COURSE STRUCTURE
AND
DETAILED SYLLABUS

M.TECH

THERMAL ENGINEERING

For
M.TECH TWO YEAR DEGREE PROGRAMME
(Applicable for the batches admitted from 2020-2021)

VAAGDEVI COLLEGE OF ENGINEERING
(Autonomous)
Bollikunta, Warangal-506 005
Telangana State, India.

VAAGDEVI COLLEGE OF ENGINEERING
AUTONOMOUS

Department of Mechanical Engineering
M.TECH. (THERMAL ENGINEERING)

COURSE STRUCTURE

(R20 Regulations applicable for the batches admitted from Academic Year 2020-21)

I-SEMESTER

S.No	Course Code	Title of the Course	L	T	P	Credits
1	M20TE01	Advanced Thermodynamics	3	0	0	3
2	M20TE02	Advanced Fluid Mechanics	3	0	0	3
3		**PROGRAMME ELECTIVE - I**	3	0	0	3
	M20TE03	Advanced Refrigeration & Air Conditioning				
	M20TE04	Turbo Machines				
	M20TE05	Energy Management				
4		**PROGRAMME ELECTIVE – II**	3	0	0	3
	M20TE06	Gas Turbines				
	M20TE07	Non Conventional Energy Sources				
	M20TE08	Equipment Design for Thermal System				
5	M20TE09	Advanced Thermal Engineering Lab	0	0	4	2
6	M20TE10	Modeling and Analysis Lab - I	0	0	4	2
7	M20MC01	Research Methodology	2	0	0	2
8	M20AC02	**Audit Course-I** Stress Management	2	0	0	0
		Total	**16**	**0**	**8**	**18**

II-SEMESTER

S.No	Course Code	Title of the Course	L	T	P	Credits
1	M20TE11	Advanced Heat Transfer	3	0	0	3
2	M20TE12	Advanced I.C. Engines	3	0	0	3
3		**PROGRAMME ELECTIVE – III**	3	0	0	3
	M20TE13	Cryogenic Engineering (Pre – Requisite R&AC)				
	M20TE14	Jet Propulsion & Rocket Engineering (Pre – Requisite Turbo Machines)				
	M20TE15	Alternate Fuels				
4		**PROGRAMME ELECTIVE – IV**	3	0	0	3
	M20TE16	Advanced Computational Fluid Dynamics				
	M20TE17	Thermal and Nuclear Power Plants				
	M20TE18	Thermal Measurement & Process Controls				
5	M20TE19	Advanced Internal Combustion Engines Lab	0	0	4	2
6	M20TE20	Modeling and Analysis Lab – II	0	0	4	2
7	M20TE21	Mini Project	2	0	0	0
8	M20AC01	**Audit Course-II** English for Research Paper Writing	0	0	4	2
		Total	**14**	**0**	**12**	**18**

VAAGDEVI COLLEGE OF ENGINEERING
AUTONOMOUS

Department of Mechanical Engineering
M.TECH. (Thermal Engineering)

COURSE STRUCTURE

(R20 Regulations applicable for the batches admitted from Academic Year 2020-21)

III-SEMESTER

S.No	Course Code	Title of the Course	L	T	P	Credits
1		**PROGRAMME ELECTIVE – V**	3	0	0	3
	M20TE22	Advanced Materials For Thermal Systems				
	M20TE23	Computer Simulation of SI & CI Engines				
	M20TE24	Advanced Finite Element Analysis				
2		**OPEN ELECTIVE**	3	0	0	3
	M20MA01	Advanced Optimization Techniques &Applications				
	M20MB23	Business Law & Ethics				
	M20MB30	Project Management				
3	M20TE25	Dissertation Phase-I	0	0	20	10
		Total	**6**	**0**	**20**	**16**

IV-SEMESTER

S.No	Course Code	Title of the Course	L	T	P	Credits
1	M20TE26	Dissertation Phase- II	0	0	32	16
		Total	**0**	**0**	**32**	**16**

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE01) ADVANCED THERMODYNAMICS

M.Tech – I- Semester **L/T/P/C**
3/- /- /3

UNIT -I:

Review of Thermodynamic Laws and Corollaries: Transient flow analysis, Second law thermodynamics, Entropy, Availability and unavailability, Thermodynamic potential. Maxwell relations, Specific heat relations, Mayer's relation. Evaluation of thermodynamic properties of working substance.

UNIT-II:

P.V.T Surface: Equation of state. Real gas behavior, Vander Waal's equation, Generalization compressibility factor. Energy properties of real gases. Vapour pressure, Clausius, Clapeyro equation. Throttling, Joule. Thompson coefficient. Non reactive mixtures of perfect gases. Governing laws, Evaluation of properties, Psychometric mixture properties and psychometric chart, Air conditioning processes, cooling towers. Real gas mixture.

UNIT-III:

Combustion: Combustion Reactions, Enthalpy of formation. Entropy of formation, Reference levels of tables. Energy of formation, Heat reaction, Adiabatic flame temperature generated product, Enthalpies, Equilibrium. Chemical equilibrium of ideal gased, Effect of non reacting gases equilibrium in multiple reactions, The vent hoff's equation. The chemical potential and phase equilibrium. The Gibbs phase rule.

UNIT-IV:

Power Cycles: Review binary vapour cycle, co generation and combined cycles, Second law analysts of cycles. Refrigeration cycles. Thermodynamics off irreversible processes. Introduction, Phenomenological laws, Onsaga Reciprocity relation, Applicability of the Phenomenological relations, Heat flux and entropy production, Thermodynamic phenomena, Thermo electric circuits.

UNIT-V:

Direct Energy Conversion Introduction: Fuel cells, Thermo electric energy, Thermo ionic power generation, Thermodynamic devices magneto hydronamic generations, Photovoltaic cells.

REFERENCES:

1. Engineering Thermodynamics – Roges & Mayhew – Pearson.
2. Thermal Engineering / Rathore / TMH
3. Basic and Applied Thermodynamics/ P.K.Nag/ TMH
4. Applied Thermodynamics – R.K. Rajput – Laxmi Publications
5. Thermodynamics/Holman/ Me Graw Hill.
6. Thermal Engineering / Soman / PHI
7. Engg. Thermodynamics/PL.Dhar / Elsevier
8. Thermodynamics/Sonnatag & Van Wylen / John Wiley & Sons
9. Thermodynamics for Engineers/Doolittle-Messe / John Wiley & Sons
10. Irreversible Thermodynamics/HR De Groff.
11. Thermodynamics & Heat Power – Granet & Bluestein- CRC Press

COURSE OUTCOMES:

CO1: Emphasize the relevance of Evaluation of thermodynamic properties of working substance.

CO2: Know the applications of Energy properties of real gases, Vapour pressure, Clausius.

CO3: Apply Psychometric mixture properties and psychometric chart, Air conditioning processes, cooling towers.

CO4: Analyse Combustion Reactions, Enthalpy of formation. Entropy of formation, Reference levels of tables. Energy of formation, Heat reaction.

CO5: Select a problem in Review binary vapour cycle, co generation and combined cycles, Second law analysts of cycles and Refrigeration cycles.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE02) ADVANCED FLUID MECHANICS

M.Tech - I Semester **L/T/P/C**
3/- /- /3

UNIT I:

Inviscid Flow of Incompressible Fluids: Lagrangian and Eulerain Descriptions of fluid motion- Path lines, Stream lines, Streak lines, stream tubes – velocity of a fluid particle, types of flows, Equations of three dimensional continuity equation- Stream and Velocity potential functions.

Basic Laws of fluid Flow: Condition for irrotationality, circulation & vorticity Accelerations in Cartesystems normal and tangential accelerations, Euler's, Bernouli equations in 3D– Continuity and Momentum Equations

UNIT II:

Viscous Flow: Derivation of Navier-Stoke's Equations for viscous compressible flow – Exact solutions to certain simple cases : Plain Poisoulle flow - Coutte flow with and without pressure gradient - Hagen Poisoulle flow - Blasius solution.

UNIT III:

Boundary Layer Concepts : Prandtl's contribution to real fluid flows – Prandtl's boundary layer theory - Boundary layer thickness for flow over a flat plate – Approximate solutions – Creeping motion (Stokes)- Oseen's approximation - Von-Karman momentum integral equation for laminar boundary layer- Expressions for local and mean drag coefficients for different velocity profiles.

UNIT IV:

Introduction to Turbulent Flow: Fundamental concept of turbulence – Time Averaged Equations – Boundary Layer Equations - Prandtl Mixing Length Model - Universal Velocity Distribution Law: Van Driest Model –Approximate solutions for drag coefficients – More Refined Turbulence Models – k-epsilon model - boundary layer separation and form drag – Karman Vortex Trail, Boundary layer control, lift on circular cylinders

Internal Flow: Smooth and rough boundaries – Equations for Velocity Distribution and frictional Resistance in smooth rough Pipes – Roughness of Commercial Pipes – Moody's diagram.

UNIT V:

Compressible Fluid Flow – I: Thermodynamic basics – Equations of continuity, Momentum and Energy - Acoustic Velocity Derivation of Equation for Mach Number – Flow Regimes – Mach Angle – Mach Cone – Stagnation State

Compressible Fluid Flow – II: Area Variation, Property Relationships in terms of Mach number, Nozzles, Diffusers – Fanno and Releigh Lines, Property Relations – Isothermal Flow in Long Ducts – Normal Compressible Shock, Oblique Shock: Expansion and Compressible Shocks – Supersonic Wave Drag.

