SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

Grading System

Master of Engineering (THERMAL ENGG.)

Scheme of Examination w.e.f. 2016-17

I Semester/ I Year

S.No.	Subject Code	Name of Subject	Theory Slot			Practical Slot		Total Marks	Period Per Week			Total Credits
			End Sem	MID Sem Test (Two Test Avg.)	Quiz & Assignments	End Sem	Term Work		L	T	P	
1	MTTH 101	ADVANCE MATHEMATICS	100	30	20	-	-	150	3	1	-	4
2	MTTH 102	THERMODYNAMICS & COMBUSTION	100	30	20	-	-	150	3	1	-	4
3	MTTH 103	HEAT & MASS TRANSFER	100	30	20	-	-	150	3	1	-	4
4	MTTH 104	ADVANCE FLUID MECHANICS	100	30	20	-	-	150	3	1	-	4
5	MTTH 105	ELECTIVE-I	100	30	20	-	-	150	3	1	-	4
6	MTTH 106	HEAT TRANSFER LAB	-	-	-	50	50	100	-	-	4	2
7	MTTH 107	ADVANCE FLUID MECHANICS LAB	-	-	-	50	50	100	-	-	4	2
8	MTTH 108	COMPREHENSIVE VIVA-I	-	-	-	50	-	50	-	-	4	2
TOTAL			500	150	100	150	100	1000	15	5	12	26

GRAND TOTAL : 1000
L: LECTURE
P: PRACTICAL
T: TUTORIAL

Elective-I

MTTH 105 (A) STEAM AND GAS TURBINE
MTTH 105 (B) PUMPS, BLOWERS AND COMPRESSOR
MTTH 105 (C) GAS FLOW THROUGH TURBO MACHINES

IMPLEMENTED FROM JULY 2016 BATCH

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

Grading System

Master of Engineering (THERMAL ENGG.)

Scheme of Examination w.e.f. 2016-17

II Semester/ I Year

S.No.	Subject Code	Name of Subject	Theory Slot			Practical Slot		Total Marks	Period Per Week			Total Credits
			End Sem	MID Sem Test (Two Test Avg.)	Quiz & Assignments	End Sem	Term Work		L	T	P	
1	MTTH 201	THERMAL POWER PLANT ENGG.	100	30	20	-	-	150	3	1	-	4
2	MTTH 202	DESIGN OF HEAT EXCHANGERS	100	30	20	-	-	150	3	1	-	4
3	MTTH 203	ADVANCE REFRIGERATION SYSTEM	100	30	20	-	-	150	3	1	-	4
4	MTTH 204	I.C ENGINES & ALTERNATE FUELS	100	30	20	-	-	150	3	1	-	4
5	MTTH 205	ELECTIVE-II	100	30	20	-	-	150	3	1	-	4
6	MTTH 206	I.C ENGINE LAB	-	-	-	50	50	100	-	-	4	2
7	MTTH 207	ADVANCE REFRIGERATION & AIR CONDITIONING LAB	-	-	-	50	50	100	-	-	4	2
8	MTTH 208	COMPREHENSIVE VIVA-II	-	-	-	50	-	50	-	-	4	2
TOTAL			500	150	100	150	100	1000	15	5	12	26

GRAND TOTAL : 1000
L: LECTURE
P: PRACTICAL
T: TUTORIAL

Elective-II

MTTH 205 (A)	MAINTENANCE OF THERMAL POWER PLANT
MTTH 205 (B)	NON CONVENTIONAL ENERGY SOURCES
MTTH 205 (C)	ENGINE SYSTEM MODELING & ANALYSIS

IMPLEMENTED FROM JULY 2016 BATCH

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

Grading System

Master of Engineering (THERMAL ENGG.)

Scheme of Examination w.e.f. 2016-17

III Semester/ II Year

S. No.	Subject Code	Name of Subject	Theory Slot			Practical Slot		Total Marks	Period Per Week			Total Credits
			End Sem	MID Sem Test (Two Test Avg.)	Quiz & Assignments	End Sem	Term Work		L	T	P	
1	MTTH 301	DISSERTATION-I (SYNOPSIS)	-	-	-	100	100	200	-	-	24	12
TOTAL						100	100	200	-	-	24	12
GRAND TOTAL : 200 L: LECTURE P: PRACTICAL T: TUTORIAL												

IMPLEMENTED FROM JULY 2016 BATCH

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

Grading System

Master of Engineering (THERMAL ENGG.)

