resources	02	00	02	03	50	50	100	3
6	MCC	22RMI16	Research Methodology and IPR	03	00	00	03	50	50	100	3
7	PCCL	22PTPL17	Thermal Power Engineering Lab-I	01	02	00	03	50	50	100	2
8	AUD/ AEC	22AUD18/ 22AEC27	**BOSrecommendedONLINEcourses**	**Classesandevaluationproceduresareasperthepolicy oftheonline courseproviders**							**PP**
				17	**04**	**06**	**21**	**350**	**350**	**700**	**22**

Note: BSC-Basic Science Courses, PCC: Professional core. IPCC-Integrated Professional Core Courses, MCC- Mandatory CreditCourse,
AUD/AEC –Audit Course / Ability Enhancement Course (A pass in AUD/AEC is mandatory for the award of the degree

Integrated Professional Core Course (IPCC): Integrated Professional Core Course (IPCC):

Refers to 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.

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 specialization 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 registerfor 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.

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. Accustom 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 modelling of systems and algorithms for transient and steady-state operations, thermal study, etc.
7. Work on different software/s (tools) to simulate, analyze 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 to involve 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 which will enhance their skill. The prepared report shall be evaluated for CIE marks.

ADMISSION YEAR: 2022-23 **ACADEMICYEAR:2022-23**

1	COURSE TITLE--COMPUTATIONAL METHODS			M.Tech I-Sem (TPE)
Course Code	22MAT11	BSC	CIEMarks	50
TeachingHours/Week(L :P: SDA)	3:0:0		SEEMarks	50
Credits	3		ExamHours	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	
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	
Roots of equations: Muller method, Graeffe's 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	
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	
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	
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

SUGGESTED TEXT BOOKS & REFERENCES:

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: 2022-23 **ACADEMICYEAR:2022-23**

2	COURSE TITLE--THEORY OF I C ENGINES			M.Tech I-Sem (TPE)
Course Code	22PTP12	IPCC	CIEMarks	50
TeachingHours/Week(L :P/S: SDA)	3:2:0		SEEMarks	50
Credits	4		ExamHours	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.Toprovidethesufficientknowledgeofcombustionengineeringapplyinrealengineeringproblems
4.To understand the environment aspects of IC engines

COURSE CONTENTS	Hrs
Module-1	
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. Fuel –Air and Actual Engines: Modeling 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	
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. 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	
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	
Engine emissions and their control: Air pollution due to IC engines, emission characteristics, Euro norms, engine emissions, Hydro carbon 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	
Alternate fuels for IC engines: Vegetable oils, alcohol, LPG, CNG, Hydrogen fuels, Bio gas, Dual fuels, other possible fuels Measurement: Noise, Emission, Pressure, crank angle torque, valve timings, Temperature and flow measurements	10hrs

SUGGESTED TEXT BOOKS & REFERENCES:

1.V.Ganesan,–InternalCombustionEngines‖,TataMcGraw-Hill Publications, 4th Edition
2.R. K. Rajput, A Text Book of Internal Combustion Engines, Laxmi Publishers (P) Ltd, 3rd Edition, 2016, ISBN: 978813180066
3.R. P. Sharma, M. L. Mathur, Internal Combustion Engines, Dhanpat Rai Publications, 2011, New Delhi, ISBN:978-81-89928-46-9
4.JohnBHeywood,–ICEnginesfundamentals‖,McGraw-HillPublications,2011.
5.W.W. Pulkrabek Engineering Fundamentals of IC Engine, PHI Pvt. Ltd 2002
6.CRFergusun,–InternalCombustionEngines:AppliedThermosciences‖,JohnWiley& Sons.
7.Richardstone_ 'IntroductiontoICEngines ''PalgravePublication3rd edition.
8.CharlesFayetteTaylor_ 'The Internal-CombustionEngineinTheoryandPractice ''M I T Press2nd edition.

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: 2022-23 **ACADEMICYEAR:2022-23**

3	**COURSE TITLE--FLUID DYNAMICS**			**M.Tech I-Sem (TPE)**
Course Code	22PTP13	PCC	CIEMarks	50
TeachingHours/Week(L :P/S: SDA)	3:2:0		SEEMarks	50
Credits	4		ExamHours	03

COURSEOBJECTIVES: 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	
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 center 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, center of buoyancy, metacentre and metacentric height, Conditions of equilibrium for floating and submerged bodies	10hrs
Module-2	
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	
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. Fluid flow measurements: Introduction, Venturi meter, Orifice meter and Pitot tube, Discharge over rectangular and triangular notches, Numerical problems. 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	
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. 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	
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. 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 TEXT BOOKS & REFERENCES:

1. Foundations of fluid mechanics - S.W. Yuan, Prentice Hall of India, 1976.
2. Engineering Fluid Mechanics - P.A. Aswatha Narayana& K.N. Seetharamu, 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: 2022-23 **ACADEMICYEAR:2022-23**

4	COURSE TITLE--STEAM GENERATOR AND AUXILIARIES			M.Tech I-Sem (TPE)
Course Code	22PTP14	PCC	CIEMarks	50
TeachingHours/Week(L :P/S: SDA)	2:0:2		SEEMarks	50
Credits	3		ExamHours	03

COURSEOBJECTIVES: 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	
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	
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. 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	
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	
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	
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. EIA study- pollutants emitted, particulate matter, Sox and NOx and ground level concentration.	8hrs

SUGGESTED TEXT BOOKS & 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: 2022-23 **ACADEMICYEAR:2022-23**

5	**COURSE TITLE--ENERGY RESOURCES**			**M.Tech I-Sem (TPE)**
Course Code	22PTP15	PCC	CIEMarks	50
TeachingHours/Week(L :P/S: SDA)	2:0:2		SEEMarks	50
Credits	3		ExamHours	03

COURSEOBJECTIVES: 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 comparedto fossil fuels.

COURSE CONTENTS	**Hrs**
Module-1	
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	
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	
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	
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	
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 TEXT BOOKS &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 Solonki, 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.Sukhatme 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: 2022-23 **ACADEMICYEAR:2022-23**

6	COURSE TITLE--RESEARCH METHODOLOGY			M.Tech I-Sem (TPE)
Course Code	22RMI16	MCC	CIEMarks	50
TeachingHours/Week(L :P/S: SDA)	3:0:0		SEEMarks	50
Credits	3		ExamHours	03

COURSE CONTENTS	Hrs
Module-1	
Research Methodology: Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration.	8hrs
Module-2	
Reviewing the literature: Place of the literature review in research, bringing clarity and focus to research problem, improving research methodology, broadening knowledge base in research area, enabling contextual findings, Review of the literature, searching the existing literature, reviewing the selected literature, developing a theoretical framework, developing a conceptual framework, writing about the literature reviewed. Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.	9hrs
Module-3	
Design of Sample Surveys: Design of Sampling: Introduction, Sample Design, Sampling and Non-Sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement, Techniques of Developing Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multi-dimensional Scaling, Deciding the Scale. Data Collection: Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection	9hrs
Module-4	
Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis TestingforMean, Proportion, Variance, for Differenceof Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis. Chi-square Test: Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautionsin Using Chi-square Tests, Z-test, T-test, F-test, ANOVA, FactorAnalysis and Report Writing;Bibliography.Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports	9hrs
Module-5	
Intellectual Property: The Concept, Intellectual Property System in India, World Intellectual Property Organization (WIPO), Protection of Intellectual Property under TRIPS, Patents Act - Meaning of a Patent – Characteristics/Features. Patentable and Non-Patentable Invention. Types of Patent applications in India. Procedure for obtaining Patent. The Designs Act, Introduction to Industrial Designs. Essential requirements of Registration. Designs which are not registrable, Procedure for Registration of Designs, Copyright Act,1957 and Related Rights - Meaning of Copy Right, Characteristics of Copyright, various rights of owner of Copyright. Procedure for registration, Publication and term of copyright Infringement of Copyright and Its remedies. Trade Mark Act, 1999, The Geographical Indications of Goods (Registration and Protection) Act1999.	7hrs

