VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)
M. TECH THERMAL ENGINEERING

COURSE STRUCTURE
(R22 Regulations applicable for the batches admitted from Academic Year 2022-2023)

I YEAR I SEMESTER

S. No.	Course Code	Title of the Course	L	T	P	Credits
1	M22TE01	Advanced Thermodynamics	3	0	0	3
2	M22TE02	Advanced Fluid Mechanics	3	0	0	3
3	M22TE03 M22TE04 M22TE05	1. Fuels & Combustion 2. Electric & Hybrid Vehicles 3. Experimental Methods in Thermal Engineering	3	0	0	3
4	M22TE06 M22TE07 M22TE08	1. Advanced I.C. Engines 2. Gas turbines & Jet Propulsion 3. Nano Fluids	3	0	0	3
5	M22TE09	Research Methodology & IPR	2	0	0	2
6	M22TE10	Advanced Thermal Engineering lab	0	0	4	2
7	M22TE11	Advanced Fluid Mechanics Lab	0	0	4	2
8	M22AC - I	Audit Course - I	2	0	0	0
		Total	**16**	**0**	**8**	**18**

I YEAR II SEMESTER

S. No.	Course Code	Title of the Course	L	T	P	Credits
1	M22TE12	Advanced Heat and Mass Transfer	3	0	0	3
2	M22TE13	Computational Fluid Dynamics	3	0	0	3
3	M22TE14 M22TE15 M22TE16	1. Finite Element Analysis 2. Optimization Techniques & Applications 3. Utilization of Solar energy	3	0	0	3
4	M22TE17 M22TE18 M22TE19	1. Cogeneration & Waste Heat Recovery Systems 2. Renewable Energy Sources 3. Energy conservation and Management	3	0	0	3
5	M22TE20	Mini Project with Seminar	0	0	4	2
6	M22TE21	Advanced Heat Transfer Lab	0	0	4	2
7	M22TE22	Computational Methods Lab	0	0	4	2
8	M22AC - II	Audit Course - II	2	0	0	0
		Total	**14**	**0**	**12**	**18**

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COURSE STRUCTURE
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II YEAR I SEMESTER

S. No.	Course Code	Title of the Course	L	T	P	Credits
1	M22TE23 M22TE24 M22TE25	1. Refrigeration & HVAC 2. Gas Dynamics 3. Equipment Design for Thermal Systems	3	0	0	3
2	M22OE - I	Open Elective	3	0	0	3
3	M22TE26	Dissertation Work Review - II	0	0	12	6
		Total	**6**	**0**	**12**	**12**

II YEAR II SEMESTER

S. No.	Course Code	Title of the Course	L	T	P	Credits
1	M22TE27	Dissertation Work Review - III	0	0	12	6
2	M22TE28	Dissertation Viva-Voce	0	0	28	14
		Total	**0**	**0**	**40**	**20**

***For Dissertation Work Review - I, please refer 7.10 in R22 Academic Regulations.**

Audit Course I & II:

1. M22AC01 - English for Research Paper Writing
2. M22AC02 - Disaster Management
3. M22AC03 - Sanskrit for Technical Knowledge
4. M22AC04 - Value Education
5. M22AC05 - Constitution of India
6. M22AC06 - Pedagogy Studies
7. M22AC07 - Stress Management by yoga
8. M22AC08 - Personality Development through Life Enlightenment Skills

Open Electives

1. M22MB29 - Business Analytics
2. M22TE29 - Waste to Energy
3. M22TE30 - Basics of Refrigeration Systems
4. M22TE31 - Introduction to Thermal Storage Systems

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE01) ADVANCED THERMODYNAMICS
(Professional Core – I)

M.Tech – I Year I Sem

L	T	P	C
3	0	0	3

Prerequisites: Thermodynamics

Course Objectives: The course is intended to

- Provide analytical methods for the determination of the direction of processes AAin using equations of potentials, availability, and excergy for thermodynamic analysis
- Gain the knowledge on non-reactive mixture properties, Psychometric Mixture properties and psychometric chart and Air conditioning processes
- Develop the ability of analyzing vapor and Gas power cycles
- Provide in depth knowledge of Direct Energy Conversion of Fuel Cells, Thermo electric energy, Thermionic power generation, Thermodynamic devices Magneto Hydrodynamic Generations and Photo voltaic cells
- Develop communication and teamwork skills in the collaborative course project

UNIT – I:

REVIEW OF THERMODYNAMIC LAWS AND COROLLARIES: Transient flow analysis, Second law of 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 gases, 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 of irreversible processes. Introduction, Phenomenological laws, Onsager 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 hydrodynamic generations, Photovoltaic cells.

