GONDWANA UNIVERSITY, GADCHIROLI

MASTER OF TECHNOLOGY IN HEAT POWER ENGINEERING

(TWO YEARS COURSE IN FACULTY OF ENGINEERING & TECHNOLOGY)

COURSE AND EXAMINATION SCHEME WITH CHOICE BASED CREDIT SYSTEM

I – SEMESTER

Unique Subject Code (USC)	Course type	Subject	Teaching Scheme				Examination Scheme									
			Hours per week			No. of Credits	Theory						Practical			
			L	Field Work/ Assignment / Tutorial	P		Duration of Paper (Hrs.)	Max. Marks	Max. Marks Sessional		Total	Min. Passing Marks	Max. Marks	Max. Marks	Total	Min. Passing Marks
								ESE	MSE	IE			TW	PEE		
PHPS11	C	Advanced Heat and Mass Transfer	3	2	-	4	3	70	10	20	100	50	-	-	-	-
PHPS12	C	Advanced Thermodynamics	3	2	-	4	3	70	10	20	100	50	-	-	-	-
PHPS13	C	Thermal Engineering-I	3	2	-	4	3	70	10	20	100	50	-	-	-	-
PHPS14x	P	Elective-I	3	2	-	4	3	70	10	20	100	50	-	-	-	-
Laboratories/ Practical																
PHPS15	C	Heat Power Engineering Lab – I	-	-	2	1	3	-	-	-	-	-	25	25	50	25
PHPS16	E	Seminar-I			2	1	3						50	50	50	25
TOTAL			12	08	4	18	-	400					100			
SEMESTER TOTAL			24			18	500									

Elective-I(X): ***(A) Advanced power Plant Engineering. (B): Cryogenic Engineering. (C): Computer Aided Design.***

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COURSE AND EXAMINATION SCHEME WITH CHOICE BASED CREDIT SYSTEM

II – SEMESTER

Unique Subject Code (USC)	Course type	Subject	Teaching Scheme				Examination Scheme									
			Hours per week			No. of Credits	Theory						Practical			
			L	Field Work/ Assignment/ Tutorial	P		Duration of Paper (Hrs.)	Max. Marks	Max. Marks (Sessional)		Total	Min. Passing Marks	Max. Marks	Max. Marks	Total	Min. Passing Marks
								ESE	MSE	IE			TW	PEE		
PHPS21	C	Fluid Dynamics	3	2	-	4	3	70	10	20	100	50	-	-	-	-
PHPS22	C	Advanced Refrigeration and Air Conditioning	3	2	-	4	3	70	10	20	100	50	-	-	-	-
PHPS23	C	Thermal Engineering-II	3	2	-	4	3	70	10	20	100	50	-	-	-	-
PHPS24x	P	Elective – II (x)	3	2	-	4	3	70	10	20	100	50	-	-	-	-
Laboratories/ Practical																
PHPS25	C	Heat Power Engineering Lab –II	-	-	2	1	3	-	-	-	-	-	25	25	50	25
PHPS26	E	Seminar-II			2	1	3						50	50	50	25
		TOTAL	12	08	4	18	-	400					100			
		SEMESTER TOTAL	24			18	500									

Elective – II (x) : *(A) Design of Heat Transfer Equipments (B) Design of I.C. Engine Components and Subsystems. (C)Thermal Storage Systems*

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COURSE AND EXAMINATION SCHEME WITH CHOICE BASED CREDIT SYSTEM

III – SEMESTER

Unique Subject Code (USC)	Course type	Subject	Teaching Scheme				Examination Scheme									
			Hours per week			No. of Credits	Theory						Practical			
			L	Field Work/ Assignment / Tutorial	P		Duration of Paper (Hrs.)	Max. Marks	Max. Marks (Sessional)		Total	Min. Passing Marks	Max. Marks	Max. Marks	Total	Min. Passing Marks
								ESE	MSE	IE			TW	PEE		
PHPS31	C	Solar and Wind Energy Utilization	3	2	-	4	3	70	10	20	100	50	-	-	-	-
PHPS32x	P	Elective – III (x)	3	2	-	4	3	70	10	20	100	50	-	-	-	-
Laboratories/ Practical																
PHPS33	E	Grand Seminar? Industrial Training		10		5	3						100	-	100	50
PHPS34	E	Pre-Dissertation	-	10		5	3	-	-	-	-	-	200	-	200	100
		TOTAL	6	24		18	-	200					300			
		SEMESTER TOTAL	30			18	500									

Elective – III (x): (A): Advanced Fluid Mechanics. (B): Thermal Measurements & Process Controls. (C): Turbo Machines.