SUGGESTED TEXT BOOKS & REFERENCES:

1. Research Methodology: Methods and Techniques C.R. Kothari, Gaurav Garg New Age International 4th Edition,2018.
2. Research Methodology a step-by- step guide for beginners. (For the topic Reviewing the literature under module 2) Ranjit Kumar SAGE Publications Ltd 3rd Edition, 2011.
3. Study Material (For the topic Intellectual Property under module 5) Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company
Secretaries of India, Statutory Body Under an Act of Parliament, September 2013.

Reference Book
Research Methods: the concise knowledge base Trochim Atomic Dog Publishing 2005

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: 2022-23 **ACADEMICYEAR:2022-23**

7	COURSE TITLE--THERMAL POWER ENGG LAB-I			M.Tech I-Sem (TPE)
Course Code	22PTPL17	PCCL	CIEMarks	50
TeachingHours/Week(L :P/S: SDA)	1:2:0		SEEMarks	50
Credits	2		ExamHours	03

COURSEOBJECTIVES: The objectives of this course are to make the student to learn

1.Students should apply the knowledge and conduct the experiments of Flash and Fire points, Viscosity and calorific value of a solid, liquid and gaseous fuel.
2.Conduct the tests on two and four stroke petrol and diesel engines.
3.Conduct the Morse Test on a four-cylinder petrol engine.
4.Conduct the test on air compressor and centrifugal blower

COURSE CONTENTS

Tests conducted are listed below

A. Conduct the following Experiments

1.Determination of Flash point and Fire point of lubricating oil using Abel apparatus and Pensky Martin apparatus.

2.Determination of Calorific value of solid, liquid and gaseous fuels.

3.Determination of Viscosity of a lubricating oil using Redwoods, Saybolts, Torsion Viscometers.

4.Valve, Timing/ port opening diagram of an I C Engine (4 stroke/ 2 stroke).

B. 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-stagereciprocating 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.

Note: The above list of Experiments may be added relevant to the theory courses taught in the semester.

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

CO1	Determine properties such as flash and fire point, viscosity and calorific value of various types of fuels.
CO2	Demonstrate the use of Valve timing diagram of I C Engines and use of Planimeter
CO3	Conduct experiments on I C Enginesto 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: 2022-23 **ACADEMICYEAR:2022-23**

8	**22AUD18/22AEC27- BOS Recommended ONLINE Courses** **Note: Audit Course / Ability Enhancement Course**	**M.Tech** **I-Sem (TPE)**
Course Code	22AUD18/22AEC27	AUD/AEC
Credits	PP	
Classesandevaluationproceduresareasperthepolicy oftheonline courseproviders		
AUD/AEC –Audit Course / Ability Enhancement Course (A pass in AUD/AEC is mandatory for the award of the degree		

ADMISSION YEAR: 2022-23 **ACADEMICYEAR:2022-23**

POOJYA DODDAPPA COLLEGE OF ENGINEERING, KALABURAGI

SchemeofTeachingandExaminations–2022

M.Tech.,Thermal Power Engineering(PTP)

ChoiceBasedCreditSystem(CBCS)andOutcome-BasedEducation (OBE)

II-SEMESTER

Sl.NO.	Course	Course Code	Course Title	Teaching Hours per Week			Examination				
				Theory	Practical/ Seminar	Skill Development Activities (Hours are for interaction between faculty and students)	Duration in hrs	CIE-Marks	SEE-Marks	Total Marks	Credits
				L	P	SDA					
1	PCC	22PTP21	Alternative Fuel Technologies	02	00	02	03	50	50	100	3
2	IPCC	22PTP22	Heat Transfer	03	02	00	03	50	50	100	4
3	PEC	22PTP23X	Professional Elective-1	02	00	02	03	50	50	100	3
4	PEC	22PTP24X	Professional Elective-2	02	00	02	03	50	50	100	3
5	MPS	22PTP25	Mini Project with Seminar	00	04	02	--	100	--	100	3
6	PCCL	22PTPL26	Thermal Power Engineering Lab-II	01	02	00	03	50	50	100	02
7	AUD/ AEC	22AUD27	Suggested ONLINE courses	**Classes and evaluation procedures are as per the policy of the online course providers**							
			TOTAL	**10**	**08**	**08**	**15**	**350**	**250**	**600**	**18**

Note: PCC: Professional core courses'- ProfessionalElective courses IPCC-Integrated Professional Core Courses, MPS- Mini Project with seminar, AUD/AEC –Audit Course / Ability Enhancement Course (A pass in AUD/AEC is mandatory for the award of the degree

Professional Elective-1		**Professional Elective-2**	
CourseCodeUnder22PTP23X	**Coursetitle**	**CourseCodeUnder22PTP24X**	**Coursetitle**
22PTP231	Computational Fluid Dynamics	22PTP241	Thermodynamicsand Combustion
22PTP232	Finite Elements Methods	22PTP242	Steam Turbine & its Auxiliaries
22PTP233	Convective Heat Transfer	22PTP243	Refrigeration and Cryogenics
22PTP234	SolarEnergyTechnologies	22PTP244	Nuclear Engineering in Power Generation
22PTP235	Thermal Power Station	22PTP245	Wind Energy and Its Utilization

Note:

1 Mini Project 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.

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. Participation in the seminar by all postgraduate students of the program shall be mandatory.

The CIE marks awarded for Mini-Project work and Seminar, shall be based on the evaluation of Mini 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.

2. Internship: All the students shall have to undergo a mandatory internship of 06 weeks during the vacation of II and III semesters. A University examination shall be conducted during III semester and the prescribed internship credit shall be counted in the same semester. The internship 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 internship shall be declared as fail in the internship course and have to complete the same during the subsequent University examination after satisfying the internship requirements.