Scheme of Examination w.e.f. 2016-17

IV Semester/ II Year

S. No.	Subject Code	Name of Subject	Theory Slot			Practical Slot		Total Marks	Period Per Week			Total Credits
			End Sem	MID Sem Test (Two Test Avg.)	Quiz & Assignments	End Sem	Term Work		L	T	P	
1	MTTH 401	DISSERTATION-II	-	-	-	150	150	300	-	-	24	12
TOTAL						150	150	300	-	-	24	12
GRAND TOTAL : 300 L: LECTURE P: PRACTICAL T: TUTORIAL												

IMPLEMENTED FROM JULY 2016

MTTH – 101 Advance Mathematics

UNIT 1

Linear Algebra: Linear transformation, vector spaces, hash function, Hermite polynomial, Heavisite's unit function and error function. Elementary concepts of Modular mathematics

UNIT 2

Solution of Partial Differential Equation (PDE) by separation of variable method, numerical solution of PDE (Laplace, Poisson's, Parabolic) using finite difference methods, Elementary properties of FT, DFT, WFT, Wavelet transform, Haar transform.

UNIT 3

Probability, compound probability and discrete random variable, Binomial, Normal and Poisson's distributions, Sampling distribution, elementary concept of estimation and theory of hypothesis, recurred relations.

UNIT 4

Stochastic process, Markov process transition probability transition probability matrix, just and higher order Markov process, Application of Eigen value problems in Markov Process, Markov chain. Queuing system, transient and steady state, traffic intensity, distribution queuing system, concepts of queuing models (M/M/1: Infinity/ Infinity/ FC FS), (M/M/1: N/ Infinity/ FC FS), (M/M/S: Infinity/ Infinity/ FC FS)

UNIT 5

FEM: Variational functionals, Euler Lagrange's equation, Variational forms, Ritz method, Galerkin's method, descretization, finite elements method for one dimensional problems.

Reference Books:

1. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Hill.
2. Advance Engineering Mathematics by Ervin Kreszig, Wiley Easten Edd.
3. Applied Numerical Methods with MATLAB by Steven C Chapra, TMH.
4. Advance Engineering Mathematics, O'Neil, Cengage (Thomson)
5. Introductory Methods of Numerical Analysis by S.S. Shastry,
6. Krishmurthy Finite element TMH
7. Buchanan Finite element analysis(Schaum Outline S) TMH
8. Numerical Solution of Differential Equation by M. K. Jain
9. Numerical Mathematical Analysis By James B. Scarborogh
10. Fourier Transforms by J. N. Sheddon
11. Advance Mathematics for Engr and Sc, Spiegel, Schaum Series, TMH

MTTH –102 Thermodynamics and Combustion

Unit 1

Classical Thermodynamics: Concept of classical thermodynamics, review of zeroth, first and second law of thermodynamics. Availability analysis of thermal system and concept of energy conservation.

UNIT 2

Phase and reaction equilibriums: Equilibrium constants .calculation of equilibrium composition of multi components gaseous mixtures.

UNIT 3

Equations of state: Equations of state & calculations of thermodynamics and transport properties of substances, reaction rates of first ,second and higher order reactions, reactions in gaseous, liquid and solid phases .

Unit 4

Equilibrium, real substances and properties, triple point, critical point, temperatureentropy, entropy-enthalpy charts, Vanderwal's equation of state, Claperon's equation, Gibbs phase rule, law of corresponding states.

UNIT 5

Combustion and flames: combustion and flame velocities, Laminar and turbulent flames. Premixed and diffusion flames: their properties and structures. Theories of flame propagation, combustion of solid, liquid and gaseous fuels, combustion of fuel droplets and sprays, combustion systems, combustion in closed and open systems, application to IC engines , boilers, gas turbine, combustors and rocket motors.

Recommended Books:

1. Heat Power and Thermodynamics by M.W.Zemansky (McGraw Hill).
2. Combustion, Flames and explosions of gases, B.Lewis and G.Von Elbe Academic P.
3. Thermal Sciences, Potter, Cengage Learn (Thomson)
4. Engineering thermodynamics by Gurdon Rogers Yon Mayhew.
5. Concept of thermodynamics by Obert (McGraw Hill).