REFERENCES:

1. Fluid Mechanics and Machines/Modi and Seth/Standard Book House
2. Fluid Mechanics – Jog – Cambridge
3. Fluid Mechanics with Engineering Applications – Finnemore & Franzini – McGrawHill
4. Fluid Mechanics and Machinery – Khan – Oxford
5. Fluid Mechanics/Cohen and Kundu/Elsevier/5th edition
6. Fluid Mechanics/Potter/Cengage Learning
7. Fluid Mechanics/William S Janna/CRC Press
8. Fluid Mechanics and Machines/CP Kodandaraman/New Age Publications

9. A Text book of Fluid Mechanics/RK Rajput/S. Chand
10. Boundary Layer Theory/ Schlichting H /Springer Publications
11. Dynamics & Theory and Dynamics of Compressible Fluid Flow/ Shapiro.
12. Fluid Mechanics and Machinery/ D. Rama Durgaiah/New Age Publications
13. Fluid Dynamics/ William F. Hughes & John A. Brighton/TMH

COURSE OUTCOMES:

CO1: Relate Applications Of In Viscid Flow Of Incompressible Fluids
CO2: Apply Basic Laws Of Fluid Flow
CO3: Understanding The Viscous Flow
CO4: Contrast Boundary Layer Concepts
CO5: Tabulate Fundamental Concept Of Turbulence

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VAAGDEVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

(M20TE03) ADVANCED REFRIGERATION AND AIR CONDITIONING

(Programme Elective - I)

M.Tech – I- Semester **L/T/P/C**

3/- /- /3

UNIT – I

Vapour Compression Refrigeration: Performance of Complete vapor compression system.

Components of Vapor Compression System: The condensing unit – Evaporators – Expansion valve – Refrigerants – Properties – ODP & GWP - Load balancing of vapor compression Unit.

Compound Compression: Flash inter-cooling – flash chamber – Multi-evaporator & Multistage systems.

UNIT – II

Production of Low Temperature: Liquefaction system ;Cascade System – Applications.– Dry ice system.

Vapor absorption system – Simple and modified aqua – ammonia system – Representation on Enthalpy – Concentration diagram. Lithium – Bromide system Three fluid system – HCOP.

UNIT – III

Air Refrigeration: Applications – Air Craft Refrigeration -Simple, Bootstrap, Regenerative and Reduced ambient systems – Problems based on different systems. **Steam Jet refrigeration system**: Representation on T-s and h-s diagrams – limitations and applications.

Unconventional Refrigeration system – Thermo-electric – Vortex tube & Pulse tube – working principles.

UNIT – IV

Air –Conditioning: Psychrometric properties and processes – Construction of Psychrometric chart. Requirements of Comfort Air –conditioning – Thermodynamics of human body – Effective temperature and Comfort chart – Parameters influencing the Effective Temperature. Summer, winter and year round air – conditioning systems. Cooling load Estimation: Occupants, equipments, infiltration, duet heat gain fan load, Fresh air load.

UNIT – V

Air –Conditioning Systems: All Fresh air , Re-circulated air with and without bypass, with reheat systems – Calculation of Bypass Factor, ADP,RSHF, ESHF and GSHF for different systems.

Components: Humidification and dehumidification equipment – Systems of Air cleaning – Grills and diffusers – Fans and blowers – Measurement and control of Temperature and Humidity.

REFERENCES:

1. Refrigeration & Air Conditioning /C.P. Arora/TMH
2. Basic Refrigeration & Air Conditioning – P.N. Ananthanarayanan – McGraw Hill
3. Refrigeration and Air Conditioning – Dr. S.S. Thipse - Jaico
4. Principles of Refrigeration/Dossat /Pearson
5. Refrigeration & Air Conditioning /Arora & Domkundwar/ Dhanpat Rai
6. Refrigeration and Air Conditioning /Manohar Prasad/
7. Refrigeration and Air Conditioning /Stoecker /Mc Graw Hill
8. Refrigeration and Air Conditioning /Jordan& Preister /Prentice Hall
9. Refrigeration and Air Conditioning/Dossat /Mc Graw Hill

COURSE OUTCOMES:

CO1: Deal with Components of Vapor Compression System

CO2: Develop the study skills on Production of Low Temperature.

CO3: Develop the study skills on Steam Jet refrigeration system,Representation on T-s and h-s diagrams – limitations and applications.

CO4: Enable students on Construction of Psychometric chart, Requirements of Comfort Air – conditioning ,Thermodynamics of human body.

CO5: Equip students with Parameters influencing the Effective Temperature. Summer, winter and year round air – conditioning systems.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE04) TURBO MACHINES
(Programme Elective - I)

M.Tech – I- Semester **L/T/P/C**
3/- /- /3

UNIT-I:
Fundamentals of Turbo Machines: Classifications, Applications, Thermodynamic analysis, Isentropic flow. Energy transfer. Efficiencies, Static and Stagnation conditions, Continuity equations, Euler's flow through variable cross sectional areas, Unsteady flow in turbo machines

UNIT –II:
Steam Nozzles: Convergent and Convergent-Divergent nozzles, Energy Balance, Effect of back pressure of analysis. Designs of nozzles.
Steam Turbines: Impulse turbines, Compounding, Work done and Velocity triangle, Efficiencies, Constant reactions, Blading, Design of blade passages, Angle and height, Secondary flow. Leakage losses, Thermodynamic analysis of steam turbines.

UNIT-III:
Gas Dynamics: Fundamental thermodynamic concepts, isentropic conditions, mach numbers and area, Velocity relations, Dynamic Pressure, Normal shock relation for perfect gas. Supersonic flow, oblique shock waves. Normal shock recoveries, Detached shocks, Aerofoil theory.
Centrifugal compressor: Types, Velocity triangles and efficiencies, Blade passage design, Diffuser and pressure recovery. Slip factor, Stanitz and Stodolas formula's, Effect of inlet mach numbers, Pre whirl, Performance

UNIT-IV:
Axial Flow Compressors: Flow Analysis, Work and velocity triangles, Efficiencies, Thermodynamic analysis. Stage pressure rise, Degree of reaction, Stage Loading, General design, Effect of velocity, Incidence, Performance
Cascade Analysis: Geometrical and terminology. Blade force, Efficiencies, Losses, Free end force, Vortex Blades.

UNIT-V:
Axial Flow Gas Turbines: Work done. Velocity triangle and efficiencies, Thermodynamic flow analysis, Degree of reaction, Zweifels relation, Design cascade analysis, Soderberg, Hawthrone, Ainley, Correlations, Secondary flow, Free vortex blade, Blade angles for variable degree of reaction. Actuator disc, Theory, Stress in blades, Blade assembling, Material and cooling of blades, Performances, Matching of compressors and turbines, Off design performance.

REFERENCES:
1. Principles of Turbo Machines/DG Shepherd / Macmillan
2. Fundamentals of Turbomachinery/William W Perg/John Wiley & Sons
3. Element of Gas Dynamics/Yahya/TMH
4. Principles of Jet Propulsion and Gas Turbine/NJ Zucrow/John Wiley & Sons/Newyork
5. Turbines, Pumps, Compressors/Yahya/TMH
6. Practice on Turbo Machines/ G.Gopal Krishnan & D. Prithviraj/ Sci Tech Publishers, Chennai
7. Theory and practice of Steam Turbines/ WJ Kearton/ELBS Pitman/London
8. Gas Turbines Theory and Practice/Zucrow/John Wiley & Sons/Newyork
9. Element of Gas Dynamics/Liepeman and Roshkow/ Dover Publications

COURSE OUTCOMES:

CO1: Understand the Fundamentals of turbo machines and their applications

CO2: Applicability of steam nozzle and steam turbine in power plant and the relation of their flow on performance of plant.

CO3: To equip students with the fundamental of thermodynamics concepts for gas dynamics.

CO4: Get Knowledge about type and working principle of centrifugal compressors.

CO5: Deal with Fundamental concept of Axial flow compressors and different type of cascade systems

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE05) ENERGY MANAGEMENT
(Programme Elective - I)

M.Tech - I-Semester **L/T/P/C**
3/- /- / 3

UNIT-I

Introduction: Principles of energy management. Managerial organization, Functional areas for i) Manufacturing industry ii) Process industry iii) Commerce iv) Government Role of Energy manager in each of these organizations. Initiating, Organizing and managing energy management programs

UNIT -II

Energy Audit: Definition and concepts. Types of energy audits, Basic energy concepts, Resources for plant energy studies. Data gathering, Analytical techniques. Energy Conservation: Technologies for energy conservation, Design for conservation of energy materials, Energy flow networks. Critical assessment of energy usage. Formulation of objectives and constrains, Synthesis of alternative options and technical analysis of options. Process integration.

UNIT -III

Economic Analysis: Scope, Characterization of an investment project. Types of depreciation, Time value of money. Budget considerations, Risk analysis.

UNIT-IV

Methods Of Evaluation Of Projects: Payback, Annualized costs, Investor's rate of return, Present worth, Internal rate of return, Pros and cons of the common method of analysis, Replacement analysis.

UNIT-V

Alternative Energy Sources: Solar Energy: Types of devices for solar energy collections, Thermal storage system, Control systems. Wind Energy, Availability, Wind Devices, Wind Characteristics, performance of turbines and systems.

REFERENCES:

1. Energy Management Hand Book / W.C. Turner (Ed)
2. Energy Management Principles / CB Smith/ Pergamon Press
3. Energy Management / W.R.Murthy and G.Mc.Kay / BS Publication
4. Management / H.Koontz and Cyrill Donnel / McGraw Hill
5. Financial Management / S.C.Kuchhal / Chaitanya Publishing House

COURSE OUTCOMES:

CO1: Understand The Need Of Energy Management And Its Principles.
CO2: Analyze The Requirement Of Energy Audit And Its Concepts.
CO3: Applythe Concepts Of Economic Analysis And Its Scope.
CO4: Select Methods Of Evaluation Of Projects.
CO5: Survey Fundamental Concept Energy Audit

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE06) GAS TURBINES
(Programme Elective - II)

M.Tech-I-Semester **L/T/P/C**
3/-/-/3

Unit I

Introduction: Classification of Turbo machines, Applications of Gas Turbines, Assumptions for Air Standard Cycles, Simple Brayton Cycle, Heat Exchange Cycle, Inter-cooling and Reheating Cycle, Comparison of Various Cycles.