ADMISSION YEAR: 2022-23 **ACADEMICYEAR:2022-23**

1	COURSE TITLE--ALTERNATIVE FUEL TECHNOLOGIES			M.Tech II-Sem (TPE)
Course Code	22PTP21	PCC	CIEMarks	50
TeachingHours/Week(L :P: SDA)	2:0:2		SEEMarks	50
Credits	3		ExamHours	03

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

1.ToUnderstandtheneedofalternativefuels,environmentimpact,typesofalternativefuels,preparationofal ternativefuels
2.Tofamiliarizethestudentsaboutenginealterationtousealternativefuels
3.Tounderstandthecurrentstatusofalternativefuels

COURSE CONTENTS	Hrs
Module-1	
Introduction: Need foralternatefuel,availability and properties of alternate fuels, general use of alcohols,LPG, hydrogen, ammonia, CNG and LNG, vegetable oils and biogas, merits and demerits ofvarious alternate fuels, introduction to alternate energy sources. Like Electric vehicle, hybrid, fuelcellandsolarcars.	8hrs
Module-2	
Alcohols: Properties as engine fuel, alcohols and gasoline blends, performance in SI engine, methanol andgasoline blends, combustion characteristics in CI engines, emission characteristics, DME, DEEpropertiesperformanceanalysis,performancein SI&CI Engines.	8hrs
Module-3	
CNG,LPG,HydrogenandBiogas: AvailabilityofCNG,properties,modificationrequiredtouseinengines,performanceand emission characteristics of CNG, LPG and Biogas using in SI & CI engines, Hydrogen;storageand handling, performance andsafetyaspects.	8hrs
Module-4	
VegetableOils: Various vegetable oils for engines, transesterification, biodiesel and its properties, performance,emissionand combustioncharacteristics of engine. Fuel cell vehicles, specifications, system components, selection of fuel cell, thermal management,maintenance,advantageand limitations,	8hrs
Module-5	
ElectricandHybridVehicle: Layoutofanelectricvehicle,advantageandlimitations,specifications,system components,electronic control system,high energyandpowerdensitybatteries,hybrid vehicle. Solarpoweredvehicles,specifications,system components,advantageandlimitations,	8hrs

SUGGESTED TEXT BOOKS & REFERENCES:

1. M.K.GajendraBabu,K.A.Subramanian,AlternativeTransportationFuels:UtilizationinCombustionE ngines, CRC Press, 2013.
2. RichardL.Bechfold,AlternativeFuelsGuideBook-SAEInternationalWarrendale1997.
3. B.P.Pundir,EngineEmissions,AlphaScienceInternational Limited,2007
4. B.P.Pundir,ICEnginesCombustionandEmissions,AlphaScienceInternationalLimited,2010.
5. Nagpal,PowerPlantEngineering,KhannaPublishers-1991.

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

CO1	DemonstrateStructureofpetroleum,refiningprocess,Productsofrefiningprocess,Selectsuitable fuelsforuseinSIengines.Understandvariousperformancesratinginengines.
CO2	Illustrate properties of petroleum products and classify them on their characteristic.
CO3	DescribeandanalyzeNeedforalternativefuelssuchasEthanol,Methanol,LPG,CNG,Hydrogen andtheirmanufacturingprocedure
CO4	Calculate and estimate performance and emission characteristics of alternative fuels
CO5	Analyseenvironmentaleffectsofcombustionofvariousfuels,suggestmodificationintheirusage

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: 2022-23 **ACADEMICYEAR:2022-23**

2	COURSE TITLE--HEAT TRANSFER			M.Tech II-Sem (TPE)
Course Code	22PTP22	IPCC	CIEMarks	50
TeachingHours/Week(L :P: SDA)	3:2:0		SEEMarks	50
Credits	4		ExamHours	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 properties emissivity, reflectivity and transmissivity on directional and total basis

COURSE CONTENTS	Hrs
Module-1	
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. 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). One dimensional Steady state conduction: Steady state conduction in a slab, in a cylinder and in a sphere without heat generation.	10hrs
Module-2	
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. 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	
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. 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	
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, dropwise condensation theory, Pool boiling regimes, Use of correlations for film and dropwise condensation on tubes. 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	
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 TEXT BOOKS & REFERENCES:

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

2.Yunus A Cengel, "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", Wieley Eastern Ltd., 1995.

Data Hand Book:

Heat Transfer data hand book 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 stateheat 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.										

PROFESSIONAL ELECTIVES-1

ADMISSION YEAR: 2022-23 **ACADEMICYEAR:2022-23**

3	1.COURSE TITLE--COMPUTATIONAL FLUID DYNAMICS			M.Tech II-Sem (TPE)
Course Code	22PTP231	PEC-1	CIEMarks	50
TeachingHours/Week(L :P: SDA)	2:0:2		SEEMarks	50
Credits	3		ExamHours	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 modeling.

COURSE CONTENTS	Hrs
Module-1	
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 kineticenergy equation, the general differential equations, Nature of coordinates: Independentvariables, choice of coordinates, one way and two-way coordinates.	8hrs
Module-2	
Solution of Systems of Linear Algebraic Equations--Criteria for unique solution, infinite number of solutions and no solution, Solutiontechniques for systems of linear algebraic equations: Elimination, Iteration and GradientSearch method, Elimination method: Forward elimination and backward substitution,Assessment of number of computations, L-U decomposition technique, Tridiagonal matrixalgorithm (TDMA): Thomas algorithm Iteration methods: Jacobi's method and GaussSiedel method, Generalized analysis of the iterative methods, Sufficient condition forconvergence, Rate of convergence, Scarborough criteria of sufficient condition forconvergence in Gauss Siedel Method, Illustrative examples of Jacobi's method and GaussSiedel method.	8hrs
Module-3	
Discretisation Methods and Heat Conduction--The Discretization concept, the structure of Discretization equation, Methods of derivingthe Discretization equation: Taylor series formulation, variation formulation, method ofWeighted 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 generalDiscretization equation, Explicit, Crank Nicolson and fully implicit schemes, Two dimensional and three-dimensional situation, Over relaxation and Under relaxation Methods. Problems.	8hrs
Module-4	
Convection and Diffusion--Steady one dimensional Convection and diffusion, the primary derivation, the upwindscheme, the exact solution, The Exponential scheme, The Hybrid scheme, The power lawscheme, consequences of various scheme, Discretization equation for Two dimension,details of derivation, final Discretization equation, Discretization equation for Threedimension, one way space coordinates, outflow boundary conditions, False diffusion:common and proper view of False diffusion.	8hrs
Module-5	
Navier Stokes Equations and Turbulent Modelling--Discretization of the Momentum Equation: Stream Function-Vorticity approach and Primitive variableapproach, Staggered grid and Collocatedgrid, SIMPLE Algorithm,SIMPLER Algorithm Important features of turbulent flow, Vorticity transport equation, Statistical representationof turbulent flows: Homogeneous turbulence and isotropic turbulence, General Propertiesof turbulent quantities, Reynolds average Navier stokes (RANS) equation, Closureproblem in turbulence: Necessity of turbulence modeling, Different types of turbulencemodel: Eddy viscosity 2 models, Mixing length model, Turbulent kinetic energy anddissipation, The κ-ε model, Advantages and disadvantages of κ -ε model.	8hrs

SUGGESTED TEXT BOOKS & 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. Ferziger 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: 2022-23 **ACADEMICYEAR:2022-23**

3	2.COURSE TITLE--FINITE ELEMENTS METHODS			M.Tech II-Sem (TPE)
Course Code	22PTP232	PEC-1	CIEMarks	50
TeachingHours/Week(L :P: SDA)	2:0:2		SEEMarks	50
Credits	3		ExamHours	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	
Introduction-General description of Finite Element Method, Geometry, Elements, Node NumberingSchemes, Application and limitations. Equilibrium equations in elasticity. Definitions ofFEA and FDM. Interpolation and One – Dimensional Problems--Euler – Lagrange's equation for bar, beam (cantilever / simply supported fixed) Principle ofvirtual work, principle of minimum potential energy, Raleigh's Ritz method and Galerkin'smethod boundary conditions. Interpolation polynomials- Linear, quadratic and cubic, 2DPASCAL's triangle. CST elements-Shape functions. Solutions of bars and stepped bars fordisplacements, reactions and stresses by using penalty approach and elimination approach.Guass-elimination technique.	8hrs
Module-2	
Higher Order Elements-Lagrange's interpolation, Higher order one dimensional elements-Quadratic and cubicelement 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	
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	
Beams-Governing Differentia Equation for beambending Hermite shape functions for beam element, Derivation of stiffness matrix. Numerical problems of beams carrying concentrated, UDL and linearly varying loads.	8hrs
Module-5	
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 FluxBoundary Conditions, Forced and Natural Boundary Conditions.	8hrs