Course Outcomes: At the end of the course, the student will be able to:

- Explain basic thermodynamic concepts and laws
- Describe the concepts entropy and excergy and their use in analyses of thermal energy systems
- Analyze power plants, refrigeration plants and thermal/chemical installations
- Evaluate means for minimizing excergy losses in selected processes
- Use advanced thermodynamics on a research case

TEXT BOOKS:

1. Basic and Applied Thermodynamics by P. K. Nag, TMH
2. Engineering Thermodynamics by Rogers & Mayhew, Pearson
3. Thermodynamics by Holman, Mc Graw Hill.

REFERENCE BOOKS:

1. https://nptel.ac.in/courses/103103162
2. Thermal Engineering by Rathore, TMH
3. Applied Thermodynamics by R.K. Rajput, Laxmi Publications
4. Thermal Engineering by Soman, PHI
5. Engineering Thermodynamics by P. L. Dhar, Elsevier
6. Thermodynamics by Sonnatag & Van Wylen, John Wiley & Sons
7. Thermodynamics for Engineers by Doolittle-Messe, John Wiley & Sons
8. Irreversible Thermodynamics by HR De Groff.
9. Thermodynamics & Heat Power by Granet & Bluestein, CRC Press
10. Engineering Thermodynamics by Chatopadyaya

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE02) ADVANCED FLUID MECHANICS
(Professional Core – II)

M.Tech - I Year I Sem

L	T	P	C
3	0	0	3

Prerequisites: Fluid Mechanics & Hydraulic Machinery

Course Objectives: The course is intended to

- Establish an understanding of the fundamental concepts of fluid mechanics.
- Understand and apply the potential flow equations to basic flows.
- Understand and apply the differential equations of fluid mechanics including the ability to apply and understand the impact of assumptions made in the analysis.
- Understand the boundary layer concepts with respect to fluid flow.
- Understand and apply the compressible flow equations.

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 Carte systems normal and tangential accelerations, Euler's, Bernoulli 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 Poiseuille flow - Coutte flow with and without pressure gradient - Hagen Poiseuille flow - Approximate solutions – Creeping motion (Stokes) – Oseen's approximation.

UNIT-III:

Boundary Layer Theory: Prandtl's contribution to real fluid flows – Prandtl's boundary layer theory - Boundary layer thickness for flow over a flat plate – Von-Karman momentum integral equation - Blasius solution- Laminar boundary layer – Turbulent Boundary Layer — Expressions for local and mean drag coefficients for different velocity profiles. – Total Drag due to Laminar & Turbulent Layers – Problems.

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.

Course Outcomes: At the end of the course, the student will be able to:

- Understanding the concept of fluid and the models of fluids.
- Understanding the basic physical meaning of general equations.
- Understanding the concept of stream function and potential function.
- Ability to derive the equation for viscous flow, including laminar flow and turbulent flow.
- Ability to address such problems in engineering, and to solve the problems

TEXT BOOKS:

1. Fluid Mechanics and Fluid Machines by S K Som and G Biswas, TMH
2. Fluid Mechanics by Joseph H Spurk and Nuri Aksel, Springer
3. Compressible Fluid Dynamics by B K Hodge and Keith Koenig, Pearson
4. Fluid Mechanics by Potter, Cengage Learning.
5. Fluid Mechanics and Hydraulic Machines by Dr. R.K. Bansal.

REFERENCE BOOKS:

1. https://archive.nptel.ac.in/courses/112/105/112105287/
2. Fluid Mechanics by Jog, Cambridge
3. Fluid Mechanics and Machinery by Khan, Oxford
4. Fluid Mechanics by Cohen and Kundu, Elsevier, 5^{th} edition
5. Fluid Mechanics by William S Janna, CRC Press
6. Dynamics & Theory and Dynamics of Compressible Fluid Flow by Shapiro.
7. Fluid Dynamics by William F. Hughes & John A. Brighton, TMH

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE03) FUELS & COMBUSTION
(Professional Elective – I)