MTTH – 103 Heat and Mass Transfer

UNIT 1

Introduction: Modes of heat flow, Basic laws of heat transfer. Combined heat transfer Mechanisms. Conduction: Steady state conduction, System with internal generation of heat, Transient Conduction, Extended surfaces (Fins), Multi-dimensional heat transfer problems, Phase change, Heat transfer with moving bodies.

UNIT 2

Convection: Governing Equations in Laminar & Turbulent Flow, Free and Forced Convection, Tubes, Ducts and exterior surfaces, tube bundles in cross flow, Correlations, Dimensional analysis.

UNIT 3

Boiling heat transfer, nature of vaporization, nucleate pool boiling and empirical correlations for pool boiling heat transfer, factors affecting pool boiling film coefficients, high heat flux boiling. Condensation: Physical Mechanisms, Laminar film condensation on a vertical plate, turbulent film condensation, drop wise condensation.

UNIT 4

Radiation: Radiation Properties & Law, Electrical analogy, Radiation exchange between surfaces, Applications to cavities & enclosures.

UNIT 5

Mass transfer: equation for convective mass transfer, boundary layer mass transfer, empirical correlation for convective mass transfer.

Reference Books:

1. Heat Transfer, Krieth, Cengage learn (Thomson)
2. Heat transfer by J.P. Holman.
3. Analysis of Heat transfer E.R.G.Eckerst and R.M. Drake Jr. McGraw Hills.
4. Heat mass and momentum transfer .W.M.Roshenow and P.Choi, Prentice Hall .
5. Heat transfer B.Gebhart ,McGraw Hills .
6. Conduction Heat Transfer V.S. Arpaci ,Addison Wesley .
7. Thermal radiation H.C. Hotel .

MTTH – 104 Advanced Fluid Mechanics

UNIT 1

Reviews of basic laws, concept of continuum, fluid flow in Integral & differential form

UNIT 2

Kinematics of Fluid: Description of properties in a moving fluid, Local and material derivatives, Control mass and control volume analysis, Reynolds Transport theorem and its application.

UNIT 3

Ideal fluid flow: Introduction, Elementary flows in a 2-D plane, Flow nets, superposition of Elementary flows.

UNIT 4

Viscous Incompressible Flows: Introduction, Equations of motion, N-S equations and its application. Boundary Layer Theory: Prandtl's boundary layer equations, Flat plate boundary layer, approximate solution – Integral method, Laminar and turbulent boundary layer, Separation, Lift and Drag.

UNIT 5

Fundamental of Compressible flows: Introduction, Thermodynamic relations of perfect gases, Speed of sound, pressure wave propagation, Stagnation and Sonic properties, Shocks.

UNIT 6

Hydraulic machines: Theory and design of hydro-turbines and centrifugal pumps, their proto-type testing.

Reference Books:

1. Fluid Mechanics by Shames (McGraw Hill).
2. Mechanics of Fluid by Massey (EL-BS).
3. The Dynamics and Thermodynamics of Compressible Fluid flow A.H. Shapiro .
4. Boundary Layer Theory H. Schlichting McGraw Hills.
5. Thermal Sciences, Potter, Cengage Learn (Thomson)

MTTH – 201 Thermal Power Plant Engg.

UNIT 1

Conventional thermal power plants, super-critical power plants and its principles of working, performance curves and flow diagrams.

UNIT 2

Power plant components: Fuel and ash handling, pulverized fuel firing burners, dust handling, fluidized bed combustion. Radiant super heaters and re-heaters, economizer and pre-heaters, combustion and furnace design, boiler water supply and treatment. Drat and arrangement of draft fans, different types of cooling systems, open closed, mixed and dry cooling tower systems, air cooled condensers. Ejector and vacuum pumps, feed heating systems, heaters, evaporators and de-airator, feed line protection, boiler feed pumps, different type of drives for it, steam turbine driven feed pumps.

UNIT 3

Plant instrumentation for thermal power plants, need and importance, distributed and centralized, pneumatic and electro-mechanical transducers and controllers, distributed computer control. Piping and insulation: design and layout of ducting for air fuel, gases and pulverized fuels, selection of piping, pipe flexibility analysis, Various control valves and actuators. Insulation optimum thickness and costs.