SUGGESTED TEXT BOOKS & 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: 2022-23 **ACADEMICYEAR:2022-23**

3	3.COURSE TITLE--CONVECTIVE HEAT TRANSFER			M.Tech II-Sem (TPE)
Course Code	22PTP233	PEC-1	CIEMarks	50
TeachingHours/Week(L :P: SDA)	2:0:2		SEEMarks	50
Credits	3		ExamHours	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 back ground 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	
Introduction to Forced, free & combined convection – convective heat transfer coefficient – Application of dimensional analysis to convection – Physical interpretation of dimensionlessnumbers. 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	
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. External Turbulent Flows: Analogy solutions for boundary layer flows – Integral equation solutions. 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. Internal Turbulent Flows: Analogy solutions for fully developed pipe flow –Thermally developing pipe & plane duct flow	8hrs
Module-3	
Natural Convection: Boussineq 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	
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	
Convective Heat Transfer Through Porous Media: Area weighted velocity, Darcy flow model, energyequation, boundary layer solutions for 2, D forced convection, fully developed duct flow, Natural convection in porous media, filledenclosures, stability of horizontal porous layers.	8hrs

SUGGESTED TEXT BOOKS & REFERENCES:

1. Convective Heat & Mass Transfer /Kays& Crawford/TMH
2.Introduction to Convective Heat Transfer Analysis/ Patrick H. Oosthuigen& 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 flowpatterns and systems.
CO3	Categorize and distinguish convective heat transfer through laminar and turbulent boundarylayer
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: 2022-23 **ACADEMICYEAR:2022-23**

3	4.COURSE TITLE--SOLAR ENERGY TECHNOLOGIES			M.Tech II-Sem (TPE)
Course Code	22PTP234	PEC-1	CIEMarks	50
TeachingHours/Week(L :P: SDA)	2:0:2		SEEMarks	50
Credits	3		ExamHours	03

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

1.Toprovidethesufficientknowledgeofconcept,applications,importanceofsolarenergy
2.To enable them to understand the measurement of solar radiation using various instruments.
3.Tofamiliarizethestudentsaboutthesolarenergyanditsapplications inreallifesituations
4.To enable them to know photovoltaic cell operation and economics of solar systems.

COURSE CONTENTS	Hrs
Module-1	
Introduction: energy sources, Renewable energy sources, potential, Achievements in India, energyalternatives, 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	
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	
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	
Concentrating Collectors: Introduction, Flat plate collectors with plane reflectors, cylindrical parabolic collector, compound parabolic collectors, parabolic dish collector. Central receiver collector, tracking, numerical problems. Solar air heaters: performance analysis, types, testing procedures.	8hrs
Module-5	
Photo-Voltaic Conversion: Solar cell, working principles, conversion efficiency, commercial solar cells, applications 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 TEXT BOOKS & REFERENCES:

1.Solar Energy-Principles of energy conversion and storage, S P Sukhatme, 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/Sukhatme/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: 2022-23 **ACADEMICYEAR:2022-23**

3	5.COURSE TITLE--THERMAL POWER STATION			M.Tech II-Sem (TPE)
Course Code	22PTP235	PEC-1	CIEMarks	50
TeachingHours/Week(L :P: SDA)	2:0:2		SEEMarks	50
Credits	3		ExamHours	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	
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	
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. 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	
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 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	
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. 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	
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 TEXT BOOKS & 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

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: 2022-23 **ACADEMICYEAR:2022-23**

4	1.COURSE TITLE--THERMODYNAMICS AND COMBUSTION			M.Tech II-Sem (TPE)
Course Code	22PTP241	PEC-2	CIEMarks	50
TeachingHours/Week(L :P: SDA)	2:0:2		SEEMarks	50
Credits	3		ExamHours	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	
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	
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	
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	
Combustion and flame velocities, laminar and turbulent flames, premixed and diffusion flames, their properties and structures	8hrs
Module-5	
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 TEXT BOOKS & 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 Kanury, 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: 2022-23 **ACADEMICYEAR:2022-23**

4	2.COURSE TITLE--STEAM TURBINE & ITS AUXILIARIES			M.Tech II-Sem (TPE)
Course Code	22PTP242	PEC-2	CIEMarks	50
TeachingHours/Week(L :P: SDA)	2:0:2		SEEMarks	50
Credits	3		ExamHours	03

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

1. ToprovidethesufficientknowledgeofworkingconstructionandcontrolofSTandGT

2.To learn the working principle, operations and analysis of nozzles, diffusers, steam and gas turbines

COURSE CONTENTS	Hrs
Module-1	
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, by pass system. Feed heating system-HP feed heating, deaerator system; LP feed heating, auxiliary steam system, Condenser, different pumps, cooling towers.	8hrs
Module-2	
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	
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	
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	
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 shutdown procedure.	

SUGGESTED TEXT BOOKS & REFERENCES:

1. Rajmohan 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 Saravanamutto, 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 reactionturbines
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: 2022-23 **ACADEMICYEAR:2022-23**

4	3.COURSE TITLE--REFRIGERATION AND CRYOGENICS			M.Tech II-Sem (TPE)
Course Code	22PTP243	PEC-2	CIEMarks	50
TeachingHours/Week(L :P: SDA)	2:0:2		SEEMarks	50
Credits	3		ExamHours	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	
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	
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	
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	
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	
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 TEXT BOOKS & 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 Domkunduwar, & Arora, Dhanpatrai & Sons, 7thEdition

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

CO1	Analyse the vapor 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: 2022-23 **ACADEMICYEAR:2022-23**

4	4.COURSE TITLE--NUCLEARENGINEERINGINPOWERGENERATION			M.Tech II-Sem (TPE)
Course Code	22PTP244	PEC-2	CIEMarks	50
TeachingHours/Week(L :P: SDA)	2:0:2		SEEMarks	50
Credits	3		ExamHours	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.Toprovidethesufficientknowledgeofconcept,applications,importanceofNuclearEnergy

3.Reactor principles, nuclear safety, and reactor dynamic behaviour.

4.TounderstandtheenvironmentimpactandpoliciesabouttheNuclearPowerplant

COURSE CONTENTS	Hrs
Module-1	
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	
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	
Nuclear Materials: Introduction, Fuels, Cladding and Structural Materials Coolants, Moderating and Reflecting Materials, Control Rod Materials, Shielding Materials. Power plant instrumentations: classification, pressure measuring instrument, temperature measurement and flow measurement	8hrs
Module-4	
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	
Safety Rules: Personal Monitoring, Radiation Protection (Radiation Workers, Non-Radiation Workers, Public at large), Radiation Dose (Early effect, Late effect hereditary effect)	8hrs

SUGGESTED TEXT BOOKS & REFERENCES:

1.Thomas J. Cannoly," Fundamentals of nuclear Engineering" John Wiley 1978.