M.Tech - I Year I Sem

L	T	P	C
3	0	0	3

Prerequisites: Thermodynamics, Thermal Engineering I & II

Course Objectives: The course is intended to make a post graduate student to understand

- The fundamental of combustion phenomena in general
- The different combustion process, its thermodynamics and kinetics
- The combustion mechanism in different types of combustion
- The burner design for efficient combustion
- Different combustion models
- The effect of quantity & quality of fuel and engine technology on exhaust emissions
- The concept of laminar and turbulent flame propagation
- Different methods to reduce air pollution

UNIT – I:

Fuels: Detailed classification – Conventional and Unconventional Solid, Liquid, gaseous fuels and nuclear fuels – Origin of Coal – Analysis of coal.

Coal – Carborisation, Gasification and liquification – Lignite: petroleum-based fuels – problems associated with very low calorific value gases: Coal Gas – Blast Furnace Gas Alcohols and Biogas.

UNIT – II:

Principles of Combustion: Chemical composition – Flue gas analysis – dew point of products – Combustion stoichiometry.

Chemical kinetics – Rate of reaction – Reaction order – Molecularity – Zeroth, first, second and third order reactions - complex reactions – chain reactions. Theories of reaction Kinetics – General oxidation behavior of HC's.

UNIT – III:

Detonation and Deflagration waves of premixed gasses, Rankine Hygienist relation, Hygienist curve, laminar and turbulent flame propagation and structure, Burning velocity of fuels – Measurement of burning velocity – factors affecting the burning velocity.

UNIT – IV:

Flame Stability, Combustion of fuel, Theory of diffusion flames, droplets and sprays – Combustion systems - Pulverized fuel furnaces – fixed, Entrained and Fluidised Bed Systems.

UNIT – V:

Environmental Considerations: Air pollution – Effects on Environment, Human Health etc. Principal pollutants – Legislative Measures – Methods of Emission control.

Course Outcomes: At the end of the course, the student will be able to:

- Understand the concepts of combustion phenomena in energy conversion devices
- Apply the knowledge of adiabatic flame temperature in the design of combustion devices
- Identify the phenomenon of flame stabilization in laminar and turbulent flames
- Analyze the pollution formation mechanisms in combustion of solid, liquid and gaseous fuels

TEXT BOOKS:

1. Combustion Fundamentals by Roger A Strehlow, Mc Graw Hill
2. Fuels and combustion by Sharma and Chander Mohan, Tata Mc Graw Hill

REFERENCE BOOKS:

1. https://archive.nptel.ac.in/courses/103/105/103105110/
2. Combustion Engineering and Fuel Technology by Shaha A.K., Oxford and IBH.
3. Principles of Combustion by Kanneth K. Kuo, Wiley and Sons.
4. Fuels & Combustion by Sameer Circar, Mc. Graw Hill.
5. An Introduction to Combustion by Stephen R. Turns, Mc. Graw Hill International Edition.
6. Combustion Engineering by Gary L. Berman & Kenneth W. Ragland, Mc. Graw Hill International Edition.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE04) ELECTRIC & HYBRID VEHICLES
(Professional Elective – I)

M.Tech - I Year I Sem

L	T	P	C
3	0	0	3

Course Objectives

- Explain the history of Electric vehicles and development
- Discuss the Social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies
- Explore to basic concept of electric traction, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives etc.
- Analyse the Fuel Cell based energy storage and Super Capacitor based energy storage etc.
- Explore to types of Driving Cycles, Range modelling for Battery Electric Vehicle, Hybrid (ICE & others) etc.

UNIT - I:

Introduction to Electric Vehicle: History of Electric Vehicles, Development towards 21st Century, Types of Electric Vehicles in use today – Battery Electric Vehicle, Hybrid (ICE & others), Fuel Cell EV, Solar Powered Vehicles. Motion and Dynamic Equations of the Electric Vehicles: various forces acting on the Vehicle in static and dynamic conditions.

UNIT - II:

Induction to Hybrid Electric Vehicle: Social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid Drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

UNIT - III:

Electric Drive Trains: Basic concept of electric traction, introduction to various electric drive train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.
Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT - IV:

Types of Storage Systems: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive

system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Calculation for the rating.

UNIT - V:

Modelling Of Hybrid Electric Vehicle Range: Driving Cycles, Types of Driving Cycles, Range modelling for Battery Electric Vehicle, Hybrid (ICE & others), Fuel Cell EV, Solar Powered Vehicles. Case study of 2 wheeler, 3 wheeler and 4 wheeler vehicles.