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(TWO YEARS COURSE IN FACULTY OF ENGINEERING & TECHNOLOGY)

COURSE AND EXAMINATION SCHEME WITH CHOICE BASED CREDIT SYSTEM

IV – SEMESTER

Unique Subject Code (USC)	Course type	Subject	Teaching Scheme				Examination Scheme								
			Hours per week			No. of Credits	Theory					Practical			
			L	Field Work/ Assignment/ Tutorial	P		Duration of Paper (Hrs.)	Max Marks	Max. Marks		Total	Min. Passing Marks	Max. Marks	Max. Marks	Total	Min. Passing Marks
									Sessional							
								ESE	MSE	IE			TW	PEE		
PHPS41	E	Final Dissertation	-	24		18	3						250	250	500	250
		TOTAL		24		18	-							500		
		SEMESTER TOTAL		24		18								500		

GONDWANA UNIVERSITY, GADCHIROLI

Name of the Program : **I-Semester M. Tech. (Heat Power Engineering)**
Subject Code : **PHPS11**
Subject Title : **Advanced Heat and Mass Transfer**

Course Scheme					Examination Scheme				
Lecture	Tutorial	Practical	Periods per week	Credits	Duration of Paper, Hrs	MSE	IE	ESE	Total
03	02	-	04	04	03	10	20	70	100

Contents

1. Conduction Heat Transfer – Heat equation in Cartesian, cylindrical and spherical co-ordinates (without derivation), boundary conditions, and steady and unsteady state heat conduction in one, two and three dimensions. Analytical, Graphical and Numerical methods of analysis, Conduction shape factor, extended surface heat transfer, transient condition, multi-dimensional systems, numerical methods in unsteady state heat transfer, Integral heat conduction equation, Biot approximate method, Error in temperature measurement.

2. Radiation Heat Transfer – Fundamentals laws of thermal radiations, surface properties, Heat exchange between nonblack bodies, Electrical network analogy for thermal radiation system, Radioactive heat exchange among diffuse, gray and non-gray surfaces separated by non-participating media, Formulation of Numerical solutions, Radiation shields, Gas radiations, Radiation from gases vapour and flames, Solar radiation, Radiations heat transfer coefficient.

3. Heat transfer by convection: Hydrodynamic and Thermal boundary Layer, Turbulence. Energy equation of boundary layer, Momentum equation, Von-Karman integral momentum equation, relationship between fluid friction and heat transfer. Turbulent – Boundary-Layer Heat transfer, Heat transfer in Laminar and Turbulent fluid flow, heat transfer in high speed flow.

4. Empirical and practical relations for forced convection heat transfer. Relations for pipes and tube flow, flow across cylinder and sphere. Flow across tube banks, Liquid metal heat transfer. Free Convection, Convection with change of phase, Condensation and boiling heat transfer, Heat Exchanger, Heat transfer Augmentation techniques. Mass transfer: Fick's law of radiation, diffusion in gases, diffusion in liquids and solids. The mass transfer co-efficient, Heat transfer in Magnate fluid dynamic (MFD) systems.

Text Book:

1. Saddik Kakac: Heat Conduction, McGraw-Hill Pub.
2. S.P.Sukhatme: Heat Transfer, University press.
3. J.P. Holman, Heat Transfer, McGraw-Hill Pub.
4. A.J. Chapman: Heat Transfer, Macmillan Publishing Co. New York.
5. W.M.Kays and Crawford: Convective Heat and Mass transfer, McGraw-Hill Co.
6. Heat and Mass Transfer by Ozzisic.

References:

1. Eckert and Drake: Analysis of Heat Transfer, McGraw-Hill Co.
2. Naylor: Introduction to Convective Heat Transfer Analysis
3. Burmister: Convective Heat Transfer

Name of the Program : I-Semester M. Tech. (Heat Power Engineering)
Subject Code : PHPS12
Subject Title : Advanced Thermodynamics

Course Scheme					Examination Scheme				
Lecture	Tutorial	Practical	Periods per week	Credits	Duration of Paper, Hrs	MSE	IE	ESE	Total
03	02	-	04	04	03	10	20	70	100

Contents

1. Analysis of Engineering Process in Thermodynamics – Control mass analysis, control volume analysis, continuous system, first law of thermodynamics for continuous system, first law of thermodynamics for a control volume, Transient flow processes, charging of a cylinder, Discharging of a cylinder, Second law analysis of Engineering processes, Second law analysis of control volume.

2. Thermodynamic relations – Vander Waals equation of state, Virial equation of state, compressibility charts, Maxwell's relations, Mnemonic Diagrams, Thermodynamic potentials, Helmholtz potential, Clapeyron equation, Kirchhoff's equation, Gibbs phase rule.

3. Gas and Gas – Vapour Mixtures – Mixtures of gas, mixing of ideal gases, mixtures of real gases, mixtures of ideal gases and vapours, process of mixtures of ideal gases and vapours, fugacity and fugacity coefficients, Binary mixtures, phase equilibrium and chemical equilibrium.

4. Thermodynamic aspects of fluid flow – Basic dynamic equation for steady, one dimensional fluid flow convenient properties of fluids, Application of basis relations, flow in pipes – adiabatic, irreversible flow in constant area passage, flow with combustion or heat transfer.