Ideal Shaft Power Cycles and their Analysis: Assumptions for Air-Standard Cycles, Simple Brayton Cycle, Heat Exchange Cycle, Inter-cooling and Reheating Cycle, Comparison of Various Cycles.

Unit II

Real Cycles and their Analysis: Methods of Accounting for Component Losses, Isentropic and Polytropic Efficiencies, Transmission and Combustion Efficiencies, Comparative Performance of Practical Cycles, Combined Cycles and Cogeneration Schemes.

Jet Propulsion Cycles and their Analysis: Criteria of Performance, Simple Turbojet Engine, Simple Turbofan Engine, Simple Turboprop Engine, Turbo-shaft Engine, Thrust Augmentation Techniques

Unit III

Fundamentals of Rotating Machines: General Fluid Dynamic Analysis, Euler's Energy Equation, Components of Energy Transfer, Impulse and Reaction Machines.

Centrifugal Compressors: Construction and Principle of Operation, Elementary Theory and Velocity Triangles, Factors Effecting Stage Pressure Ratio, The Diffuser, The Compressibility Effects, Pre-rotation and Slip Factor, Surging and Choking, Performance Characteristics.

Unit IV

Flow Through Cascades: Cascade of Blades, Axial Compressor Cascades, Lift and Drag Forces, Cascade Efficiency, Cascade Tunnel.

Axial Flow Compressors: Construction and Principle of Operation, Elementary Theory and Velocity Triangles, Factors Effecting Stage Pressure Ratio, Degree of Reaction, Work done factor, Three Dimensional Flow, Design Process, Blade Design, Stage Performance, Compressibility Effects, Off-Design Perform

Unit V

Combustion System: Operational Requirements, Classification of Combustion Chambers, Factors Effecting Combustion Chamber Design, The Combustion Process, Flame Stabilization, Combustion Chamber Performance, Some Practical Problems Gas Turbine Emissions.

Axial and Radial Flow Turbines: Construction and Operation, Vortex Theory, Estimation of Stage Performance, Overall Turbine Performance, Turbine Blade Cooling, the Radial Flow Turbine.

Off-Design Performance: Off-Design Performance of Single Shaft Gas Turbine, Off-Design Performance of Free Turbine Engine, Off-Design Performance of the Jet Engine, Methods of Displacing the Equilibrium Running Line

Text Books:

1. Sarvanamuttoo, H.I.H., Rogers, G. F. C. and Cohen, H., Gas Turbine Theory, 6th Edition, Pearson Prentice Hall, 2008.
2. Ganesan, V., Gas Turbines, 3rd Edition, Tata McGraw Hill, 2010.

Reference Books:

1. Dixon, S.L., Fluid Mechanics and Thermodynamics of Turbo machinery, 7th Edition, Elsevier, 2014.

2. Flack, R.D., Fundamentals of Jet Propulsion with Applications, Cambridge University Press, 2011.
3. Yahya, S. M., Turbines, Compressors and Fans, 4th Edition, Tata McGraw Hill, 2010. Lefebvre, A.H., Gas Turbine Combustion, CRC Press, 2010

COURSE OUTCOMES:

CO1: Explain the Applications and classifications of gas turbines
CO2: Applicability of different processes for improving the performance of the plant.
CO3: Analysis of Ideal and Real cycle gas turbines and concept of improving the efficiency.
CO4: Get Knowledge about fundamental equations and laws of rotating machines
CO5: Learn the basic and advanced concepts and working principles of different type of compressors.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE07) NON CONVENTIONAL ENERGY SOURCES
(Programme Elective-II)

M.Tech – I-Semester **L/T/P/C**
3/- /- /3

UNIT-I

Introduction, Energy Scenario, Survey of energy resources. Classification and need for conventional energy resources.

Solar Energy: The Sun-sun-Earth relationship, Basic matter to waste heat energy circuit, Solar Radiation, Attention, Radiation measuring instruments.

Solar Energy Applications: Solar water heating. Space heating, Active and passive heating. Energy storage. Selective surface. Solar stills and ponds, solar refrigeration, Photovoltaic generation.

UNIT -II

Geothermal Energy: Structure of earth, Geothermal Regions, Hot springs. Hot Rocks, Hot Aquifers. Analytical methods to estimate thermal potential. Harnessing techniques, Electricity generating systems.

UNIT-III

Direct Energy Conversion: Nuclear Fusion: Fusion, Fusion reaction, P-P cycle, Carbon cycle, Deuterium cycle, Condition for controlled fusion, Fuel cells and photovoltaic. Thermionic & thermoelectric generation, MHD generator. **Hydrogen Gas as Fuel:** Production methods, Properties, I.C. Engines applications, Utilization strategy, Performances.

UNIT-IV

Bio-energy: Biomass energy sources. Plant productivity, Biomass wastes, aerovic and Anaerobic bioconversion processed, Raw metrical and properties of bio-gas, Bio-gas plant technology and status, the energetic and economics of biomass systems, Biomass gasification

UNIT-V

Wind Energy: Wind, Beaufort number, Characteristics, Wind energy conversion systems, Types, Betz model. Interference factor. Power coefficient, Torque coefficient and Thrust coefficient, Lift machines and Drag machines. Matching, Electricity generation.

Energy from Oceans: Tidal energy. Tides. Diurnal and semi-diurnal nature, Power from tides, Wave Energy, Waves, Theoretical energy available. Calculation of period and phase velocity of waves, Wave power systems, Submerged devices. Ocean thermal Energy, Principles, Heat exchangers, Pumping requirements, Practical considerations.

REFERENCES:

1. Non-conventional Energy Resources – Khan – McGraw Hill
2. Energy Resources Utilization & Technologies – Y.Anjaneyulu & T. Francis – BS Publications
3. Renewable Energy Resources- Basic Principles and Applications/ G.N.Tiwari and M.K.Ghosal/ Narosa Publications
4. Renewable Energy Resources/ John Twidell & Tony Weir/Taylor & Francis/2nd edition
5. Alternative Energy Sources & Systems – Steeby – Cengage Learning
6. Biological Energy Resources/ Malcolm Fleischer & Chris Lawis/E&FN Spon
7. Renewable Energy Sourse – Tasneem & S.A. Abbasi - PHI
8. Solar Energy – Sukhatme & Nayak – McGraw Hill

COURSE OUTCOMES:

CO1: Know About Solar Energy Applications: Solar Water Heating. Space Heating, Active And Passive Heating Energy

CO2: Group Structure Of Earth, Geothermal Regions, Hot Springs. Hot Rocks

CO3: Illustrate A Problem In Thermionic & Thermoelectric Generation, MHD Generator.

CO4: Compare Fusion, Fusion Reaction, P-P Cycle, Carbon Cycle, Deuterium Cycle, Condition For Controlled Fusion, Fuel Cells And Photovoltaic.

CO5: Relate Energy Sources. Plant Productivity, Biomass Wastes, Aerobic And Anaerobic Bioconversion Processed

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)
(M20TE08) EQUIPMENT DESIGN FOR THERMAL SYSTEMS
(Programme Elective - II)

M.Tech – I-Semester **L/T/P/C**
3/- /- / 3

UNIT -I:

Classification Of Heat Exchangers: Introduction, Recuperation & regeneration, Tabular heat exchangers, Double pipe, shell & tube heat exchanger, Plate heat Exchangers, Gasketed plate heat exchanger. Spiral plate heat exchanger, Lamella heat exchanger, extended surface heat exchanger, Plate fin and Tabular fin.

Basic Design Methods of Heat Exchanger: Introduction, Basic equations in design, Overall heat transfer coefficient, LMTD method for heat exchanger analysis, Parallel flow, and Counter flow. Multipass, cross flow heat exchanger design calculations:

UNIT-II:

Double Pipe Heat Exchanger: Film coefficient for fluids in annulus, fouling factors, calorific temperature, Average fluid temperature, The calculation of double pipe exchanger, Double pipe exchangers in series parallel arrangements.

Shell & Tube Heat Exchangers: Tube layouts for exchangers, Baffle heat exchangers, Calculation of shell and tube heat exchangers, Shell side film coefficients, Shell side equivalent diameter, The true temperature difference in a 1-2 heat exchanger. Influence of approach temperature on correction factor. Shell side pressure drop, Tube side pressure drop, Analysis of performance of 1-2 heat exchanger and design of shell & tube heat exchangers, Flow arrangements for increased heat recovery, the calculation of 2-4 exchangers.

UNIT-III:

Condensation Of Single Vapours: Calculation of horizontal condenser, Vertical condenser, De-Super heater condenser, Vertical condenser-sub-Cooler, Horizontal Condenser-Sub cooler, Vertical reflux type condenser. Condensation of steam.

UNIT-IV:

Vaporizers, Evaporators And Reboilers: Vaporizing processes, Forced circulation vaporizing exchanger, Natural circulation vaporizing exchangers, Calculations of a reboiler. Extended Surfaces: Longitudinal fins. Weighted fin efficiency curve, Calculation of a Double pipe fin efficiency curve. Calculation of a double pipe finned exchanger, Calculation of a longitudinal fin shell and tube exchanger.