2.Collier J.G., and Hewitt G.F," introduction to Nuclear power", Hemisphere publishing, NewYork,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.Glasstone S. and Sesonske 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 theWorld, Nuclear Power Scenario in India, Scope
CO2	Describe Nuclear physics, reactor, classification and types of nuclear reactor, economics of power plant.
CO3	Discussnuclearreactionsradiations with matter.
CO4	Identify theenvironmentaleffectsdue 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: 2022-23 **ACADEMICYEAR:2022-23**

4	5.COURSE TITLE--WIND ENERGY AND ITS UTILIZATION			M.Tech II-Sem (TPE)
Course Code	22PTP245	PEC-2	CIEMarks	50
TeachingHours/Week(L :P: SDA)	2:0:2		SEEMarks	50
Credits	3		ExamHours	03

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

1.Tounderstandhistoryofwindenergyanditsscopeinfuture.
2.Togetpracticalknowledgeaboutusevariouswindenergymeasurementindicators
3.Tocalculatevariousparametersofwindturbine**.**
4.Study of the wind turbine design and various aspects of siting and wind farm design.
5.Study of the economics and environmental impacts of wind energy generation.

COURSE CONTENTS	Hrs
Module-1	
Introduction: Origin of Winds, Nature of winds, Modern wind turbines; Wind resource; Technologyachievements; Wind energy penetration level. Wind Power in India: Introduction, Commercial Wind Power Development, wind turbine manufacturing Industry, Current wind power Scenario and Challenges and opportunities.	8hrs
Module-2	
Types of Wind Turbine Plants: Introduction, Types axis, Upwind and Downwind WPPSs, Blade count, Power rating of WPPs Classification of wind turbines; turbine components Aerodynamics: Introduction; Aerofoil; Actuator disc; Axial moment theory; Momentum theory of rotating wake; Blade element theory; Strip theory; Tip losses; Tip loss correction; Wind machine parameters; C_p - λ characteristics, SERI blade sections; Wind machine mechanics; Numerical problems.	8hrs
Module-3	
Wind turbine design**:** Rotor blade theory; Blade geometry; Variation of aerofoil characteristics with Reynolds number; cambered aerofoil's; Simplified methods for loss calculation; basis for design loads; Functions of control and safety systems; Turbulence and wakes; Non-operational load cases; Cost modelling; Relationship between rotational speed and solidity; Teetering; Power control; Braking systems; Blades.	8hrs
Module-4	
Siting and Wind farm design: Wind flow modeling, Power curve for wind turbine generator; Capacity factor; Planning of wind farms, Siting, wake models. Wind energy economics: Annual energy output; Simple payback period; Capital recovery factor, Depreciation; Life cycle costing; Project appraisal.	8hrs
Module-5	
Electrical and control systems: Classification of electrical machine; synchronous and induction generators; Variable speed generators; Control systems; Power collection systems; Earthing of wind farms; Embedded (Dispersed)wind generation. Environmental Impact: Impact of wind power on environment, Benefit of wind power for environment, Land demand, Local impact: Physical impact, Sound propagation shadow and reflexes.	8hrs

SUGGESTED TEXT BOOKS & REFERENCES:

1.Wind Energy – Theory and Practice by Siraj Ahmed, PHI Learning Private Limited, Eastern Economy Edition, New Delhi, 2010.

2.Freris, L.L., Wind Energy Conversion Systems, Prentice Hall.

3.Spera, D.A., Wind Turbine Technology: Fundamental Concepts of Wind Turbine Engineering, ASME Press.

4.GargLJohnson: "WindEnergySystems"PrenticeHall.Inc, NewJersey–1985

5.DesireLeGouriers:"WindPowerPlants:TheoryandDesign"PergamonPress–1982

6.Tony Burton, David Sharpe, Nick Jenkins, and Ervin Bossanyi: Wind Energy Hand Book- John Wiley & Sons 2001

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

CO1	Acquaint the modern wind turbines, components and various type of wind turbines.
CO2	Understand the methods and importance of wind resource assessment
CO3	Apply the aerodynamic and performance parameters in wind turbines
CO4	Analyse the wind turbine design and various aspects of sitting and wind farm design.
CO5	Evaluate the issues related to economics and environmental impacts of wind energy generation.

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: 2022-23 **ACADEMICYEAR:2022-23**

5	**COURSE TITLE—MINI PROJECT WITH SEMINAR**			**M.Tech II-Sem (TPE)**
Course Code	22PTP25	MPS	CIEMarks	100
TeachingHours/Week(L :P: SDA)	0:4:2		SEEMarks	--
Credits	3		ExamHours	--

ADMISSION YEAR: 2022-23 **ACADEMICYEAR:2022-23**

6	COURSE TITLE—THERMAL POWER ENGINEERING LAB-II			M.Tech II-Sem (TPE)
Course Code	22PTPL26	PCCL	CIEMarks	50
TeachingHours/Week(L :P: SDA)	1:2:0		SEEMarks	50
Credits	2		ExamHours	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 Boltzman 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 stefen Boltzman 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: 2022-23 **ACADEMICYEAR:2022-23**

7	COURSE TITLE--SUGGESTED ONLINE COURSES			M.Tech II-Sem (TPE)
Course Code	22AUD27	AUD/AEC	CIEMarks	--
TeachingHours/Week(L :P: SDA)	--		SEEMarks	--
Credits	PP		ExamHours	--

Classes and evaluation procedures are as per the policy of the online course providers

ADMISSION YEAR: 2022-23 **ACADEMICYEAR:2022-23**

POOJYA DODDAPPA COLLEGE OF ENGINEERING, KALABURAGI

SchemeofTeachingandExaminations–2022

M.Tech.,Thermal Power Engineering(PTP)

ChoiceBasedCreditSystem(CBCS)andOutcome-BasedEducation (OBE)

III -SEMESTER

Sl.NO.	Course	Course Code	Course Title	Teaching Hours per Week			Examination				
				Theory	Practical/ Seminar	Skill Development Activities (Hours are for interaction between faculty and students)	Duration in hrs	CIE-Marks	SEE-Marks	Total Marks	Credits
				L	P	SDA					
1	PCC	22PTP31	EnvironmentalEngineeringandPollutionControl	03	00	02	03	50	50	100	4
2	PEC	22PTP32X	Professional Elective-3	03	00	00	03	50	50	100	3
3	OEC	22PTP33X	Open Elective Courses-1	03	00	00	03	50	50	100	3
4	PROJ	22PTP34	Project Work phase -1	00	06	00	--	100	--	100	3
5	SP	22PTP35	Societal Project	00	06	00	--	100	--	100	3
6	INT	22PTPI36	Internship	(06 weeks Internship Completed during the intervening vacation of II and III semesters.)			03	50	50	100	6
				09	**12**	**03**	**12**	**400**	**200**	**600**	**22**

Note: PCC: Professional core Courses, PEC: Professional Elective Courses. PROJ-Project Work, INT-Internship, OEC Open Elective Courses, SP- Societal Project

Professional Elective-3		**OpenElective-1**	
CourseCode Under 22PTP32X	**Coursetitle**	**CourseCode Under22PTP33X**	**Coursetitle**
22PTP321	Energy Conservationand Management	22PTP331	Optimization techniques
22PTP322	Energy from Waste		
22PTP323	Pumps, Blowers and Compressors		
22PTP324	Thermal Measurements and Process Controls		
22PTP325	Advanced Power Plant Engineering		

Note:

1.Project Work Phase-1: The project work shall be carried out individually. However, in case a disciplinary or interdisciplinary project requires more participants, then a group consisting of not more than three shall be permitted.