Text Books:

1. V. Wylen & E. Sonntag. "Fundamentals of Classical Thermodynamics" Wiley Eastern Limited, New Delhi,
2. J. P. Holman, "Thermodynamics", McGraw Hill, London.
3. Adrian Bejan, George T., Michael Moran, "Thermal Design and Optimization" John Willey and Sons, Inc., pp 113-127, 1996.

4. T.J. Kotas, “The Energy Method of Thermal Plant Analysis”, Butterworth, 1985
5. J.L. Thrdkeld, “Thermal environmental engineering”, Prentice Hall, Inc. New Jersy. 1970
6. M.W. Zemansky, “Heat and Thermodynamics”,
7. M.L. Mathur & S.C. Gupta, “Thermodynamics for Engineers”, Dhanpatrai and Sons Ltd., New Delhi.

References:

1. Howell & Duckins, “Fundamentals of Engineering Thermodynamics”.
2. Lee-Sears, “Engineering Thermodynamics”.
3. N.A. Chigier, Energy Combustion and Environment –McGraw-Hill 1981
4. A. Murthy Kanury, Gordon and Breach, Introduction to combustion phenomena,1975 5.S. P. Sharma and Chandra Mohan, Fuels and combustion –Tata McGraw –Hill. 1984.

Name of the Program : I-Semester M. Tech. (Heat Power Engineering)
Subject Code : PHPS13
Subject Title : Thermal Engineering – I

Course Scheme					Examination Scheme				
Lecture	Tutorial	Practical	Periods per week	Credits	Duration of Paper, Hrs	MSE	IE	ESE	Total
03	02	-	04	04	03	10	20	70	100

Contents

1. Combustion Process – Introduction of combustion theories Stoichiometry, First and Second law of thermodynamics applied to combustion, combustion mass balance, combustion energy balance,
   Fundamentals of combustion Kinetics, Laminar Flame Propagation, Flammability, limits and quenching of laminar flames, Turbulent flame propagation, Flame stabilization. Chemistry of combustion reactions, Excess air.
2. Furnaces: Classification, performance evaluation of a typical furnace, Fluidized bed combustion systems, Furnace design, Insulation and Refractory, Economical thickness of thermal Insulation, Selection criterion.
3. Cogeneration – Basics of thermodynamics cycles, operating strategies for cogeneration plant, typical cogeneration performance parameters.
4. Waste heat recovery – Classification, benefits, development of a waste heat recovery systems

Text Books:

1. V. Wylen & E. Sonntag. “Fundamentals of Classical Thermodynamics” Wiley Eastern Limited, New Delhi,
2. J. P. Holman, “Thermodynamics”, McGraw Hill, London.
3. Adrian Bejan, George T., Michael Moran, “Thermal Design and Optimization” John Willey and Sons, Inc., pp 113-127, 1996.
4. T.J. Kotas, “The Energy Method of Thermal Plant Analysis”, Butterworth, 1985
5. J.L. Thrdkeld, “Thermal environmental engineering”, Prentice Hall, Inc. New Jersy. 1970
6. M.W. Zemansky, “Heat and Thermodynamics”,
7. M.L. Mathur & S.C. Gupta, “Thermodynamics for Engineers”, Dhanpatrai and Sons Ltd., New Delhi.

References:

1. Howell & Duckins, “Fundamentals of Engineering Thermodynamics”.
2. Lee-Sears, “Engineering Thermodynamics”.
3. N.A. Chigier, Energy Combustion and Environment –McGraw-Hill 1981
4. A. Murthy Kanury, Gordon and Breach, Introduction to combustion phenomena,1975
5.S. P. Sharma and Chandra Mohan, Fuels and combustion –Tata McGraw –Hill. 1984
6.Civil Davies, Calculations in Furnace Technology, Pregamon Press, Oxford 1966 7. D. A. Ray, Heat Recovery System, E & F . N. span, London

Name of the Program : I-Semester M. Tech. (Heat Power Engineering)

Subject Code : PHPS14x

Subject Title : (Elective-I) (A): Advanced Power Plant Engineering

Course Scheme					Examination Scheme				
Lecture	Tutorial	Practical	Periods per week	Credits	Duration of Paper, Hrs	MSE	IE	ESE	Total
03	02	-	04	04	03	10	20	70	100

Contents

1. Analysis of Steam cycles: Rankine cycle, Carnot cycle, mean temperature of heat addition, effect of variation of steam condition on thermal efficiency of steam power plant, reheating of steam, regeneration, regenerative feed water heating, feed water heaters, optimization of Rankine cycle, optimum degree of regeneration, Super critical pressure cycle, steam power Plant appraisal, Deaerator, typical layout of steam power plant, efficiencies in a steam power plant, Cogeneration of Power and Process Heat, Numerical Problems.
   Combined cycle power generation: Flaws of steam as working fluid in Power Cycle, Characteristics of ideal working fluid in vapor power cycle, Binary vapor cycles, coupled Cycles , combined cycle plants, gas turbine- steam turbine power plant, MHD-steam power plant, Thermionic- Steam power plant, Numerical problems.