UNIT-V:

Direct Contact Heat Exchanger: Cooling towers, relation between wet bulb & dew point temperatures, The Lewis number and Classification of cooling towers, Cooling tower internals and the roll of fill, Heat Balance. Heat Transfer by simultaneous diffusion and convection, Analysis of cooling tower requirements, Deign of cooling towers, Determination of the number of diffusion units, Calculation of cooling tower performance.

REFERENCES:

1. Process Heat Transfer/D.Q.Kern/ TMH
2. Heat Exchanger Design/ A.P.Fraas and M.N.Ozisicj/ John Wiely & sons, New York.
3. Cooling Towers / J.D.Gurney and I.A. Cotter/ Maclaren

COURSE OUTCOMES:

1. Get details about heat exchanger and its classifications.
2. Determine the effect of increasing pipes in performance of heat exchanger and get idea about double pipe heat exchanger.
3. Understand the working principle of steam condenser and explore the condensation of single vapors.
4. Get Knowledge about processes like vaporization, evaporation and reboiling and study about the equipments used for these processes
5. To understand the working principle of cooling tower

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE09) ADVANCED THERMAL ENGINEERING LAB

M.Tech – I-Semester **L/T/P/C**
-/ -/ 4/ 2

1. Evacuative tube concentrator.
2. Dryness fraction of steam.
3. COP estimation of vapour compression refrigeration test.
4. Analysis of air conditioning unit.
5. Analysis of heat pipe.
6. Performance analysis of flat plate collector.
7. Compressibility factor measurement for gases
8. Study of type and capacity of air conducting unit required for a class room

COURSE OUTCOMES:

CO1: Understand the Analysis of air conditioning unit.
CO2: Understand the Analysis of heat pipe.
CO3: Know about Performance analysis of flat plate collector.
CO4: Know about Performance analysis of evacuative tube concentrator

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE10) MODELING AND ANALYSIS LAB-I

M.Tech – I-Semester **L/T/P/C**
-/-/4/2

1. Designing the nozzle.
2. Analysis of flow profile on the designed nozzle.
3. Effect of changing angle of nozzle on flow profile.
4. Designing the diffuser.
5. Analysis of flow profile on the designed diffuser.
6. Effect of changing angle of diffuser on flow profile.
7. Analysis of fluid flow on over curved surface.
8. Analysis of force exerted by the fluid jet on fixed flat plate.
9. Analysis of force exerted by the fluid jet on movable flat plate.

Solving Thermal Engineering Problems using available Packages such as Pro –E, ANSYS, CFX, MAT LAB

COURSE OUTCOMES:

CO1: Understand the Analysis of flow profile on the designed nozzle.
CO2: Understand the Designing the diffuser and Analysis of flow profile on the designed diffuser.
CO3: Understand the Analysis of fluid flow on over curved surface.
CO4: Understand the Analysis of force exerted by the fluid jet on fixed flat plate

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20MC01) RESEARCH METHODOLOGY

M.Tech. I-Semester **L/T/P/C**
2/- /- /2

Prerequisites: English

Course Objectives:

- To develop an understanding of IPR/ research methodology in the process of creation of patents through research.
- To develop further research capabilities.
- To learn better report writing skills and Patenting.

Learning Outcomes: At the end of this course, students will be able to

- Understand research problem formulation.
- Analyze research related information.
- Follow research ethics.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasise the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.
- Compose and write quality research reports and attain familiarity with intellectual property rights.

UNIT I:

RESEARCH METHODOLOGY: Objectives and Motivation of Research, Significance of Literature review, Types of Research, Research Approaches, and Research Methods verses Methodology, Research and Scientific Method, Importance of Research Methodology, Research Process, Criteria of Good Research.

UNIT II:

RESEARCH DESIGN: Meaning of Research Design, Need of Research Design, Feature of a Good Design Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Data collection methods, Collection of primary data, Secondary data, Data organization, Methods of data grouping, Diagrammatic representation of data, Graphic representation of data.

UNIT III:

RESEARCH REPORT WRITING: Format of the Research report, Synopsis, Dissertation, References/Bibliography/ Webliography, Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

UNITIV:

NATURE OF INTELLECTUAL PROPERTY: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development.

UNIT V:

PATENT RIGHTS: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. New Developments in IPR: Administration of Patent System.

TEXT BOOKS:

1. C.R Kothari, "Research Methodology, Methods & Technique".New Age International Publishers, 2004.
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011.
3. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", Aspen Publishers, 2016.
4. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.
5. Satarkar, S.V,."Intellectual property rights and copy right". ESS Publications, 2000.

REFERENCES:

1. Ranjit Kumar, "Research Methodology: A Step by Step Guide for beginners", SAGE Publications Ltd. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007

COURSE OUTCOMES:

CO1: Understand about Intellectual Property Right
CO2: Compose and write quality research reports and attain familiarity with intellectual property rights.
CO3: Estimate research problem formulation.
CO4: Analyze research related information.
CO5: Discuss new and better products for economic growth and social benefits.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20AC02) STRESS MANAGEMENT
(Audit Course-I)

M.Tech. I-Semester **L/T/P/C**
2/- /- /0

Course Objectives:

- Promotion of positive health and overall wellbeing (Physical, mental, emotional, social and spiritual).
- Prevention of stress related health problems.

Learning Outcomes: After completion of the course the student will be able to

- Enhance of Physical strength and flexibility.
- Learn to relax and focus.
- Relieve physical and mental tension
- Improve work performance/ efficiency.

Unit-I

Understanding Stress: Meaning – Symptoms – Work Related Stress – Individual Stress – Reducing Stress -sources of stress –consequence of stress-burnout-symptoms of Burnout- stress verses Burnout-model of stress-strategies for coping stress (individual and organizational strategies) –case study

Unit-II

Time Management: Techniques – Importance of Planning the day –developing concentration – Prioritizing Beginning at the start – Techniques for conquering procrastination – Sensible delegation – Taking the right breaks – Learning to say "No"

Unit-III

Career Plateau: Career plateau – Identifying Career plateaus – Structural and Content - Plateauing – Making a fresh start – Importance of Sabbaticals – Counseling out – Executive leasing – Sustaining a marketable Career.

Unit-IV

Crisis Management: Implications – People issues – Structure issues – Environmental issues – Learning to keep calm - Preventing interruptions – Controlling crisis – Pushing new ideas – Empowerment – Work place Humor, developing a sense of Humor – Learning to laugh – role of group cohesion and team spirit.

Unit-V

Self-Development: Improving personality – Leading with Integrity – Enhancing Creativity – Effective decision making – Sensible Communication – The Listening Game – Managing Self – Mediation for peace – Yoga for Life

TEXT BOOKS

1. Bhatia R.L., The Executive Track: An Action Plan for Self-Development Wheeler Publishing, New Delhi
2. Charavathy.S.K, "Human Values for Manager", McGraw Hill/Henely Management Series

REFERENCES

1. Jeffr Davison, Managing Stress, Prentice Hall of India, New Delhi
2. Jerrold S Greenberg, Comprehensive Stress Management, Jain Books, 2009

COURSE OUTCOMES:

CO1: Understand The Need Of Energy Management And Its Principles.
CO2: Analyze The Requirement Of Energy Audit And Its Concepts.
CO3: Apply The Concepts Of Economic Analysis And Its Scope.
CO4: Discuss The Methods Of Evaluation Of Projects.
CO5: Compare The Enhancing Creativity By Self Development Program Like Yoga.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE11) ADVANCED HEAT TRANSFER

M.Tech – II-Semester **L/T/P/C**
3/- /- / 3

UNIT-I:

Brief Introduction to Different Modes Of Heat Transfer: Conduction: General heat Conduction equation-initial and boundary conditions.

Transient heat conduction: Lumped system analysis-Heisler charts-semi infinite solid-use of shape factors in conduction-2D transient heat conduction-product solutions.

UNIT- II:

Finite Difference Methods For Conduction: ID & 2D steady state and simple transient heat conduction problems-implicit and explicit methods.

Forced Convection: Equations of fluid flow-concepts of continuity, momentum equations-derivation of energy equation-methods to determine heat transfer coefficient: Analytical methods-dimensional analysis and concept of exact solution. Approximate method-integral analysis.

UNIT-III:

External Flows: Flow over a flat plate: integral method for laminar heat transfer coefficient for different velocity and temperature profiles. Application of empirical relations to variation geometries for laminar and turbulent flows.

Internal flows: Fully developed flow: integral analysis for laminar heat transfer coefficient-types of flow-constant wall temperature and constant heat flux boundary conditions-hydrodynamic & thermal entry lengths; use of empirical correlations.

UNIT-IV:

Free Convection: Approximate analysis on laminar free convective heat transfer-boussinesque approximation-different geometries-combined free and forced convection.

Boiling and condensation: Boiling curve-correlations-Nusselts theory of film condensation on a vertical plate-assumptions & correlations of film condensation for different geometries.

UNIT-V:

Radiation Heat Transfer: Radiant heat exchange in grey, non-grey bodies, with transmitting. Reflecting and absorbing media, specular surfaces, gas radiation-radiation from flames.

Mass Transfer: Concepts of mass transfer-diffusion & convective mass transfer analogies significance of non-dimensional numbers.