Course Outcomes: At the end of the course, the student will be able to:

- Choose the appropriate source of energy for the hybrid electric vehicle based on driving cycle.
- Analyze the power and energy need of the various hybrid electric vehicle and Measure and Estimate the energy consumption of the Hybrid Vehicles
- Evaluate energy efficiency of the vehicle for its drive trains
- Elaborate the types of storage systems such as battery based, fuel cell based etc.
- Explain the types of Driving Cycles, Fuel Cell EV, Solar Powered Vehicles

TEXT BOOKS:

1. James Larminie, J. Lowry, “Electric Vehicle Technology Explained”, John Wiley & Sons Ltd. 2003.
2. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design”, CRC Press, 2004.

REFERENCE BOOKS:

1. https://archive.nptel.ac.in/courses/108/103/108103009/
2. S. Onori, L. Serrao and G. Rizzoni, “Hybrid Electric Vehicles: Energy Management Strategies”, Springer, 2015.
3. Iqbal Hussein, “Electric and Hybrid Vehicles: Design Fundamentals”, CRC Press, 2003.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE05) EXPERIMENTAL METHODS IN THERMAL ENGINEERING
(Professional Elective – I)

M.Tech - I Year I Sem

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the course, student will be able to:

- Understand the concepts of errors in measurements, statistical analysis of data, regression analysis, correlation and estimation of uncertainty.
- Understand conceptual development of zero, first and second order systems.
- Describe the working principles in the measurement of field and derived quantities.
- Analyze sensing requirements for measurement of thermo-physical properties, radiation properties of surfaces, and vibration.

UNIT - I:

Introduction – Generalized measurement system – standards – calibration – Dynamic measurements – System response – Distortion – Impedance matching – Fourier analysis – Experiment planning – causes and types of errors – Error analysis – Uncertainty analysis – Evaluation – Statistical analysis of experimental data – Probability distribution

UNIT - II:

Data Acquisition – Data transmission – data storage and display Variable resistance transducers, capacitive transducers, piezoelectric transducers, photoconductive transducers, photovoltaic cells, ionization transducers, Hall effect transducers

UNIT - III:

Dynamic response considerations, Bridgman gauge, McLeod gauge, Pirani thermal conductivity gauge, Knudsen gauge, Alphatron.

UNIT - IV:

Flow measurement by drag effects; hot-wire anemometers, magnetic flow meters, flow visualization methods, interferometer, Laser Doppler anemometer. Temperature measurement by mechanical effect, temperature measurement by radiation, transient response of thermal systems, thermocouple compensation, temperature measurements in high- speed flow.

UNIT - V:

Thermal conductivity measurement of solids, liquids, and gases, measurement of gas diffusion, convection heat transfer measurements, humidity measurements, heat - flux meters. Detection of thermal radiation, measurement of emissivity, reflectivity and transmissivity, solar radiation measurement.

TEXT BOOKS:

1. J. P. Holman, Experimental Methods for Engineers, 7th Edition, Tata Mc Graw-Hill 2001.
2. T.G. Beckwith, J.H. Lienhard V, R. D. Marngoni, Mechanical Measurements, 5th Edition, Pearson Education, 2010.
3. E.O. Doebelin, Measurement systems, Application and Design, 5th Edition, Tata McGraw-Hill, 2008

Online Resources:

1. Mechanical Measurements and Metrology by Prof. S P Venkateshan (IIT Madras), NPTEL Course (Link: https://nptel.ac.in/courses/112/106/112106138/).
2. Principles of Mechanical Measurement by Prof. Dipankar N Basu (IIT Guwahati), NPTEL Course (Link: https://nptel.ac.in/courses/112/103/112103261/).

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE06) ADVANCED I.C. ENGINES
(Professional Elective – II)

M.Tech - I Year I Sem

L	T	P	C
3	0	0	3

Prerequisites: Thermodynamics, Thermal Engineering I & II

Course objectives: The course is intended to

- Analyze engine cycles and the factors responsible for making the cycle different from the Ideal cycle.
- Apply principles of thermodynamics, fluid mechanics, and heat transfer to influence the engine's performance.
- Understand the delay period and fuel injection system.
- Become aware of the relevance of environmental and social issues on the design process of internal combustion engines

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 SI Engines: Combustion and Speed – Cyclic Variations – Ignition – Abnormal combustion Fuel factors, MPFI, SI engine testing.