2. Fuels and combustion : Coal, fuel oil, natural and petroleum gas, emulsion firing, coal – oil and coal – water mixtures, synthetic fuels, bio-mass, combustion reactions, heat of combustion and enthalpy of combustion, theoretical flame temperature, free energy of formation, equilibrium constant, effect of dissociation, Numerical problems. Combustion Mechanisms : Kinetics of combustion, mechanisms of solid fuel combustion, kinetic and diffusion control, pulverized coal firing system, fuel-bed combustion, fluidized bed combustion, coal gassifiers, combustion of fuel oil, combustion of gas, combined gas fuel oil burners, Numerical problems.

3. Steam Generators: Basic type of steam generators, fire tube boilers, water tube boilers. Economizers, super heaters, reheaters, steam generator control, air preheater, fluidized bed boilers, electrostatic precipitator, fabric filters and bag houses, ash handling system, feed water treatment, deaeration, evaporation, internal treatment, boiler blow down, steam purity, Numerical problems. Condenser, feed water and circulating water systems: Need of condenser, direct contact condensers, feed water heaters, circulating water system, cooling towers, calculations, Numerical Problems.

4. Nuclear Power Plants: Chemical and nuclear reactions, nuclear stability and binding energy, radioactive decay and half-life, nuclear fission, chain reaction, neutron energies. Neutron flux and reaction rates, moderating power and moderating ratio, variation of neutron cross sections with neutron energy, neutron life cycle. Reflectors, Types of Reactor, PWR, BWR, gas cooled reactors. Liquid metal fast breeder reactor, heavy water reactors. Fusion Power reactors, Numerical problems. Hydro Electric Power Plant: Introduction, advantages and disadvantages of water power, optimization of hydro – thermal mix, hydrological cycles, storage and pond age, essential elements of hydroelectric power plant, comparisons of turbines, selection of turbines, Numerical problems.

Text books:

1. Power Plant Engineering - P.K. Nag, Tata McGraw-Hill Publications.
2. Power Plant Engineering - M.M. EI-Wakil, McGraw- Hill Publications
3. An Introduction to Power plant engineering, G.D.Rai, Khanna Publishers, III edition,2001 4. Hydropower development series, Vol.1-17, Norwejian Institute of Technology,1996/2005.
5. Combined cycle Gas and Steam Turbine Power Plants, Rolf H Kohlhofer, PennWell Books, 1991

Reference:

1. Standard Handbook of Power plant Engineering, Thomas C Elliot, Robert C Swanekamp, Kao Chen, McGraw Hill Professional, 1997
2. Wet steam turbines for Nuclear Power plants, Aleksander Lejzerovic, Penn Well Books, 2005.
3. TMI 25 Years Later: the Three Mile Island nuclear power plant accident and its impact, Bonnie Anne Osif, Anthony Baratta, Thomas W Conkling, Penn State Press,2004.

Name of the Program : I-Semester M. Tech. (Heat Power Engineering)

Subject Code : PHPS14x

Subject Title : (Elective-I) (B): Cryogenic Engineering

Course Scheme					Examination Scheme				
Lecture	Tutorial	Practical	Periods per week	Credits	Duration of Paper, Hrs	MSE	IE	ESE	Total
03	02	-	04	04	03	10	20	70	100

UNIT - 1

Introduction to Cryogenic Systems: Applications Areas of Cryogenic Engineering

Low temperature properties of engineering materials – Mechanical properties, Thermal properties, Electrical properties. Introduction the Thermodynamically Ideal system Production of low temperatures – Joule Thompson Effect, Adiabatic expansion.

Gas Liquification Systems: Liquefaction systems for Air Simple Linde – Hampson System, Claude System, Heylndt System, Dual pressure, Claude. Liquefaction cycle Kapitza System. Comparison of Liquefaction Cycles Liquefaction cycle for hydrogen, helium and Neon, Critical components of liquefaction systems.

UNIT - 2

Gas Cycle Cryogenic Refrigeration Systems: Classification of Cryo coolers Stirling cycle Cryo – refrigerators, Ideal cycle – working principle. Schmidt's analysis of Stirling cycle Various configurations of Sterling cycle refrigerators Integral piston Sterling Cryo-cooler, Free displacer split type Stirling Cryo coolers, Gifford Mcmahon Cryo- refrigerator, Pulse tube refrigerator, Solvay cycle refrigerator, Vuillimier refrigerator, Cryogenic regenerators.

Gas Separation And Gas Purification Systems: Thermodynamic ideal separation system, Properties of mixtures, Principles of gas separation, Linde single column air separation. Linde double column air separation, Argon and Neon separation systems. Adsorption Process, PSA systems.

UNIT - 3

Vacuum Technology: Fundamental principles. Production of high vacuum, Mechanical vacuum pumps, Diffusion pumps, Cryo-pumping, Measurement of high vacuum level.