REFERENCES:

1. Principals of Heat Transfer/Frank Kreith/Cengage Learning
2. Elements of Heat Transfer/E. Radha Krishna/CRC Press/2012
3. Heat Transfer/RK Rajput/S.Chand
4. Introduction to Heat Transfer/SK Som/PHI
5. Engineering Heat & Mass Transfer/Mahesh Rathore/Lakshmi Publications
6. Heat Transfer / Necati Ozisik / TMH
7. Heat Transfer / Nellis & Klein / Cambridge University Press / 2012.
8. Heat Transfer/ P.S. Ghoshdastidar/ Oxford Press
9. Engg. Heat & Mass Transfer/ Sarit K. Das/Dhanpat Rai
10. Heat Transfer/ P.K.Nag /TMH

COURSE OUTCOMES:

CO1: Emphasize the General heat Conduction equation.
CO2: Know the Lumped system analysis
CO3: Know about Equations of fluid flow
CO4: To understand the concept of free convection, boiling and condensation
CO5: Get the knowledge about transfer of heat in the space and at higher temperature

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE12) ADVANCED I.C. ENGINES

M.Tech – II-Semester **L/T/P/C**
3/- /- /3

UNIT - I:
Introduction – Historical Review – Engine Types – Design and operating Parameters.
Cycle Analysis: Thermo-chemistry of Fuel – Air mixtures, properties – Ideal Models of Engine cycles – Real Engine cycles - differences and Factors responsible for – Computer Modeling.

UNIT - II:
Gas Exchange Processes: Volumetric Efficiency – Flow through ports – Supercharging and Turbo charging.
Charge Motion: Mean velocity and Turbulent characteristics – Swirl, Squish – Pre-chamber Engine flows.

UNIT - III:
Engine Combustion in S.I Engines: Combustion and Speed – Cyclic Variations – Ignition – Abnormal combustion Fuel factors, MPFI, SI engine testing.
Combustion in CI engines: Essential Features – Types off Cycle. Pr. Data – Fuel Spray Behavior – Ignition Delay – Mixing Formation and control, Common rail fuel injection system.

UNIT - IV:
Pollutant Formation and Control: Nature and extent of problems – Nitrogen Oxides, Carbon monoxide, unburnt Hydrocarbon and particulate – Emissions – Measurement – Exhaust Gas Treatment, Catalytic converter, SCR, Particulate Traps, Lean, NOx, Catalysts.

UNIT - V:
Engine Heat Transfer: Importance of heat transfer, heat transfer and engine energy balance, Convective heat transfer , radiation heat transfer, Engine operating characteristics. Fuel supply systems for S.I. and C.I engines to use gaseous fuels like LPG, CNG and Hydrogen.
Modern Trends in IC Engines: Lean Burning and Adiabatic concepts, Rotary Engines, Modification in I.C engines to suit Bio – fuels, HCCI and GDI concepts.

REFERENCES:
1. I.C. Engines / V.Ganesan/TMH
2. I.C. Engines/G.K. Pathak & DK Chevan/ Standerd Publications
3. I.C. Engines Fundamentals/Heywood/TMH
4. Dual-Fuel Diesel Engines – Ghazi A. Karim – CRC Press
5. I.C. Engines /RK Rajput/Laxmi Publications
6. Internal Combustion Engines – S.S. Thipse - Jaico
7. Computer Simulation of C.I. Engine Process/ V.Ganesan/University Press
8. Fundamentals of IC Engines/HN Gupta/PHI/2nd edition
9. I.C. Engines/Fergnson/Wiley
10. The I.C. Engine in theory and Practice Vol.I / Teylor / IT Prof. And Vol.II

COURSE OUTCOMES:
CO1: Know about Design and operating Parameters
CO2: Applicability of Thermo-chemistry of Fuel-Air mixtures.
CO3: Understanding the effect of Volumetric Efficiency on the performance of the engines.
CO4: Get Knowledge on Mean velocity and turbulent characteristics.
CO5: Deal with Abnormal combustion Fuel factors, MPFI.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE13) CRYOGENIC ENGINEERING
(Programme Elective – III)

M.Tech – II-Semester **L/T/P/C**
3 /- /-/ 3

Pre – requisite: REFRIGERATION AND AIR CONDITIONING

UNIT -I:

Introduction To Cryogenic Systems: Mechanical Properties at low temperatures. Properties of Cryogenic Fluids.

Gas Liquefaction: Minimum work for liquefaction. Methods to protect low temperature. Liquefaction systems for gages other than Neon. Hydrogen and Helium.

UNIT II:

Liquefaction Systems For Neon, Hydrogen And Helium: Components of Liquefaction. Heat exchangers. Compressors and expanders. Expansion valve, Losses in real machines.

UNIT-III:

Gas Separation And Purification Systems: Properties of mixtures, Principles of mixtures, Principles of gas separation, Air separation systems.

UNIT-IV:

Cryogenic Refrigeration Systems: Working Medium, Solids, Liquids, Gases, Cryogenic fluid storage & transfer, Cryogenic storage systems, Insulation, Fluid transfer mechanisms, Cryostat, Cryo Coolers

UNIT-V:

Applications: Space technology, In-Flight air separation and collection of LOX, Gas industry, Biology, Medicine, Electronics.

REFERENCES:

1. Cryogenic Systems/ R.F.Barren/ Oxford University Press
2. Cryogenic Research and Applications: Marshal Sitting/ Von Nostrand/ Inc. New Jersey
3. Cryogenic Heat Transfer/ R.F.Baron
4. Cryogenic Engineering Edit / B.A. Hands/ Academic Press, 1986
5. Cryogenic Engineering/ R.B.Scottm Vin Nostrand/ Inc. New Jersey, 1959
6. Experimental Techniques in Low Temperature Physics- O.K. White, Oxford Press, 1968
7. Cryogenic Process Engineering/ K.D. Timmerhaus & TM Flynn/ Plenum Press, 1998
8. Hand Book of Cryogenic Engineering – J.G.Weisend –II, Taylor and Francis, 1998

COURSE OUTCOMES:

CO1: To understand the main concept of cryogenic systems.
CO2: To know the importance and applications of gas liquefaction
CO3: Understand the working of liquefaction systems for various types of gases
CO4: Equip students with the knowledge of gas separation systems and purification systems.
CO5: To impart knowledge on cryogenic refrigeration systems

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE14) JET PROPULSION AND ROCKET ENGINEERING
(Programme Elective – III)

M.Tech – II-Semester **L/T/P/C**
3/- /- /3

Pre – requisite: Turbo Machines

UNIT - I:

Turbo Jet Propulsion System: Gas turbine cycle analysis – layout of turbo jet engine. Turbo machinery-compressors and turbines, combustor, blade aerodynamics, engine off design performance analysis.
Flight Performance: Forces acting on vehicle – Basic relations of motion – multi stage vehicles.

UNIT - II:

Principles Of Jet Propulsion And Rocketry: Fundamentals of jet propulsion, Rockets and air breathing jet engines – Classification – turbo jet , turbo fan, turbo prop, rocket (Solid and Liquid propellant rockets) and Ramjet engines.
Nozzle Theory and Characteristics Parameters: Theory of one dimensional convergent – divergent nozzles – aerodynamic choking of nozzles and mass flow through a nozzle – nozzle exhaust velocity – thrust, thrust coefficient, Ac / At of a nozzle, Supersonic nozzle shape, non-adapted nozzles, summer field criteria, departure from simple analysis – characteristic parameters – 1) characteristic velocity, 2) specific impulse 3) total impulse 4) relationship between the characteristic parameters 5) nozzle efficiency, combustion efficiency and overall efficiency.

UNIT - III:

Aero Thermo Chemistry Of The Combustion Products: Review of properties of mixture of gases – Gibbs – Dalton laws – Equivalent ratio, enthalpy changes in reactions, heat of reaction and heat of formation – calculation of adiabatic flame temperature and specific impulse – frozen and equilibrium flows.
Solid Propulsion System: Solid propellants – classification, homogeneous and heterogeneous propellants, double base propellant compositions and manufacturing methods. Composite propellant oxidizers and binders. Effect of binder on propellant properties. Burning rate and burning rate laws, factors influencing the burning rate, methods of determining burning rates.

UNIT - IV:

Solid propellant rocket engine – internal ballistics, equilibrium motor operation and equilibrium pressure to various parameters. Transient and pseudo equilibrium operation, end burning and burning grains, grain design. Rocket motor hard ware design. Heat transfer considerations in solid rocket motor design. Ignition system, simple pyro devices.
Liquid Rocket Propulsion System: Liquid propellants – classification, Mono and Bi propellants, Cryogenic and storage propellants, ignition delay of hypergolic propellants, physical and chemical characteristics of liquid propellant. Liquid propellant rocket engine – system layout, pump and pressure feed systems, feed system components. Design of combustion chamber, characteristic length, constructional features, and chamber wall stresses. Heat transfer and cooling aspects. Uncooled engines, injectors – various types, injection patterns, injector characteristics, and atomization and drop size distribution, propellant tank design.

UNIT - V:

Ramjet And Integral Rocket Ramjet Propulsion System: Fuel rich solid propellants, gross thrust, gross thrust coefficient, combustion efficiency of ramjet engine, air intakes and their classification – critical, super critical and sub-critical operation of air intakes, engine intake matching, classification and comparison of IIRR propulsion systems.

REFERENCES:

1. Mechanics and Dynamics of Propulsion/ Hill and Peterson/John Wiley & Sons
2. Rocket propulsion elements/Sutton/John Wiley & Sons/8th Edition
3. Gas Turbines/Ganesan /TMH
4. Gas Turbines & Propulsive Systems/Khajuria & Dubey/Dhanpat Rai & Sons
5. Rocket propulsion/Bevere/
6. Jet propulsion /Nicholas Cumpsty/

COURSE OUTCOMES:

CO1: To understand the concept of turbo jet propulsion system and performance of flight.
CO2: Enable students to learn the concept of rocketry and its fundamentals.
CO3: To impart knowledge on the effect of nozzle design on the performance of jet propulsion.
CO4: Get idea about the combustion chemistry of fuels used in rocketry.
CO5: Equip students with the knowledge of advanced rocket engines.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE15) ALTERNATE FUELS
(Programme Elective – III)

M.Tech – II-Semester **L/T/P/C**
3/- /- /3

UNIT-I

Need for alternate fuel : Availability and properties of alternate fuels, general use of alcohols, LPG, hydrogen, ammonia, CNG and LNG, vegetable oils and biogas, merits and demerits of various alternate fuels, introduction to alternate energy sources. Like EV, hybrid, fuel cell and solar cars.