Combustion in CI Engines: Essential Features – Types of 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.

Course Outcomes: At the end of the course, the student will be able to:

- Apply thermodynamic analysis to IC engines and describe combustion phenomena in spark ignition and compression ignition engines.
- Describe the working of major systems used in conventional and modern engines.
- Summarize the methods used to improve engine performance and estimate performance parameters.
- Describe engine emission control techniques and implement viable alternate fuels.

TEXT BOOKS:

1. I.C. Engines by V. Ganesan, TMH
2. I.C. Engines Fundamentals by Heywood, TMH

REFERENCE BOOKS:

1. https://nptel.ac.in/courses/112103262
2. I.C. Engines by G.K. Pathak & DK Chevan, Standard Publications
3. Dual-Fuel Diesel Engines by Ghazi A. Karim, CRC Press
4. I.C. Engines by RK Rajput, Laxmi Publications
5. Internal Combustion Engines by S.S. Thipse, Jaico
6. Computer Simulation of C.I. Engine Process by V. Ganesan, University Press
7. Fundamentals of IC Engines by HN Gupta, PHI, 2nd edition
8. I.C. Engines by Fergnson, Wiley.
9. The I.C. Engine in theory and Practice Vol. I /Teylor /IT Prof. And Vol. II.
10. Computer Simulation of Spark-Ignition Engine Processes by V. Ganesan, Universities Press

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE07) GAS TURBINES & JET PROPULSION
(Professional Elective – II)

M.Tech - I Year I Sem

L	T	P	C
3	0	0	3

Course Objectives:

- To present a detailed understanding of the components of a typical turbojet engine.
- To demonstrate the physical processes involved in the operation of turbojets.
- To teach students methods to size and design components as well as perform integration of an engine system.
- Understand of thermodynamic cycles of jet engines.
- Analyze jet engines; determine propulsion efficiency and design inlets and nozzles.

UNIT-I:

Introduction, Cycles, Actual and Ideal cycles, merits and demerits, Performance characteristics and improvement.

UNIT-II:

Gas dynamics, Centrifugal, axial and mixed flow compressor, principles and characteristics, Turbine construction.

UNIT-III:

Blade materials, manufacturing techniques, blade fixing, Problems of high temperature operation, blade cooling, practical air-cooled blades Combustion Systems, various fuels and fuel systems,

UNIT-IV:

Theory of jet propulsion, Jet propulsion cycles and their analysis, thrust equation, parameters affecting performance, thrust power and propulsive efficiency, Operating principle and cycle analysis of ramjet, turbojet, turbofan and turboprop engines. thrust augmentation, environmental considerations and applications

UNIT-V:

Types of rocket engines, propellants & feeding systems, ignition and combustion, theory of rocket propulsion, performance study, staging, terminal and characteristic velocity, space flights

Course Outcomes:

- Understand construction and design features of gas turbines as used for power generation.
- Explore to thermodynamics and fluid mechanics component for enhancing the efficiency and effectively of gas turbines
- Develop skills in problem solving for aircraft propulsion systems, in particular gas turbine engines.
- Analyse the performance enhancement approaches for jet propulsion engines
- Describe the basic concepts of rocket propulsion.

TEXT BOOK:

1. V. Ganesan, "Gas Turbines", Tata McGraw Hill, 2003.

REFERENCE BOOKS:

1. https://nptel.ac.in/courses/112103262
2. https://nptel.ac.in/courses/112103281
3. H Cohen, GFC Rogers and HIH Saravanamuttoo, "Gas Turbine Theory", Pearson Education, 2000.
4. S.M.Yahya "Turbines, Compressors and Fans", Tata McGraw Hill, 1992.
5. Vincent "The theory and design of Gas Turbine and Jet Engines", McGraw Hill, 1950.
6. W WBathic, "Fundamentals of Gas Turbines", John Wiley and Sons.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE08) NANO FLUIDS
(Professional Elective – II)

M.Tech - I Year I Sem

L	T	P	C
3	0	0	3

Prerequisites: Fluid Mechanics, Thermodynamics

Course Objectives: The course is intended to introduce the application of nanotechnology in different applications related to thermal engineering.