Students in consultation with the guide/co-guide (if any) in disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall pursue a literature survey and complete the preliminary requirements of the selected Project work. Each student shall prepare a relevant introductory project document, and present a seminar.

CIE marks shall be awarded by a committee comprising of HOD as Chairman, all Guide/s and co-guide/s (if any) and a senior faculty of the concerned departments. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question-and-Answer session in the ratio of 50:25:25.

2.Societal Project: Students in consultation with the internal guide as well as with external guide (much preferable) shall involve in applying technology to workout/proposing viable solutions for societal problems.

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. The CIE marks awarded, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question-and-Answer session in the ratio of 50:25:25.

Those, who have not pursued /completed the Societal Project, shall be declared as fail in the course and have to complete the same during subsequent semester/s after satisfying the Societal Project requirements. There is no SEE (University examination) for this course.

3. Internship: Those, who have not pursued /completed the internship, shall be declared as fail in the internship course and have to complete the same during subsequent University examinations after satisfying the internship requirements. Internship SEE (University examination) shall be as per the University norms.

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. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question-and-Answer session in the ratio of 50:25:25.

ADMISSION YEAR: 2022-23 **ACADEMICYEAR:2022-23**

1	COURSE TITLE:ENVIRONMENTALENGG.ANDPOLLUTIONCONTROL			M.Tech III-Sem (TPE)
Course Code	22PTP31	PCC	CIEMarks	50
TeachingHours/Week(L :P: SDA)	3:0:2		SEEMarks	50
Credits	4		ExamHours	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	
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	
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	
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 biomagnification - fertilizers and its Effect of pollutants on plants - animals and human beings soil pollution Control measures - soil microbes and function - biofertilizer. Noise pollution and its effects - noise pollution - sources – noise Exposure level and standards - impacts - noise control and abatement Measures.	10hrs
Module-4	
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. 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	
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 - biomonitoring and bioremediation - pollution control Legislations for air - water - land etc. Biotechnology in pollution control - bioremediation (organic and Inorganic pollutants) - bioleaching and biomineralization	10hrs

SUGGESTED TEXT BOOKS & 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 field.
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.										

PROFESSIONAL ELECTIVE-3

ADMISSION YEAR: 2022-23 **ACADEMICYEAR:2022-23**

2	1.COURSE TITLE--ENERGY CONSERVATION AND MANAGEMENT			M.Tech III-Sem (TPE)
Course Code	22PTP321	PEC	CIEMarks	50
TeachingHours/Week(L :P: SDA)	3:0:0		SEEMarks	50
Credits	3		ExamHours	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 Energy Conservation and management
2.To familiarize the students about the Energy audit and its applications in real life situations
3.To carry out a energy audit on the existed thermal system

COURSE CONTENTS	Hrs
Module-1	
Energy scenario and its various forms, General energy problem, Energy use patterns, Energy balance.Energy Management Principles: Need, Organizing, Initiating and managing an energy management program.Energy Auditing: Elements and concepts, Types of energy audits, Instruments used in energy auditing. Economic Analysis: Cash flows, Time value of money, Formulae relating present and future cash flows - single amount, uniform series.	8hrs
Module-2	
Financial appraisal methods: Payback period, Net present value, Benefit-cost ratio, Internal- rate of return & Life cycle costs/benefits. Thermodynamics of energy conservation, Energy conservation in Boilers and furnaces, Energy conservation in Steam and condensate system.	8hrs
Module-3	
Cogeneration: Concepts, Types of cogeneration systems, Performance evaluation of a cogeneration system.Waste Heat Recovery: Potential, benefits, waste heat recovery equipment. Space Heating, Ventilation Air Conditioning (HVAC) and water heating of building, Transfer of heat, Space heating methods, Ventilation and air conditioning, Heat pumps, Insulation, Cooling load, Electric water heating systems, Electric energy conservation methods.	8hrs
Module-4	
Industrial Insulation: Insulation materials, Insulation selection, Economical thickness of insulation. Industrial Heating: Heating by indirect resistance, direct resistance heating (salt bath furnace), Heat treatment by induction heating in the electric arc furnace industry.	8hrs
Module-5	
Energy Conservation in Electric Utility and Industry: Energy costs and two – part tariff, Energy conservation in utility by improving load factor, Load curve analysis, Energy efficient motors, Energy conservation in illumination systems, Importance of Power factor in energy conservation - Power factor improvement methods, Energy conservation in industries	8hrs

SUGGESTED TEXT BOOKS & REFERENCES:

1.S.C. Tripathy:"ElectricEnergyUtilizationandConservation",TMGDelhi,1991.
2.WayneC.Turner:"EnergyManagementHandbook",WileyIntersciencePublication,NY,1982.
3.D.A. Reay:"IndustrialEnergyConservation",PergamonPress.1980.
4.T.LBoten:"ThermalEnergyRecovery",Wiley,1980.
5.IndustrialEnergyConservationManuals:MITPress.
6.W.C. Turner,EnergyConservationHandbook.

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

CO1	Demonstrate energy management principles, identify need, organizing it. carry out energy auditing.
CO2	Conduct economic analysis of any industry or power plant, obtain conclusion and suggest it toindustry.
CO3	Interpret financial appraisal methods, and thermodynamic analysis, and estimate financial budget ofvisited industry.
CO4	Apply their knowledge to improve thermal efficiency of various systems
CO5	Ability to select suitable application specific heat recovery systems

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: 2022-23 **ACADEMICYEAR:2022-23**

2	2.COURSE TITLE--ENERGY FROM WASTE			M.Tech III-Sem (TPE)
Course Code	22PTP322	PEC	CIEMarks	50
TeachingHours/Week(L :P: SDA)	3:0:0		SEEMarks	50
Credits	3		ExamHours	03

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

1.To Understand the concept of Biomass its importance, availability, and energy conversion process
2.To familiarize the students about the biomass systems design
3.To understand the industrial applications of Biomass systems through real life problems

COURSE CONTENTS	Hrs
Module-1	
Introduction to Energyfrom waste: Classification of waste as fuel, Agro based, Forestresidue, Industrial waste, Conversion devices, Incinerators, gasifiers, digestorsEnergy plantation: Concept, Objectives and advantages.	8hrs
Module-2	
Wasteland development: Extent of water lands in India, Nature of waste lands. Relevance of biomass as an energy source, Biomass Resources, cultivated biomass resources, Water-to-biomass resources, Advantages associated with biomass resources, Availability of biomass for energy generation. Biomass Pyrolysis: Pyrolysis, Types, slow fast, Manufacture of charcoal, Methods Yields and application, Manufacture of pyrolytic oils and gases, yields and applications.	8hrs
Module-3	
Biomass Gasification: Gasifiers, Fixed bed system, Downdraft and updraft gasifier– Fluidized bed gasifiers, Design, construction and operation, Gasifier burner arrangement for thermal heating, gasifier engine arrangement and electrical power Equilibrium and kinetic consideration in gasifier operation.	8hrs
Module-4	
Biomass Combustion: Biomass stoves, Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation, Operation of all the above biomass combustors.	8hrs
Module-5	
Biogas: Properties of biogas (Calorific value and composition) , Biogas plant technology and status , Bio energy system , Design and constructional features , 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 Plants, Applications , Alcohol production from biomass, Bio diesel production ,Urban waste to energy conversion	8hrs

SUGGESTED TEXT BOOKS & REFERENCES:

1.Biogas Technology, A Practical Hand Book, Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

2.Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley &Sons, 1996.