Cryogenic Insulation: Heat transfer due to conduction, Evacuated porous insulation Powder & Fibers Opacified powder insulation, Gas filled powders & Fibrous materials Multilayer super-insulation, Composite insulation.

UNIT - 4

Cryogenic Fluid Storage and Transfer Systems: Design of cryogenic fluid storage vessels, Inner vessel, Outer Insulation, Suspension system, Fill and drain lines. Cryogenic fluid transfer, External pressurization, Self-pressurization, Transfer pump.

Application Of Cryogenic Systems: Cryogenic application for food preservation – Instant Quick Freezing techniques 11.2 super conductive devices, Cryogenic applications for space technology.

TEXT BOOKS:

1. **Cryogenic Systems,** Randall Barron – Oxford Press, 1985
2. **Cryogenic Engineering,** Thomas M. Flynn, Marcel Dekker, Inc N.Y. Basal 1997

REFERENCE BOOK:

1. **Cryogenic Process Engineering,** Klaus D. Timmerhaus & Thomas M. Flynn, Plenum Press, New York & London 1989.

Name of the Program : I-Semester M. Tech. (Heat Power Engineering)
Subject Code : PHPS14x
Subject Title : (Elective-I) (C): Computer Aided Design

Course Scheme					Examination Scheme				
Lecture	Tutorial	Practical	Periods per week	Credits	Duration of Paper, Hrs	MSE	IE	ESE	Total
03	02	-	04	04	03	10	20	70	100

UNIT – I

Introduction of CAD: Difference between Conventional & CAD design, Rasterisation techniques frame buffer, N-bit plane buffers, Simple color frame buffer algorithm for the generation of basic geometric entities like line, circle & ellipse by using parametric & non-parametric equations. Introduction to windowing & clipping (excluding algorithm), Window and Viewport, line clipping & polygon clipping

2D transformation: Translation, Scaling, Rotation, Reflection & Shear, Concept of homogeneous representation & concatenation. Inverse Transformation (enumeration of entity on graph paper)

3D Transformation: Translation, Scaling, Rotation, Reflection etc.

UNIT – II

Techniques for Geometric Modeling:

Graphic standards, parametric representation of geometry, Bezier curves, Cubic spline curves, B-Spline curves, constructive solid geometry, Feature Based modeling, Feature recognition, Design by feature, Wire frame modeling, solid modeling of basic entities like box, cone, cylinder. CSG & B-representation technique using set theory.

Assembly modeling: Representation, mating conditions, representation schemes, generation of assembly sequences and importance of precedence diagram.

UNIT – III

Finite Element Analysis:

One Dimensional Problem: Fundamental concept of finite element method, Plain stress and strain, Finite Element Modeling, Potential Energy Approach, Galerkin Approach, Coordinate and Shape function, Assembly of Global Stiffness Matrix and Load Vector, Properties of Stiffness Matrix, Finite Element Equations, Quadratic Shape Function, Temperature Effects, Torsion of a circular shaft.

Truss & Two Dimensional FEM:

Plane truss problems, two dimensional problems using Constant strain triangle. Derivation of shape functions for CST element. Formulation of stiffness matrices for Truss and CST element. Preprocessing and Post processing.

UNIT – IV

Optimization in Design:

Objectives of optimum design, adequate and optimum design, Johnson's Method of optimum design, primary design equation, subsidiary design equations and limit equations, optimum design with normal and redundant specifications of simple machine elements like: tension bar, transmission shaft and helical spring.

TEXT BOOKS:

1. CAD/CAM Theory and Practice, Zeid Ibrham, Tata McGraw Hill.
2. CAD/CAM, Principles and Applications, P.N. Rao, McGraw Hill.
3. Computer Aided design and Manufacturing, Lalit Narayan, Rao & Sarcar, PHI pub.
4. Introduction to Finite Elements in Engineering, Chandrupatla T. R. and Belegunda A.D., Prentice Hall India.
5. Finite Element Method with application in Engineering, Y.M. Desai, T.I. Eldho, A.H. Shah, Pearson publication.
6. Optimization: Theory and Practice, Joshi M.C, Narosa Publication.

REFERENCE BOOKS:

1. Computer Graphics, D. Hearn & M.P. Baker, Pearson.
2. Computer Graphics, S. Harrington, McGraw Hill.
3. Computer Control of Manufacturing Systems, Yoram Koren, McGraw Hill.
4. First Course in the Finite Element Method, Daryl Logan, Cengage Learning.
5. Mathematical Elements for Computer Graphics, Dravid F Rogers, J. Alan Adams, McGraw Hill.
6. Schaum's Outline Series: Theory & Problems of Computer Graphics, Roy A. Plastock, Gordon Kalley, McGraw Hill.
7. Computer Graphics & Product Modeling for CAD / CAM, S.S. Pandey, Narosa publication.
8. Optimum Design of Mechanical Elements, R. C. Johnson, John Wiley & Sons.