UNIT- I:
Introduction to nanofluids, nanostructure materials, base fluids, dispersion, sonication and stable suspension. Various types of nanofluids-volumetric concentration. Thermophysical properties: Density; principles of measurement and apparatus. Theoretical equations and new empirical correlations to determine the density of different nanofluids. Viscosity: principles of measurement and apparatus. Andrade's and other theoretical equations and new empirical correlations to determine the viscosity of different nanofluids. Effect of volumetric concentration and temperature. Effect of subzero temperature on nanofluid viscosity.

UNIT- II:
Thermal conductivity: principles of measurement and apparatus. Hamilton-Crosser and other theoretical equations and new empirical correlations to determine the thermal conductivity of different nanofluids. Effect of volumetric concentration and temperature. Effect of Brownian motion on enhancing the thermal conductivity. Specific heat: principles of measurement and apparatus. Buongeorno's thermal equilibrium equation and other theoretical equations and new empirical correlations to determine the specific heat of different nanofluids. Effect of volumetric concentration and temperature.

UNIT- III:
Combined effects of thermophysical properties of nanofluids on the thermal diffusivity, the Prandtl number, the Reynolds number and the Nusselt number. Basic understanding of their effects on frictional loss and Heat transfer. Convective heat transfer: Single-phase fluid equations, laminar flow, entry length and fully developed friction factor and heat transfer coefficient. Graetz number effect in the entry region. Correlations for friction factor and Nusselt number for nanofluids. Turbulent flow: Single phase fluid fully developed flow Dittus-Boelter and Glienilski equations. Blasius and other turbulent friction factor correlations. Their comparison with nanofluids data. New correlations for turbulent friction factor and Nusselt number for nanofluids.

UNIT- IV:
Principles of measurement and apparatus for the nanofluid convective heat transfer coefficient. Recent empirical relations for convection coefficient of various types of nanofluids. Effect of

particle Peclet number. Effect of volumetric concentration. Application of nanofluids to various types of industrial heat exchangers. Heating capacity, mass flow, heat exchanger surface area, LMTD and pumping power for nanofluids versus conventional heat transfer fluids.

UNIT- V:

Application to building heating and cooling Comparison of nanofluids performance with glycol solution in hydronic coils. Application to automobile radiators. Comparison of the performance of nanofluids under arctic and sub-arctic temperatures with glycol solutions. Introduction to electronic cooling in microchannels with nanofluids.

Course Outcomes: At the end of the course, the student will be able to:

1. Understand the types of nano fluids and the effect of volume concentration and temperature on thermo physical propertiesof nano fluids
2. Estimate thermal conductivity and specific heat of nanofluids.
3. Determine Nusselt number and friction factor of various nanofluids using correlations
4. Apply nano fluids in industrial heat exchanger and study their effect in obtaining higher thermal efficiency and saving energy
5. Apply nanofluids in heating and cooling processes

TEXT BOOKS:

1. Microscale and Nanoscale Heat Transfer by C. Sobhan and G. Peterson, First edition, CRC Press.
2. Handbook of Nanostructured Materials and Nanotechnology by H.S. Nalwa, I edition, Vol. I and II, American Scientific Publishers.
3. Springer Handbook of Nanotechnology by Bharat Bhushan, 1st edition, Springer-Verlag Publication

REFERENCE BOOKS:

1. https://nptel.ac.in/courses/112106222
2. Text book of Nano Science and Nano Technology by BS Murthy, P. Shankar, Universities Press.
3. Fluid Mechanics by F. M. White, 5th Edition, McGraw-Hill.
4. Heat Transfer by A. Bejan 2nd Edition, John Wiley

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE09) RESEARCH METHODOLOGY & IPR

M.Tech - I Year I Sem

L	T	P	C
2	0	0	2

Course Objectives:

- To understand the research problem
- To know the literature studies, plagiarism and ethics
- To get the knowledge about technical writing
- To analyze the nature of intellectual property rights and new developments
- To know the patent rights

UNIT-I:

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT-II:

Effective literature studies approaches, analysis, Plagiarism, Research ethics

UNIT-III:

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT-IV:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT-V:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent informationand databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

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

1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

TEXT BOOKS:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction".