UNIT-II

Alcohols: Properties as engine fuel, alcohols and gasoline blends, performance in SI engine, methanol and gasoline blends, combustion characteristics in CI engines, emission characteristics, DME, DEE properties performance analysis, performance in SI & CI Engines.

UNIT-III

Natural Gas, LPG, Hydrogen and Biogas: Availability of CNG, properties, modification required to use in engines, performance and emission characteristics of CNG using LPG in SI & CI engines, performance and emission of LPG. Hydrogen; storage and handling, performance and safety aspects.

UNIT-IV

Vegetable Oils: Various vegetable oils for engines, esterification, performance in engines, performance and emission characteristics, bio diesel and its characteristics

UNIT-V

Electric, Hybrid, Fuel Cell And Solar Cars: Layout of an electric vehicle, advantage and limitations, specifications, system components, electronic control system, high energy and power density batteries, hybrid vehicle, fuel cell vehicles, solar powered vehicles.

REFERENCES:

1. Richard.L.Bechfold, Alternative Fuels Guide BooK, SAE International Warrendale - 1997.
2. Maheswar Dayal, Energy today & tomorrow, -1 & B Horishr India-1982.
3. Nagpal, Power Plant Engineering, Khanna Publishers, 1991.
4. Alcohols as motor fuels progress in technology, Series No. 19 - SAE Publication USE - 1980.
5. SAE paper nos. 840367, 841333, 841334, 841156, Transactions, SAE, USA

COURSE OUTCOMES:

CO1: Know about Availability and properties of alternate fuels, general use of Alcohols, LPG, hydrogen, and ammonia.
CO2: Deal with Properties as engine fuel, alcohols and gasoline blends.
CO3: Deal with to solve a problem in performance in SI & CI Engines.
CO4: Deal with performance and emission characteristics, bio diesel and its characteristics
CO5: To enable students on Layout of an electric vehicle, advantage and Limitations, specifications, system components.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE16) ADVANCED COMPUTATIONAL FLUID DYNAMICS
(Programme Elective – IV)

M.Tech – II-Semester **L/T/P/C**
3/- /- / 3

UNIT - I

Introduction: Finite difference method, finite volume method, finite element method, governing equations and boundary conditions, Derivation of finite difference equations.

Solution methods: Solution methods of elliptical equations — finite difference formulations, interactive solution methods, direct method with Gaussian elimination. Parabolic equations-explicit schemes and Von Neumann stability analysis, implicit schemes, alternating direction implicit schemes, approximate factorization, fractional step methods, direct method with tridiagonal matrix algorithm.

UNIT – II

Hyperbolic equations: explicit schemes and Von Neumann stability analysis, implicit schemes, multi step methods, nonlinear problems, second order one-dimensional wave equations. Burgers equations: Explicit and implicit schemes, Runge- Kutta method.

UNIT - III

Formulations Of Incompressible Viscous Flows: Formulations of incompressible viscous flows by finite difference methods, pressure correction methods, vortex methods.

Treatment of compressible flows: potential equation, Euler equations, Navier-stokes system of equations, flow field-dependent variation methods, boundary conditions, example problems.

UNIT - IV

Finite Volume Method: Finite volume method via finite difference method, formulations for two and three-dimensional problems.

UNIT - V

Standard Variational Methods: Linear fluid flow problems, steady state problems, Transient problems.

REFERENCES:

1. Computational fluid dynamics/ T. J.C'hung/ Cambridge University press, 2002.
2. Text book of fluid dynamics/ **Frank** Choriton/ CBS Publishers & distributors, 1985
3. Numerical heat transfer and fluid flow / Suhas V. Patankar/ Hema shava Publishers corporation & Mc Graw Hill.
4. Computational Fluid Flow and Heat Transfer/ Muralidaran/ Narosa Publications
5. Computational Fluid Dynamics: Basics with applications/John D. Anderson/ Mc Graw Hill.

COURSE OUTCOMES:

CO1: Understand Finite Difference Method, Finite Volume Method, Finite Element Method

CO2: Consider Solution Methods Of Elliptical Equations

CO3: Understand Boundary Layer Equations For Laminar, Turbulent Flow

CO4: Solve Numerical On Burgers Equations: Explicit And Implicit Schemes, Runge- Kutta Method.

CO5: Apply Knowledge On Formulations Of Incompressible Viscous Flows By Finite Difference Methods.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE17) THERMAL AND NUCLEAR POWER PLANTS
(Programme Elective – IV)

M.Tech – II-Semester **L/T/P/C**
3/-/- /3

UNIT –I

Introduction: Sources of energy, Type of Power plants. Direct energy conversion system, Energy sources in India, Recent developments in power generation, Combustion of coal, Volumetric analysis, Gravimetric analysis. Fuel gas analysis.

Steam power plant: Introduction. General layout of steam power plant, Modern coal. Fired Steam, Steam power plant. Power plant cycle, Fuel Handling, Combustion equipment, Ash handling, Dust collectors.

Steam Generators: Types, Accessories. Feed water heaters, Performance of boiling, Water treatment, cooling towers. Steam turbines. Compounding of turbines, Steam condensers, Jet and surface condensers.

UNIT-II

Gas Turbine Power Plant: Cogeneration. Combined cycle power plant, Analysis, Waste heat recovery, IGCC power plant, Fluidized bed, Combustion, Advantages, Disadvantages

UNIT-III

Nuclear Power Plant: Nuclear physics, Nuclear Reactor, Classification, Types of reactors, Site selection. Method of enriching uranium. Application of nuclear power plant. Nuclear Power Plant Safety: Bi-Product of nuclear power generation, Economics of nuclear power plant, Nuclear power plant in India, Future of nuclear power.

UNIT-IV

Economics of Power Generation: Factors affecting the economics, Loading factors, Utilization factor, Performance and operating characteristics of power plant, Point economic load sharing, Depreciation. Energy rate, Criteria for optimum loading. Specific economic energy problem

UNIT-V

Power Plant Instrumentations: Classification, Pressure measuring instrument, Temperature measurement and Flow Measurement, Analysis of combustion gases, Pollution types, Methods of control.

REFERENCES:

1. Power Plant Engineering / P.K.Nag / TMH
2. Power Plant Engineering / R.K.Rajput/ Lakshmi Publications.
3. Power Plant Engineering / P.C.Sharma/ Kotearia Publications.
4. Power Plant Technology / Wakil.

COURSE OUTCOMES:

CO1: Understand the Type of Power plants, Direct energy conversion system.
CO2: Analysis and Understand Recent developments in power generation.
CO3: Know about Feed water heaters.
CO4: To impart knowledge on Combined cycle power plant and its importance.
CO5: To understand the concepts of Nuclear Reactor and its Classification

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE18) THERMAL MEASUREMENTS & PROCESS CONTROLS
(Programme Elective – IV)

M.Tech – II-Semester **L/T/P/C**
3/- /- /3

UNIT-I

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.

UNIT-II

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.

UNIT-III

Temperature Measurement: Different principles of Temperature Measurement, use of bimetallic thermometers – Mercury thermometers, Vapor Pressure thermometers, Thermo positive elements, thermocouples in series & parallel, pyrometry, measurement of heat flux, calibration of temperature measuring instruments. Design of temperature measuring instruments.

UNIT-IV

Level Measurement: Direct & indirect methods, manometric 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.

UNIT-V

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, transient regulations.

REFERENCES:

1. Mechanical Measurements – Beckwith, Leinhard & Marangoni - Pearson
2. Measurement System, Application & Design – E.O. Doeblin.
3. Mechanical and Industrial Measurements – R.K. Jain – Khanna Publishers.
4. Mechanical Measurements – Buck & Beckwith – Pearson.
5. Control Systems, Principles & Design, 2nd Edition – M. Gopal – TMH.
6. Principles of Measurement Systems – John Bentley - Pearson

COURSE OUTCOMES:

CO1: Understand the fundamental principles of measuring instruments.
CO2: Identify the working principle of all the instruments used to determine the flow.
CO3: Develop the advanced thermometers for different type of operations.
CO4: Measure the level by direct or indirect methods.
CO5: Impart knowledge on principles used for process control.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE19) ADVANCED INTERNAL COMBUSTION ENGINES LAB

M.Tech II-Semester **L/T/P/C**
-/-/4/2

1. Effect of changing the sequence of spark ignition on the performance of multi cylinder petrol engine
2. Effect of change in compression ratio on the performance of petrol engine.
3. Effect of change in fuel injection timing on the performance of diesel engine.
4. Effect of change in spark timing on the performance of petrol engine.
5. Heat balance sheet, volumetric efficiency and air fuel ratio estimation of IC engine.
6. Flame propagation analysis of gaseous fuels.
7. Measuring physicochemical properties of petrol and diesel fuels.
8. Effect on the performance of diesel engine using 20% n-butanol blend with diesel.
9. Effect on the performance of petrol engine using 20% ethanol blend with gasoline.

COURSE OUTCOMES:

CO1: Understand the effect of change in compression ratio on the performance of diesel& petrol engine.
CO2: Analyze the effect of change in fuel injection timing on the performance of diesel engine.
CO3: Understand and analysis Flame propagation analysis of gaseous fuels.
CO4: Use different type of fuels and analyze its effect on the performance of diesel and petrol

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE20) MODELING AND ANALYSIS LAB-II

M.Tech. II-Semester **L/T/P/C**
-/-/4/2

1) Designing the piston head of diesel engine.
2) Thermal stress analysis of piston head of diesel engine for real condition.
3) Effect of using different material for piston head on thermal stresses of diesel engine.
4) Design of crank rod of diesel engine and petrol engine.
5) Thermal stress analysis of crank rod of diesel engine for real operating conditions.
6) Design of piston rings for diesel engine and gasoline engine.
7) Thermal stress analysis of piston rings of diesel engine for real operating conditions.
8) Design of intake and exhaust valve for diesel engine.
9) Effect of thermal stress on the intake and outlet valve of IC engines.