Name of the Program : I-Semester M. Tech. (Heat Power Engineering)

Subject Code : PHPS15

Subject Title : Heat Power Engineering Lab- I

Course Scheme					Examination Scheme		
Lecture	Tutorial	Practical	Periods per week	Credits	TW	POE	Total
-	-	02	04	01	25	25	50

Contents

Student is expected to perform at least E**ight Experiments/Practical's** based on the prescribed syllabus of all the theory courses of first semester.

1. Determination Thermal conductivity of Liquids and gases.
2. Determination of Effectiveness in parallel and counter flow heat Exchanger.
3. Determination of heat transfer in Boiling and Condensation.
4. Design of a thermal system such as gas turbine systems, steam power plants
5. 5. Design of thermal system components such as nozzles, pumps, heat exchanger.
6. Design of pumps or compressors.
7. Design of refrigeration systems.
8. Trial on thermal system and its validation.
9. Design of heat exchanger.
10. Design of Condenser.
11. Design of Compressor.
12. Design of Flow through duct.
13. Design of air conditioning system.
14. Design of solar thermal system.
15. Modeling of regenerative heat exchanger

Name of the Program : I-Semester M. Tech. (Heat Power Engineering)
Subject Code : PHPS16
Subject Title : Seminar-I

Course Scheme					Examination Scheme		
Lecture	Tutorial	Practical	Periods per week	Credits	TW	POE	Total
-	-	02	01	01	50	-	50

Contents :

Student is required to select appropriate topic related to the course work. Topic should be approved from the coordinator. Student have to deliver the seminar and submit the report for final evaluation with minimum 25 pages in the prescribed format.

Name of the Program : II-Semester M. Tech. (Heat Power Engineering)

Subject Code : PHPS21

Subject Title : Fluid Dynamics

Course Scheme					Examination Scheme				
Lecture	Tutorial	Practical	Periods per week	Credits	Duration of Paper, Hrs.	MSE	IE	ESE	Total
03	02	-	04	04	03	10	20	70	100

Contents

1. Fluid Flow Concepts, Euler's equation of motion, Continuity equation, Stream function, potential function flow nets, rotational and irrotational flow, Circulation Vortices, Conformal mapping, Simple and inverse transfer.

2. Navier-Stock's equations: Fundamental equation of motion and continuity applied to fluid flow, General stress in a deformable body, rate at which the fluid element strained in a flow; relation between stress and rate deformation, Stroke's hypothesis. Navier-Stoke's equation, Reynolds's principle of similarity, Exact solutions of Navier-Stoke's equations, Hydrodynamic theory of lubrication.

3. Laminar Boundary Layer: Boundary Layer equations for flow along flat plate, separation of boundary layer, Momentum-Integral equation of the Boundary Layer. Exact solution of Boundary Layer equations to flow past a cylinder, two-dimensional jet. Boundary Layer control and its applications, Drag; Pressure, form and skin friction.

4. Turbulent Flow: The origin of turbulence, Reynolds modification of Navier-Stokes equation for Turbulent flow. Mean values and fluctuations, Semi-empirical theories of similarity hypothesis,
   Turbulent flow in pipes, Turbulent boundary layer. Introduction to Boundary layer for compressible fluids.

Text books:

1. Mohanty A.K.-Fluid Mechanics, II edition, PHI private Ltd. New Delhi.
2. E.Rathakrishnan- Fluid Mechanics, II edition, PHI private Ltd. New Delhi.
3. James A.Fay-Introduction to Fluid Mechanics, PHI private Ltd. New Delhi.
4. Streeter-"Fluid Mechanics", Tata McGraw Hill, New Delhi.
5. Schlichting-Boundary layer theory, Springer Pub.

References:
1. G.Biswas and K. Muralidhar- Advanced Fluid mechanics.
2. F.M. White- Viscous Fluid Flow. Tata McGraw Hill, New Delhi.
3. Fox R.W. and McDonald A.T- "Introduction to Fluid Mechanics" John Wiley & Sons.
4. Bird R.B. Stewart W.F.-"Transport Phenomena", John Wiley & Sons.

Name of the Program : II Semester M. Tech. (Heat Power Engineering)
Subject Code : PHPS22
Subject Title : Refrigeration and Air Conditioning

Course Scheme					Examination Scheme				
Lecture	Tutorial	Practical	Periods per week	Credits	Duration of Paper, Hrs	MSE	IE	ESE	Total
03	02	-	04	04	03	10	20	70	100

Contents

1. Analysis of Conventional refrigeration systems –Vapour Compression Refrigeration Systems and Advanced Vapour absorption Refrigeration Systems, Component selection and System balance, Multi pressure systems and their thermal analysis, Multi evaporator systems and their analysis.
2. Refrigerants: Nomenclature, Mixture refrigerants, Ozone layer depletion and Global warming, Montreal and Kyoto Protocol, Alternatives to CFC's and HFC's, Natural refrigerants, Retrofitting of domestic refrigerator using hydrocarbon blends. Introduction to simulation software's in Refrigeration
3. Analysis of Non-conventional Refrigeration Systems – Steam jet refrigeration systems, Thermoelectric refrigeration system, Vortex tube refrigeration system, Pulse tube refrigeration system, Mixture refrigeration system, Adsorption Refrigeration system, Desiccant cooling, hybrid systems. Environmental impact of insulation
4. Cryogenic Applications – Gas Liquification systems, Cryogenic Refrigeration systems, storage and handling of Cryogens, Cryogenic insulations Advanced Psychometric - Heat load calculations and equipment selection, Duct design and air distribution systems. Measuring instruments in air conditioning, thermal insulation Fans and air distribution devices.