3.Non-Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.

4.Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.

5.T.B. Reed: "Biomass Gasification Principles and Technology", Noyes DataCorporation, Energy Technology Review, No.67, U.S.A., 1981.

6.P Vimal& M S Bhatt: "Wood Energy Systems", K L Publications, New Delhi – 1989

7.S Rao& B BParulkar: "Energy Technology" Khanna Publishers Delhi – 1999

8.A. Kaupp and J.R. Goss: "State of Art Report for small scale Gas Producer Engine Systems", FriedrVieweg&SohnVerlags, Gmbh, Braunschweig, 1984

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

CO1	Illustrate relevance of biomass as energy source, enumerate advantages and disadvantages of biomass resources.
CO2	Survey and identify wasteland in India, suggest suitable biomass resource management.
CO3	Interpret biomass conversion processes, design gasification system and identify its use in SI and CI engines and analyse its performance.
CO4	Conduct an experiment and calculate load capacity, efficiency and identify maintenance, troubleshooting and exhaust emission problems.
CO5	Design and construct down draft gasifier, its Cooling–cleaning systems and Performance evaluationof a Down draft gasifier.

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: 2022-23 **ACADEMICYEAR:2022-23**

2	3.COURSE TITLE--THERMAL MEASUREMENTS AND PROCESS CONTROLS			M.Tech III-Sem (TPE)
Course Code	22PTP323	PEC	CIEMarks	50
TeachingHours/Week(L :P: SDA)	3:0:0		SEEMarks	50
Credits	3		ExamHours	03

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

1.To make the students to gain knowledge of various instruments.
2.To equip the students with various measuring devices.
3.To impart the knowledge of various temperature measuring devices.
4.To discuss the working principle of various level measuring devices.
5.To help the student to know the process control principle with examples.

COURSE CONTENTS	Hrs
Module-1	
General Concepts: - Fundamental elements of a measuring instrument. Static and dynamic characteristics – errors in instruments – Different methods of measurement and their analysis – Sensing elements and transducers. Measurement of pressure – principles of pressure measurement, static and dynamic pressure, vacuum and high-pressure measuring – Measurement of low pressure, Manometers, Calibration methods, Dynamic characteristics- design principles.	8hrs
Module-2	
Measurement of Flow: -Obstruction meters, variable area meters. Pressure probes, compressible fluid flow measurement, Thermal anemometers, calibration of flow measuring instruments. Introduction to design of flow measuring instruments.	8hrs
Module-3	
Temperature Measurement: - Different principles of Temperature Measurement, use of bimetallic thermometers – Mercury thermometers, Vapor Pressure thermometers, Thermo x, calibration of temperature measuring instruments. Design of temperature measuring instruments.	8hrs
Module-4	
Level Measurement: - Direct & indirect methods, barometric methods, float level meters, electrical conductivity, Capacitive, Ultrasonic, and Nucleonic Methods. Measurement of density – Hydrometer, continuous weight method, Gamma rays, Gas impulse wheel. Velocity Measurement – Coefficient of viscosity, Ostesld method, free fall of piston under gravity, torque method. Measurement of moisture content and humidity. Measurement of thermal conductivity of solids, liquids and gases	8hrs
Module-5	
Process Control: -Introduction and need for process control principles, transfer functions, block diagrams, signal flow graphs, open and closed loop control systems – Analysis of First & Second order systems with examples of mechanical and thermal systems. Control System Evaluation – Stability, steady state regulations, and transient regulations	8hrs

SUGGESTED TEXT BOOKS & REFERENCES:

1.Measurement System, Application & Design – E.O. Doeblin, MGH,2nd Edition

2.Mechanical Measurements and Instrumentation and Control Dhanpat Rai & Sons, New Delhi,5th Edition

3.Industrial Instrumentation & Control by S. K. Singh, TMH Publication.

4.Instrumentation measurement and analysis by NakraChaudhari, TMH Publication, 3rd Edition

5.Mechanical and Industrial Measurements – R.K. Jain – Khanna Publishers, 3rd Edition

6.Mechanical Measurements – Buck & Beckwith – Pearson,8th Edition

7.Mechanical variables measurement-John G Webster,6th Edition

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

CO1	To discuss the types and parameters used in measuring devices.
CO2	Describe the working principle of flow measuring devices.
CO3	Explain the types of temperature measuring devices.
CO4	Classify the types of measuring devices
CO5	Analyse the performance of process control principles and examples.

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: 2022-23 **ACADEMICYEAR:2022-23**

2	4.COURSE TITLE--PUMPS, BLOWERS AND COMPRESSORS			M.Tech III-Sem (TPE)
Course Code	22PTP324	PEC	CIEMarks	50
TeachingHours/Week(L :P: SDA)	3:0:0		SEEMarks	50
Credits	3		ExamHours	03

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

1.Toprovidethesufficientknowledgeofconcept,applications,importanceofpumpsblowerandcompressors
2.TofamiliarizethestudentsaboutthePumpsblowersandcompressorsandtheirapplicationsinreallifesituations
3.TounderstandtheindustrialapplicationsofPumpsblowersandcompressors

COURSE CONTENTS	Hrs
Module-1	
Principles of Turbo Machinery Introduction to turbo machines - Transfer of energy to fluids - Performance characteristics - fan laws - Dimensionless parameters - Specific speed - selection of centrifugal, axial, and mixed flow machines.	8hrs
Module-2	
Centrifugal and Axial Flow Pumps--Law of momentum, Vortex theory of Euler's head. Hydraulic performance of pumps; Cavitation, Losses in Pumps, Priming, Jet pumps. The centrifugal pump, definitions, pump output and efficiency, multistage centrifugal pumps, axial flow pump, Design of pumps, Pumps in series and parallel.	8hrs
Module-3	
Rotary fans and blowers--Introduction, Centrifugal blower, types of Vane shapes, Size and speed of Machine, Vane shape: efficiency, stresses, and characteristics. Actual performance characteristics, the slip co-efficient, Drum and partial flow fans, Fan laws and characteristics, Losses in fans and blowers.	8hrs
Module-4	
Axial Compressors: Stage velocity triangles, enthalpy – entropy diagrams, flow through blade rows, stage losses and efficiency, work done factor, low hub-tip ratio stages, supersonic and trans sonic stages, performance characteristics and design.	8hrs
Module-5	
Centrifugal Compressors: Elements of centrifugal compressor stage, stage velocity diagrams, enthalpy-entropy diagram, nature of impeller flow, slip factor, diffuser, volute casing, stage losses, performance characteristics and design	8hrs

SUGGESTED TEXT BOOKS & REFERENCES:

1.A.J. Stepanoff,CentrifugalandAxial/flowPumps,Wiley,1962.
2.A. Kovats,DesignandPerformanceofCentrifugalandAxialFlowPumpsandCompressors,Oxford,Pergamon, 1958.
3.V.KadambiandManoharPrasad:"AnIntroductiontoenergyconversionVolumeIII,2002
4.SMYahya:"Turbines,CompressorsandFans",SecondEdition.
5.VGanesan:"GasTurbines",2002.
6.R. Yadav,SteamandGasTurbine,CentralPublishingHome,Allahabad.