Solving Thermal Engineering Problems using available Packages such as Pro –E, ANSYS, CFX, MAT LAB

COURSE OUTCOMES:
CO1: Aware of Thermal stress analysis of piston head of diesel engine for real condition.
CO2: Design of intake and exhaust valve for diesel engine.
CO3: Analyze the thermal stress of crank rod of diesel engine for real operating conditions.
CO4: Understand effect of thermal stress on the intake and outlet valve of IC engines.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE21) MINI PROJECT

M.Tech. II-Semester **L/T/P/C**
2/ -/ -/ -

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)
(M20AC01) ENGLISH FOR RESEARCH PAPER WRITING
(Audit Course-II)

M.Tech. II-Semester **L/T/P/C**
-/- /4 /2

Prerequisites: NIL

Course Objectives:

- To understand the nuances of language and vocabulary in writing a Research Paper.
- To develop the content, structure and format of writing a research paper.
- To give the practice of writinga Research Paper.
- To enable the students to evolve original research papers without subjected to plagiarism.

Learning Outcomes: After completion of the course the student will be able to

- The student will be able to understand the nuances of research writing
- The student will be able to write a research paper with required writing skills and be confident to share their writing with others
- The student will be able to publish a paper using the requisite standard in a journal
- The student will be able to review the research papers and articles in a scientific manner.
- The student will be able to work on citations and ably place them in her research paper.
- The student will be able to avoid plagiarism and be able to develop her own writing skills in presenting the research work.

UNIT I:

ACADEMIC WRITING: What is Research? - Meaning & Definition of a research paper– Purpose of a research paper – Scope – Benefits – Limitations – outcomes.

UNIT II:

RESEARCH FORMAT: Title – Abstract – Introduction – Discussion - Findings – Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation of sources.

UNIT III:

RESEARCH METHODOLOGY: Methods (Qualitative – Quantitative) – Literature Review – Who did what – Criticizing, Paraphrasing & Plagiarism.

UNIT IV:

PROCESS OF WRITING A RESEARCH PAPER: Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft –Revising/Editing - Typing the final draft

UNIT V:

HOW TO & WHERE TO GET PUBLISHED: Reputed Journals – National/International – ISSN No, No. of volumes, Scopes Index/UGC Journals – Free publications - Paid Journal publications – /Advantages/Benefits

TEXT BOOKS:

1. MLA Hand book for writers of Research Papers, East West Press Pvt. Ltd, New Delhi, 7th Edition.
2. C. R Kothari, Gaurav, Garg, Research Methodology Methods and Techniques, New Age International Publishers. 4th Edition.
3. Lauri Rozakis, Schaum's Quick Guide to Writing Great Research Papers, Tata McGraw Hills Pvt. Ltd, New Delhi.
4. N. Gurumani, Scientific Thesis Writing and Paper Presentation, MJP Publishers

REFERENCES:

1. NPTEL: https://onlinecourses.nptel.ac.in/noc18_mg13/preview

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE22) ADVANCED MATERIALS FOR THERMAL SYSTEMS
(Programme Elective – V)

M.Tech – III-Semester **L/T/P/C**
3/- /- /3

UNIT – I:
Review of Mechanical Properties: Fundamentals And Tensile, Hardness, And Impact Testing: The Tensile Test: Use of the Stress – Strain Diagram, True Stress and True Strain, The Bend Test for Brittle Materials, Hardness of Materials, Strain Rate effects and Impact Behavior Heat Treatment of Steels and Cast Irons: Designations and Classification of Steels, Simple Heat treatments, Isothermal Heat treatments, Quench and Temper Heat treatments, Surface treatments, Weldability of Steel. Fracture Mechanics, Fatigue, And Creep Behavior: Fracture Mechanics, The Importance of Fracture Mechanics, Micro structural Features of Fracture in Metallic Materials., Micro structural Features of Fracture in Ceramics, Glasses, and Composites, Fatigue, Result of the Fatigue test, Application of Fatigue test, Creep, Stress Rupture, and Stress Corrosion, Evaluation of creep Behavior

UNIT-II:
Nuclear Power Plant and Their Materials: Nuclear reactor, pressurized reactor, breeder reactor. Materials for fuel, control rods, coolant, moderator, shielding. Effects of Radiation on Materials Properties: Effects of ,, rays on creep, fatigue, tensile, and other properties of metals, alloys, ceramics, polymers, rubbers etc. Effects on electrical, electronic and magnetic behavior of materials, Effects on crystal structure, grain size etc.

UNIT-III:
Materials in Fuel cells and Solar Cells Electro catalyst materials for low temperature fuel cells, Conductive membranes for low-temperature fuel cells, Materials for high temperature fuel cells , silicon, quantum dots for solar energy, nano materials for solar thermal energy and photovoltaic.

UNIT-IV:
Materials in Thermal Power Generation Super alloys, steels, ceramics, TBC, hydrogen membrane materials, sensor and sensor materials, biomass, coal, fly ash, etc.

UNIT-V:
Energy storage-Artificial photosynthesis/solar to fuels, CO2 separation and utilization, Safer nuclear waste disposal, biofuels production, biological fuel cell technologies, reduction of energy use in manufacturing processes, Improved grid technologies, sustainable energy economy

REFERENCE BOOKS:
1. Introduction to Nuclear Science, Bryan, J. C., CRC Press.
2. Fundamentals of Radiation Materials Science, G.S. Was, Springer
3. Nuclear Reactor Materials and Applications, B.M. Ma, Van Nostrand Reinhold Company.
4. Nuclear Reactor Materials, C.O. Smith, Addison-Wesley Publishing Company.
5. Fundamentals Aspects of Nuclear Fuel Elements, D.R. Olander,
6. Structural Materials in Nuclear Power Systems, J. T. A. Roberts, Plenum Press.
7. Handbook of Fuel Cells, Wolf Vielstich, Arnold Lamm, Hubert A. Gasteiger, and Harumi Yokokawa, John Wiley and Sons, Inc.
8. Advanced power plant materials, design and technology, Edited by D Roddy, Woodhead Publishing Series in Energy No. 5 and CRC Press

COURSE OUTCOMES:

CO1: Understand the fundamentals of different type of testing methods.

CO2: Analyse Impact Behavior Heat Treatment of Steels and Cast Irons.

CO3: Impart knowledge on fundamentals of Nuclear Power Plant and Their Materials

CO4: survey about materials in Fuel cells and Solar Cells Electro catalyst.

CO5: Compare the Materials in Thermal Power Generation.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE23) COMPUTER SIMULATION OF SI & CI ENGINES
(Programme Elective - V)

M.Tech – III-Semester **L/T/P/C**
3/- /- /3

UNIT I:

Combustion Calculations: Heat of reaction at constant volume and constant pressure, Calculation of properties of the working medium in an engine, Constant volume and constant pressure adiabatic combustion, Calculation of Adiabatic flame temperature.

UNIT II:

Simulation Of Si Engine Combustion: Engine kinematics, Ideal Otto cycle, SI engine simulation with adiabatic combustion with air as the working substance under full and part throttle conditions. Actual SI engine heat release rate curves. SI engine combustion models including Wiebe's function.

UNIT III:

Simulation Of CI Engine Combustion: CI engine simulation with adiabatic combustion with air as the working substance under naturally aspirated, supercharged and turbocharged conditions. Actual heat release rates of diesel engines, Hardenberg and Hase and other ignition delay models for diesel enignes, Zero dimensional combustion models for CI engines - Watsons and White House and Way models.

UNIT IV:

Gas Exchange Processes: Flow through valves their characteristics, compressible and incompressible flow through valves, volumetric efficiency and Mach index, Effect of valve timing on volumetric efficiency, Swirl and squish, SI engine simulation with gas exchange, influence of valve timing and area. CI engine simulation with gas exchange.

UNIT V:

Heat Transfer And Friction In Engines: Engine friction variation, models for engine friction, Heat transfer mechanisms in engines, Models for heat transfer in engines. Two stroke engine scavenging parameters like delivery ratio, scavenging efficiency, trapping efficiency. Perfect displacement and perfect mixing models for scavenging.

TEXTBOOKS:

1. Computer simulation of compression ignition engine processes by V. Ganesan, Universities Press, 2000.
2. Computer simulation of Spark Ignition Engine Processes by V Ganesan, Universities Press, 2000.
3. Introduction to Internal Combustion Engines by Richard Stone

REFERENCES:

1. Internal Combustion Engines - Applied Thermo Sciences, Colin R Ferguson, John Wiley and Sons.
2. Internal Combustion Engine Fundamentals, John B Heywood, Mc Graw Hill.

COURSE OUTCOMES:

CO1: Impart knowledge on importance of computer simulation of IC engines.
CO2: To understand the concept of Wiebe's function in SI engine modeling.
CO3: Determine the importance of Watsons and White house and Way models in CI engines.
CO4: Understand the basics of gas exchange processes.
CO5: Equip students with knowledge of heat transfer to the surrounding from the IC engines.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE24) ADVANCED FINITE ELEMENT ANALYSIS
(Programme Elective - V)

M.Tech- III-Semester **L/T/P/C**
3/- /- /3

UNIT-I

Introduction to FEM: Basic concepts, historical back ground, applications of FEM, general description, comparison of FEM with other methods, variational approach, Glerkin's Methods. Co-ordinates, basic element shapes, interpolation function, Virtual energy principle, Rayleigh – Ritz method, properties of stiffness matrix, treatment of boundary conditions, solution of system of equations, shape functions and characteristics, Basic equations of elasticity, strain- displacement relations.