UNIT 4

Installation, commissioning and operation: Preliminary performance checks and acceptance test for various components, heat balance of items and entire plant. Starting loading and normal operation checks, maintenance logging, parallel operations, droop setting, performance analysis, maintenance, safety and pollution controls.

UNIT 5

Plant Management: Preparing specifications and contract documents, guarantee. Training of power plant personnel, safety, and seismic analysis. Purchase and contract for fuel supplies.Reference Books:

1. Power Plant Engineering, F T Morse
2. Power Plant Engineering, P K Nag
3. Power Plant Engineering, Arora and Domkundwar

MTTH – 202 Design of heat Exchangers

UNIT 1
Types of Heat Exchangers, definitions & quantitative relationship

UNIT 2
Analytical & Numerical solution Procedures, Fouling factors, Correction factors

UNIT 3
Thermal & hydraulic design of Commonly used heat exchangers : Double pipe heat exchangers , shell and tube heat exchangers, condensers, Evaporators, Cooling and dehumidifying coils, Cooling towers, Evaporative condensers , design of air washers , desert coolers .

UNIT 4
Review of mechanical Design, TEMA Codes Materials of Construction , corrosion damage , Testing and inspection .

UNIT 5
Heat Pipe: Basics & its mathematical model , micro Heat Exchangers. Use of software in heat exchanger design.

Reference Books:

1. Compact Heat Exchangers Kays and London, TMH
2. Heat Exchangers- Thermal Hydraulic fundamentals and design, Kokac, TMH
3. Extended Surface Heat Transfer, D Q Kern, A D Kraus, TMH.
4. Tubular Exchanger Manufacturer Association (TEMA), and other codes.

MTTH – 203 Advance Refrigeration System

UNIT 1

Introduction: Thermodynamics Properties of pure and Mixed Refrigerants and their selection. Vapor Compression System, Actual Vapor Compression System, Deviation from theoretical System, Multi-pressure System with Flash Chamber and Inter Cooling, Cascade system.

UNIT 2

Refrigeration Equipments: Compressors, Analysis and Thermal Design of Reciprocating, Centrifugal and Screw Compressors, Performance Characteristics & Capacity control. Expansion Devices: Capillary, Automatic and Thermostatic Expansion Valve. Other Equipments: Liquid Receiver, Oil Separators, Liquid Line Strainers, Driers, Liquid Sub-coolers.

UNIT 3

Condenser & Evaporator: Types, performance & Their Controls.

UNIT 4

Thermodynamics of Refrigerant: Absorbent Combinations, Analysis of simple and Industrial Vapor Absorption system using various working fluids Solar Powered Refrigeration & Heat Pump.

Books:

1. Refrigeration & Air Conditioning by W.F.Stoecker
2. Refrigeration & Air Conditioning by C.P.Arora
3. Refrigeration & Air Conditioning by Manohar Prasad

MTTH – 204 I.C Engines & Alternate Fuels

UNIT 1

SI Engines: Fuels for use in S.I. Engines; Rating of S.I. Engines fuels, carburetors and carburetion, fuel injection systems; Combustion in S.I. Engines-normal and abnormal, detonation, stratification and lean mixture operations. Carburetor replacement by MPFI, Elements of MPFI System like control unit, sensors, switches, Effect on engine performance & Engine Emission.

UNIT 2

Performance & testing of I.C. Engine: Introduction, breathing capacity, pumping losses, friction losses, super charging, performance parameters & their measurements for S.I.E. & C.I.E. Engine, performance maps. Air and sound pollution by engines, remedial measures;

UNIT 3

Non Conventional I.C. Engines : Dual Fuel, Multi Fuel, Stratified charge lean burn variable compression ratio, Rotary Engines, Description, Working and comparison with conventional I.C. Engines.

UNIT 4

Future Fuels for Ignition Engines : Introduction, Necessity for substitute Fuels. Substitute future fuels like Ethanol, Methnol, Bio gas, Hydrogen, Production, Transportation, storage of substitute fuel, performance of engines using these fuels.