Text Books:

R.J. Dossat, Principles of refrigeration, Pearson Education Asia
2. C.P. Arora, Refrigeration and Air-Conditioning
3. Stoecker and Jones, Refrigeration and Air-conditioning
4. Jordan and Priester, Refrigeration and Air-conditioning
5. A.R. Trott, Refrigeration and Air-conditioning, Butterworth's
6. J.L. Threlkeld, Thermal Environmental Engineering, Prentice Hall
7. W.F. Stoecker, Industrial Refrigeration Handbook, McGraw-Hill

References:

1. John A. Corinchock, Technician's guide to Refrigeration systems, McGraw-Hill
2. P.C. Koelet, Industrial Refrigeration: Principles, design and applications, by McMillan
3. ASHRAE Handbook (i) Fundamentals (ii) Refrigeration
4. ISHRAE handbooks
5. ARI Standards
6. Refrigeration Handbook, Wang, Mc Graw Hill, Int.
7. Refrigeration – Malhotra Prasad

Name of the Program : II Semester M. Tech. (Heat Power Engineering)

Course Code : PHPS23

Course Title : Thermal Engineering – II

Course Scheme					Examination Scheme				
Lecture	Tutorial	Practical	Periods per week	Credits	Duration of Paper, Hrs	MSE	IE	ESE	Total
03	02	-	04	04	03	10	20	70	100

Contents

1. Gas Turbines – Analysis of Positive displacement rotary air compressor, dynamic compressor, Thermodynamic analysis of gas turbine cycles, inter-cooled and reheat and regenerative cycles - Performance of practical gas turbine cycles - Gas turbine combustion systems – Pressure and Flow losses, Mechanical Losses, loss due to incomplete combustion.

2. Measurement and Testing of I.C. Engine – performance parameters and characteristics, derivation of excess air, Minimum mass of air required for complete combustion, volumetric efficiency, scavenging, scavenging Efficiency, charge efficiency, combustion efficiency, heat balance, Emission control, Exhaust gas Recirculation system, Catalytic converter, Particulate trap.

3. Design of Hydraulic and Pneumatic systems –Oil hydraulic system, Hydraulic actuators, control and regulation element, reciprocating quick return, accumulator circuit, industrial circuits, press circuits, milling grinding planning machine circuit design, Pneumatic system control element, pressure sensing, logic circuit, compound circuit design, combination circuit design, Hydro-pneumatic automation.

4. Power Plants – Fluctuating loads on Power plant, Effect of variable load on Power plant design and operation, Peak load plant, Economic Analysis of Power plant, Tariffs methods, Performance and operating characteristics, combined operation of different power plant, Pollution and its control.

Text Books and References:

1. P.K. Nag, Power Plant Engineering - Tata McGraw-Hill Publications.
2. M.M. EI-Wakil,Power Plant Engineering - McGraw- Hill Publications
3. G.D.Rai,An Introduction to Power plant engineering, Khanna Publishers, III edition,2001 4. Hydropower development series, Vol.1-17, Norwejian Institute of Technology, 1996/2005.
5. Ganeshan. V, Internal Combustion Engine Tata Mc Graw Hill
6. Edward F Obert, Internal Combustion Engine, Maxwell MC
7. Pipenger, Industrial Hydraulics
8. Stewart H. L, Hydraulic and Pneumatic Power for Production. Industrial Press NewYork

Name of the Program : II Semester M. Tech. (Heat Power Engineering)

Course Code : PHPS24x

Course Title : (Elective-II) (A): Design of Heat Transfer Equipment's

Course Scheme					Examination Scheme				
Lecture	Tutorial	Practical	Periods per week	Credits	Duration of Paper, Hrs	MSE	IE	ESE	Total
03	02	-	04	04	03	10	20	70	100

Contents

1. Constructional details and Heat Transfer : Types – Shell and Tube heat Exchangers – Regenerators and remunerators- Industrial applications, Temperature distribution and its implications – LMTD – Effectiveness.
2. Flow distribution and stress analysis: Effect of Turbulence – Friction factor – Pressure loss – Channel diversion – stress in tube – heater sheets and pressure vessels – Thermal Stresses –shear stresses – Types of failure.
3. Design Aspects: Heat transfer and Pressure loss – Flow configuration: Effects of Baffles- effects of deviation from ideality – Design of typical liquid – gas, gas –Liquid heat exchanger.
4. Condensers and Evaporators design: Design of surface and evaporative condensers – Design of shell and tube – plate type evaporator. Cooling Tower: Packing's – sprays design, selection of pumps – fans and pipe- testing and maintenance – experimental methods.