UNIT-II

1-D Structural Problems: Axial bar element – stiffness matrix, load vector, temperature effects, Quadratic shape functions and problems.
Analysis of Trusses: Plane Trusses And Space Truss Elements And Problems
Analysis of Beams: Hermite shape functions – stiffness matrix – Load vector – Problems.

UNIT-III

2-D Problems: CST, LST, force terms, Stiffness matrix and load vectors, boundary conditions, Isoparametric elements – quadrilateral element, shape functions – Numerical Integration. Finite element modeling of Axi-symmetric solids subjected to Axi-symmetric loading with triangular elements.
3-D Problems: Tetrahedran element – Jacobian matrix – Stiffness matrix.

UNIT-VI

Scalar Field Problems: 1-D Heat conduction-Slabs – fins - 2-D heat conduction problems –Introduction to Torsional problems.

UNIT-V

Dynamic considerations, Dynamic equations – consistent mass matrix – Eigen Values, Eigen vector, natural frequencies – mode shapes – modal analysis.

REFERENCES:

1. The Finite Element Methods in Engineering / SS Rao / Pergamon.
2. Finite Element Methods: Basic Concepts and applications, Alavala, PHI
3. Introduction to Finite Elements in Engineering, Chandrupatla, Ashok and Belegundu, Prentice-Hall
4. Finite Element Method – Zincowitz / Mc Graw Hill
5. Introduction to Fininte element analysis- S.Md.Jalaludeen,Anuradha Publications, print-2012
6. A First Course in the Finite Element Method/Daryl L Logan/Cengage Learning/5th Edition
7. Finite Element Method – Krishna Murthy / TMH
8. Finite Element Analysis – Bathe / PHI

COURSE OUTCOMES:

CO1: Understand The Basic Concepts, Historical Back Ground, Applications Of FEM.
CO2: Analysis And Understand Virtual Energy Principle
CO3: Observe 1-D Structural Problems.
CO4: Impart Knowledge On Hermite Shape Functions, Stiffness Matrix, And Load Vector.
CO5: Apply Finite element modeling of Axi-symmetric solids

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20MA01) ADVANCED OPTIMIZATION TECHNIQUES & APPLICATIONS
(Open Elective)

M.Tech – III-Semester **L/T/P/C**
3/- /- /3

UNIT- I

Single Variable Non-Linear Unconstrained Optimization: One dimensional Optimization methods, Uni-modal function, elimination method, Fibonacci method, golden section method, interpolation methods-quadratic & cubic interpolation methods.

UNIT - II

Multi Variable Non-Linear Unconstrained Optimization: Direct search method – Univariant Method – pattern search methods – Powell's – Hook – Jeeves, Rosenbrock search methods – gradient methods, gradient of function, steepest decent method, Fletcher reeves method, Variable metric method.

UNIT – III

Geometric Programming: Polynomials – arithmetic – geometric inequality – unconstrained G.P – constrained G.P

Dynamic Programming: Multistage decision process, principles of optimality, examples, conversion of final problem to an initial value problem, application of dynamic programming, production inventory. Allocation, scheduling replacement.

UNIT- IV

Linear Programming: Formulation – Sensitivity analysis. Change in the constraints, cost coefficients, coefficients of the constraints, addition and deletion of variable, constraints.

Simulation: Introduction – Types – Steps – application – inventory – queuing – thermal system.

UNIT- V

Integer Programming: Introduction – formulation – Gomoryu78 cutting plane algorithm – Zero or one algorithm, branch and bound method.

Stochastic Programming: Basic concepts of probability theory, random variables – distributions – mean, variance, Correlation, co variance, joint probability distribution – stochastic linear, dynamic programming.

REFERENCES:

1. Optimization theory & Applications/ S.S Rao/ New Age International
2. Introductory to operation research/Kasan & Kumar/Springer
3. Optimization Techniques theory and practice / M.C Joshi, K.M Moudgalya/ Narosa Publications.
4. Operation Research/H.A. Taha/TMH
5. Optimization in operations research/R.L Rardin
6. Optimization Techniques/Benugundu & Chandraputla/Person Asia
7. Optimization Techniques /Benugundu & Chandraputla / Pearson Asia

COURSE OUTCOMES:

CO1: Know about the basics of one dimensional Optimization methods.
CO2: Choose the ways to use Direct search method
CO3: Calculate dynamic programming.
CO4: Construct linear programming
CO5: Analyze integer programming

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20MB23) BUSINESS LAW AND ETHICS
(OPEN ELECTIVE)

M.Tech – III-Semester **L/T/P/C**
3/- /- /3

Objective: To understand the Legal and Regulatory Framework for doing business in India.

UNIT – I:

Companies Act, 2013: Steps and procedure for incorporation of the company, Appointment of Directors, Powers, duties, & liabilities of Directors, Company Meetings, Resolutions, Winding-up of a Company.

UNIT – II:

Law of Contract: Nature of Contract and Essential elements of valid contract, Offer and Acceptance, Consideration, Capacity to contract and Free Consent, Legality of Object. Unlawful and illegal agreements, Contingent Contracts, Performance and discharge of Contracts, Remedies for breach of contract. Contracts-II: Indemnity and guarantee, Contract of Agency, Sale of goods Act -1930: General Principles, Conditions & Warranties, Performance of Contract of Sale.

UNIT – III:

Negotiable Instruments Act - 1881: Negotiable Instruments- Promissory Note, Bills of Exchange, & Cheque, and their definitions and characteristics, Types of endorsements, Holder- Holder in due course, Discharge of Parties. Introduction to Goods and Services Tax (GST).

UNIT – IV:

Business Ethics: The Changing Environment: Business Ethics-why does it matter? ; Levels of Business Ethics-Five Myths about Business Ethics-can Business Ethics be taught and trained? stages of Moral development Kohlberg's study-carol Gilligan's Theory-Principles of Ethics.

UNIT – V:

Cyber Crime: The Legal Landscape - Need for cyber laws in the Indian context - The Indian IT Act-challenges to Indian Law and cyber crime scenario in Indian – issues and Challenges in Cyber Crime.

TEXTBOOKS:

1. Ravinder Kumar, Legal Aspects of Business, 4e,Cengage Learning, 2016.
2. P.P.S.Gogna, Company Law, S.Chand, 2016.
3. RSN Pillai, Bagavathi, Legal Aspects of Business, S.Chand, 2016.
4. Akhileshwar Pathak , Legal Aspects of Business, Tata McGraw Hill, 3e, 2011.
5. Nina Godbole & Sunit Belapure, Cyber Security, Wiley India, 2012.

COURSE OUTCOMES:

CO1: Know the Business Laws related to incorporating a company

CO2: Identify the Importance of Ethics in Business

CO3: Categorize Cyber Crime and Legal Aspects.

CO4: Analyze Business Ethics.

CO5: Understand Negotiable Instruments Act – 1881

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20MB30) PROJECT MANAGEMENT
(OPEN ELECTIVE)

M.Tech – III-Semester **L/T/P/C**
3/- /- /3

Objective: The objective of this course is to lay an important foundation to students in managing projects with a special focus on every phase such as project planning, execution, monitoring and evaluation.

UNIT-I:
Introduction: Introduction to Project management -Project Characteristics. Project Life cycle- Project Identification, Formulation and Implementation- Project management in different sectors: Construction Services Sector, Public sector and Government Projects. Systems approach to project management.

UNIT-II:
Project Planning and Appraisal: Project Planning Project Appraisal- Feasibility study- Technical Commercial, Economic, Financial, Management, Social Cost Benefit Analysis-Project Risk Analysis.

UNIT-III:
Project Finance: Project Cost Estimation, Project Financing- Investment Criteria, Project Evaluation Techniques- Pay Back Period, Accounting rate of return, Net present value, Internal Rate of return, Profitability Index, Cash Flows Estimation for new and replacement projects- Cost of Capital, Risk Analysis.

UNIT-IV:
Project Planning and Control: Planning Steps- Scheduling- Network Diagrams, Network Analysis. Critical Path, Quality Management, Project Execution, Monitoring and control, Agile project Management, Scrum. Lean Production and project management.

UNIT-V
Organizational Behavior and Project Management: Organizational Structure and Integration, Role of project manager. Roles in the project team, Project stakeholder engagement, Leadership in project management participative management, team building approach, Conflict Management in Projects, Stress Management.

TEXTBOOKS:
1. John M. Nichotas and Herman Steyn, Project Management for Engineering. Business, and Technology. 5e. Routledge, 2017
2. Prasanna Chandra, Projects, Planning. Analysis, Selection, Financing, Implementation, and review. 6eTata McGraw Hill 2008.
3. K. Nagrajan, Project Management, New Age International Publishers, 7e 2015
4. Jack Gido, Jim Clements Rose Baker, Successful Project Management, Cengage Leaming. 7e 20155. R. Paneerselvam, P. Senthil Kumar, Project Management, PHI, 2009.

COURSE OUTCOMES:
Students will be able to understand:
CO1: Importance of Project Management.
CO2: Project Planning. Execution and implementation.
CO3: Significance of teams in projects.
CO4: Project evaluate techniques.
CO5: Role of Scheduling and Network Analysis in Project Planning.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE25) DISSERTATION PHASE - I

M.Tech. III-Semester **L/T/P/C**
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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M20TE26) DISSERTATION PHASE - II

M.Tech. IV-Semester **L/T/P/C**
-/-/32/16

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