Reference Books:

1. A.S. Khatchiian ;Theory of C.I. Engines Vol.1 and 2 IIT Bombay .
2. C.F. Taylor and E.S. Taylor; Internal Combustion Engines ,Stanton
3. P.G. Burman and B.Luca Fuel injection and Engines, Technical Press
4. L.C. Litchy ,Combustion Engines Processes, McGraw-Hill
5. E.F. Obert ,Internal Combustion Engines and Air Pollution , Intext Educational Publishers
6. H.R. Ricardo , The High Speed I.C. Engine, Blackie, London.

Course: MMTP-106 THERMAL ENGG. LAB – I

Various Experiments in Heat Transfer

1. Determination of LMTD and Overall Heat Transfer Coefficient of a Parallel Flow Heat Exchanger.
2. Determination of LMTD and Overall Heat Transfer Coefficient of a Counter Flow Heat Exchanger.
3. Determination of Overall Heat Transfer Coefficient of a Double Pass Heat Exchanger.
4. Determination of Overall Heat Transfer Coefficient for Cross Flow Air/Water Heat Exchanger. 5 Performance of Heat pipe as Compared with Thermal Siphon and Air Pipe.
6. Determination of Thermal Conductivity of Metal Rod.
7. Determination of Heat transfer in Forced Convection.
8. Dropwise and Filmwise Condensation.
9. Determination of Stefan Blotzman constant by Stefan Boltzman apparatus.

Course: MMTP-107 THERMAL ENGG. LAB – II

1. To Determine Volume Flow Rate for Low Speed Wind Tunnel using Pitot Tube.
2. To study Flow around Circular/Irregular Shaped Body.
3. Heat Balance Sheet for C.I./I.C Engines.
4. To find effect of compression ratio on I.C. Engine Performance.
5. Study of Experimental Facility on Steam Turbine.
6. To conduct Numerical Experiments with Software for exploration of problems related to Fluid and Heat Transfer using the software.

MTTH – 205(A) Maintenance of Thermal Power Plant

UNIT 1

Maintenance Management: emergency maintenance procedure Maintenance strategies, maintenance sch spare part management, inventory control purchase procedure and storage, Warning systems, organization of maintenance department, human consideration.

UNIT 2

Diagnostic Maintenance and Machine Health Monitoring:

Introduction to maintenance techniques, preventive and predictive maintenance, signature analysis, observational and estimation techniques, online techniques specially dealing with instrumentation system, off-line techniques, non-destructive testing, practical application of diagnostic maintenance to specific industrial machinery and plants. Various techniques of condition monitoring wear analysis, vibration and noise signature, thermography etc.

Unit 3

Mechanism of Lubrication & Lubricants: Lubrication regimes, analysis and modes of lubrication in different bearings, squeeze films, fluid film, elasto-hydrodynamic and boundary lubrications theories and applications, environmental effects on lubrications, types of lubricant and properties, non-conventional lubricants and applications.

Unit 4

Failure Mechanisms and Analysis: Material failure due to environmental effects, Introduction; Importance of failure analysis, common causes of failure in metals & alloys. Failure due to faulty heat treatment, embrittlement of metals, Residual stresses in metals, and their effects. Defects in production and manufacture. Design faults, analysis of engineering failures, failure due to abuse of machinery, failure of seals & packing, failure of bearings, failure of gears, fatigue failure, failure due to time-temperature effects(creep) corrosion etc.

UNIT 5

Maintenance of Power Plant Machinery; Predictive and preventive maintenance of steam turbine and its components, Erosion of blades and its prevention. Lubrication of bearings, valves, Maintenance scheduling, methods of detection of leaking and its prevention in the condensers. Condenser fault systems and its cases. On load and off load cleaning of condenser tubes, Maintenance scheduling of cooling water plants, cooling towers, Life enhancement techniques, case studies.

Reference Books:

1. Maintenance & Spare Parts & Management -P. Gopal Krishnan & Bannergee
2.Maintenance Engg. Handbook - by Lindley & Higgins
3.Industrial Maintenance Management - by Neibel
4.Reliability Centered Maintenance - by Moubray
5.Maintenance Engg. & Management - By R.C. Mishra
6.Modern Poewr plant Practice -10 Volumes British Electricity Int. Ltd
7.Power Generation Handbook -Philip Kaimeh.Mc Graw HCourse

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