Text Books and References:

1. Process Heat Transfer - D.Q. Kern, McGraw-Hill Publications
2. Applied Heat Transfer - V. Ganapathy, Penn Well Publishing Company, Tulsa, Oklahoma.
3. Process Heat Transfer - Sarit Kumar Das, A. R. Balakrishan, Alpha Science International, 2005.

Name of the Program : II Semester M. Tech. (Heat Power Engineering)
Subject Code : PHPS24x
Subject Title : (Elective-II) (B): Design of IC Engine Components and Subsystems

Course Scheme					Examination Scheme				
Lecture	Tutorial	Practical	Periods per week	Credits	Duration of Paper, Hrs.	MSE	IE	ESE	Total
03	02	-	04	04	03	10	20	70	100

Contents

1. Introduction to different types of IC engine systems, air standard cycle, air fuel cycle, actual cycle analysis.
2. Engine design and operating parameters, Fuels for engine and their characteristics, fuel air mixing, as exchange, fuel injection systems, ignition.
3. Combustion chamber designs for spark ignition and compression ignition engines, engine cooling and cooling system design, engine lubrication system.
4. Emission control and electronic management systems, design of supercharged engines, IC engine exhaust emission, formation, effect of engine parameters, methods of measurement of emissions, methods of control

Text Books and References:

1. Ganeshan V, Internal Combustion Engine, Tata Mc GrawHill
2. Ganeshan V, Computer Simulation Four stroke spark ignition engines, University Press, Hyderabad
3. Ganeshan V, Computer Simulation Four stroke compression ignition engines, University Press, Hyderabad
4. Ashely S. Campbell, Thermodynamic Analysis of Combustion Engine, John Willey and sons NewYork

Name of the Program : II Semester M. Tech. (Heat Power Engineering)

Course Code : PHPS24x

Course Title : Elective-II (C): Thermal Storage Systems

Course Scheme					Examination Scheme				
Lecture	Tutorial	Practical	Periods per week	Credits	Duration of Paper, Hrs	MSE	IE	ESE	Total
03	02	-	04	04	03	10	20	70	100

Contents

1. Introduction: Necessity of Thermal storage – Energy storage devices , types of storage system- Specific areas of application – Heat Transfer Enhancement methods Sensible Heat Storage system : Basic Concepts and modeling of heat storage units, Modeling of simple water and rock bed storage system –Use of TRNSYS _ pressurized water storage system for power plant applications – packed beds.

2. Regenerators – Parallel flow and counter flow regenerators- Finite conductivity model – Non-linear model – Transient performance – step changes in inlet gas temperature – step changes in gas flow rate – Parameterization of transient response – Heat storage exchangers.

3. Latent Heat Storage system – Storage materials modeling of phase change problems and solution methodologies – Enthalpy modeling – Heat transfer enhancement configuration – Parameterization of rectangular, cylindrical geometric problems.

4. Applications- Specific areas of application of energy storage- Food preservation – Waste heat recovery – solar energy storage – Green House heating – Power Plant applications – drying and heating for process industries.

References:

1. F. W. Schmidt and A.J.Willmott, Thermal storage and Regeneration, Hemisphere Publishing Corporation 1981.

2. V. J. Lunardini, Heat Transfer In cold climates, D. Van Nostrand Reinhold NewYork 1981.

Name of the Program : II Semester M. Tech. (Heat Power Engineering)
Course Code : PHPS25
Course Title : Heat Power Engineering Lab - II

Course Scheme					Examination Scheme		
Lecture	Tutorial	Practical	Periods per week	Credits	TW	POE	Total
-	-	02	04	01	25	25	50

Contents

Student is expected to perform at least eight Experiments/Practical's based on the prescribed syllabus of all the theory courses of second semester.

1. Expt. on Flow over a cylinder/sphere at different Re. Pressure variation over the body and drag
2. Expt. on Flow past an aero foil: Pressure measurements, calculation of lift
3. Laminar/Turbulent boundary layer over a flat plate.
4. Study and trial on cascade refrigeration system
5. Study and trial on multi evaporator system
6. Trial on multi compressor system
7. Study and trial on heat pump
8. Study and trial on conventional refrigeration system
9. Study and trial on nonconventional refrigeration system
10. Study & Trial on Air-Conditioning system

Name of the Program : II Semester M. Tech. (Heat Power Engineering)
Subject Code : PHPS26
Subject Title : Seminar-II

Course Scheme					Examination Scheme		
Lecture	Tutorial	Practical	Periods per week	Credits	TW	POE	Total
-	-	02	01	01	50	-	50

Contents :

Student is required to select appropriate topic related to the course work. Topic should be approved from the coordinator. Student have to deliver the seminar and submit the report for final evaluation with minimum 25 pages in the prescribed format.