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

CO1	Study about various aspects and considerations about the turbo machines
CO2	Demonstrate Law of momentum, Vortex theory of Euler's head. Hydraulic performance of pumps,

	Cavitation,
CO3	Study types of fans and blowers, calculate their efficiency, stresses, and characteristics, draw performance characteristics
CO4	Demonstrate and interpret performance analysis of Axial flow compressors.
CO5	Demonstrate and interpret performance analysis of centrifugal flow compressors.

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: 2022-23 **ACADEMICYEAR:2022-23**

2	5.COURSE TITLE--ADVANCED POWER PLANT ENGINEERING			M.Tech III-Sem (TPE)
Course Code	22PTP325	PEC	CIEMarks	50
TeachingHours/Week(L :P: SDA)	3:0:0		SEEMarks	50
Credits	3		ExamHours	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 theengineering calculations encountered in practice.

COURSE CONTENTS	Hrs
Module-1	
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	
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, Multi stage expansion and multi stage compression Different methods of improving efficiency (Reheat regeneration and inter cooling)	8hrs
Module-3	
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	
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, Geo Thermal, Biogas and Fuel Cell power systems.	8hrs
Module-5	
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 TEXT BOOKS & REFERENCES:

1.A course in Power Plant Engineering /Arora and Domkundwar/Dhanpatrai& 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 also 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 also 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.										

OPEN ELECTIVE COURSE-1

ADMISSION YEAR: 2022-23 **ACADEMICYEAR:2022-23**

3	COURSE TITLE--OPTIMIZATION TECHNIQUES			M.Tech III-Sem (TPE)
Course Code	22PTP331	OEC	CIEMarks	50
TeachingHours/Week(L :P: SDA)	3:0:2		SEEMarks	50
Credits	3		ExamHours	03

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

1.Modeling, solving and analysing the problems using linear programming with emphasis on theory and applications.

2.Mathematical tools that are needed to solve optimization problems.

3.Ability to work in teams on multi-disciplinary projects in industry and research organizations.

COURSE CONTENTS	Hrs
Module-1	
Introduction& Solution of LinearProgramming Problems-Evolution of OR, definition of OR, scope of OR, application areas of OR, steps(phases) in OR study, characteristics and limitations of OR, models used in OR,linear programming (LP) problem-formulation and solution by graphical method. The simplex method-canonical and standard forms of an LP problem, slack, surplus and artificial variables (Numerical problems).	8hrs
Module-2	
Transportation Problem- Formulation of transportation problem, types, initial basic feasible solution using North-West Corner rule,Matrix minima and Vogel's Approximation method. Optimality in Transportation problem using U-V method optimal solution by MODI method, degeneracy in transportationproblems, application of transportation problem	8hrs
Module-3	
Assignment Problem &Replacement theory-Assignment Problem-formulation balanced and unbalanced types, application to maximization cases and travelling salesman problem (Numerical). Replacement items deteriorating with time, when money value remains same Replacement of items which fail suddenly; Individual replacement policy, Groupreplacement policy.	8hrs
Module-4	
CPM-PERT Techniques-Introduction, network construction - rules, Fulkerson's rule for numbering the events, Critical path method to find the expected completion time of a project, floats; PERT for finding expected duration of an activity and project, determining the probability of completing a project, predicting the completion time of project	8hrs
Module-5	
Game theory &Sequencing Problem - Game Theory: Definition, Pure Strategy problems, Saddle point, Max-Min and Min-Max criteria, Principle of Dominance, Solution of games with Saddle point. Mixed Strategy problems. Solution of 2X2 games by Arithmetic method, Solution of 2xN or and Mx2 games by graphical method. Practical problems in Game theory Basic assumptions, sequencing using Johnson's algorithm, 'n' jobs 2 machines, 'n' jobs 3 machines, 'n' jobs 'm' machines without passing sequence, graphical solutions.	8hrs

SUGGESTED TEXT BOOKS & REFERENCES:

1.S. D. Sharma, "Operations Research", Kedarnath Ramnath & Co, 2002.

2.Prem Kumar Gupta and D S Hira, "Operations Research", 7th edition, S Chand Pub. New Delhi, 2007.

3.Taha H. A, "Operation Operations Research and Introduction", 9th edition, Pearson Education, 2014.

4.Operations Research, A P Verma, S K Kataria& Sons, 2008

5.Operations Research**,**Paneerselvan, PHI

6.Hiller and Lieberman, "Introduction to operation research", 5th edition, McGraw Hill, 2001.

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

CO1	Formulate the industrial and real-world problems as linear programming problem and solve LPP by using Simplex algorithm.
CO2	Formulate thetransportation models and derive solution through various approaches
CO3	Formulate the assignment models and derive solution through various approaches
CO4	Estimate various parameters of projects using CPM and PERT approaches.
CO5	Illustrate the strategies of different players in a game and find the best strategy by graphical and dominance method

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: 2022-23 **ACADEMICYEAR:2022-23**

4	**COURSE TITLE--PROJECT WORK PHASE-1**			**M.Tech III-Sem (TPE)**
Course Code	22PTP34	PROJ	CIEMarks	100
TeachingHours/Week(L :P: SDA)	0:6:0		SEEMarks	--
Credits	3		ExamHours	--

ADMISSION YEAR: 2022-23 **ACADEMICYEAR:2022-23**

5	**COURSE TITLE--SOCIETAL PROJECT**			**M.Tech III-Sem (TPE)**
Course Code	22PTP35	SP	CIEMarks	100
TeachingHours/Week(L :P: SDA)	0:6:0		SEEMarks	--
Credits	3		ExamHours	--

ADMISSION YEAR: 2022-23 **ACADEMICYEAR:2022-23**

6	**COURSE TITLE--INTERNSHIP**			**M.Tech III-Sem (TPE)**
Course Code	22PTPI36	INT	CIEMarks	50
TeachingHours/Week(L :P: SDA)	0:6:0		SEEMarks	50
Credits	6		ExamHours	03

(06 weeks Internship Completed during the intervening vacation of IIand III semesters.)

ADMISSION YEAR: 2022-23 **ACADEMICYEAR:2022-23**

POOJYA DODAPPA APPA COLLEGE OFENGINEERINGKALABURAGI

SchemeofTeachingandExaminations–2022

M.Tech.,Thermal Power Engineering(PTP)

ChoiceBasedCreditSystem(CBCS)andOutcome-BasedEducation (OBE)

IV -SEMESTER

S.No.	Course	Course Code	Course Title	Teaching Hoursper Week		Examination					
				Theory	Practical/ Field work		Duration in hrs	CIE-Marks	SEE-Marks Viva Voce	Total Marks	Credits
				L	P						
1	Project	22PTP41	Project work phase -2	--	08		03	100	100	200	18
				--	**08**		**03**	**100**	**100**	**200**	**18**

Note:
1. Project Work Phase-2:

Students in consultation with the guide/co-guide (if any) in disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall

continue to work of Project Work phase -1to complete the Project work. Each student / batch of students shall prepare project document, and present a seminar.

CIE marks shall be awarded by a committee comprising of HOD as Chairman, all Guide/s and co-guide/s (if any) and a senior faculty of the concerned departments.

The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question-and-

Answer session in the ratio of 50:25:25. SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms.

TotalCredits22+18+22+18=**80**