REFERENCES:

1. https://nptel.ac.in/courses/121106007
2. https://iare.ac.in/sites/default/files/MTECH-CAD.CAM-R18-RM-IP-NOTES.pdf
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
5. Mayall, "Industrial Design", McGraw Hill, 1992.
6. Niebel, "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE10) ADVANCED THERMAL ENGINEERING LAB
(Lab – I)

M.Tech - I Year I Sem

L	T	P	C
0	0	4	2

Course Objective: To apply the laws of Thermodynamics to analyze thermodynamic systems experimentally and perform parametric analysis

List of Experiments:

1. Performance test and analysis of exhaust gases of an I.C. Engine.
2. Heat Balance sheet, Volumetric Efficiency and air fuel ratio estimation of an I.C. Engine.
3. Dryness fraction of steam.
4. COP estimation of vapour compression refrigeration test.
5. Analysis of air conditioning unit.
6. Performance analysis of flat plate collector.
7. Performance analysis of evacuative tube concentrator.
8. Flame propagation analysis of gaseous fuels.
9. Measuring physicochemical properties of petrol and diesel fuels.
10. Effect on the performance of diesel engine using 20% n-butanol blend with diesel.
11. Effect on the performance of petrol engine using 20% ethanol blend with gasoline.

Course Outcomes: At the end of the course, the student should be able to

- Apply the laws of Thermodynamics to analyze thermodynamic systems based on measured properties
- Infer from property charts and tables and to apply the data for the evaluation of performance parameters of thermodynamic systems
- Simulation and Performance Evaluation of Thermal and Fluid Flow Systems
- Apply concepts of heat transfer and alternative energy sources
- Analyze the quality of fuel through its properties

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE11) ADVANCED FLUID MECHANICS LAB
(Lab – II)

M.Tech - I Year I Sem

L	T	P	C
0	0	4	2

Prerequisites: Advanced Fluid Mechanics

Course Outcomes: At the end of the course, the student should be able to

- To identify the behavior of analytical models introduced in lecture to the actual behavior of real fluid flows.
- To explain the standard measurement techniques of fluid mechanics and their applications.
- To illustrate the students with the components and working principles of the Hydraulic machines-
- different types of Turbines, Pumps, and other miscellaneous hydraulics machines
- To analyze the laboratory measurements and to document the results in an appropriate format.

List of Experiments:

1. Jet impact on flat and curved surfaces
2. Measurement of drag on a circular cylinder in high Reynolds number flow
3. Measurement of fluid viscosity
4. Determination of friction factor as a function of Reynolds number in pipe flow
5. Measure the losses in piping System
6. Measure Friction loss along a pipe
7. Analysis of Pulsating flow setup
8. Flow Measuring Apparatus.
9. Flow through an Orifice.
10. Flow analysis over a 90˚ V-Notch Weir.
11. Performance evaluation of reciprocating pump.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE12) ADVANCED HEAT AND MASS TRANSFER
(Professional Core – III)

M.Tech - I Year II Sem

L	T	P	C
3	0	0	3

Pre-requisite: Thermodynamics

Course Objective: To apply the principles of heat transfer in the design of thermal systems

UNIT - I:

Introduction to Different Modes of Heat Transfer: Governing Laws and mathematical models -Initial and boundary conditions.

Heat Conduction – Development of Governing equation for 1D, 2D and 3D; steady and transient heat conduction – Solution of 1D steady state heat conduction – Composite Systems. Systems with heat generation – Variable thermal conductivity – Fins

2D Steady State Heat conduction – Use of conduction shape factors – Use of analytical method for temperature distribution in a slab for simple boundary conditions

UNIT - II:

Transient heat conduction: Lumped system analysis-Infinite Bodies - Heisler charts-semi infinite solid - 2D transient heat conduction using product solutions.

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 – Von Karman Integral Momentum and Energy Equations – Determination of laminar heat transfer coefficient for different velocity and temperature profiles for flow over a flat plate

UNIT - III:

External flows: Flow over a flat plate: Application of empirical relations to various geometries for laminar and turbulent flows.

Internal flows: Flow Classification based on hydrodynamic &thermal entry lengths- Fully developed flow: integral analysis for laminar heat transfer coefficient-constant wall temperature and constant heat flux boundary conditions-; use of empirical correlations for determination of heat transfer coefficient and friction factor for different types of internal flow applications.

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-Nusselt's 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 gray, non-gray 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.

Recent Advances in Heat and Mass Transfer Applications.

Course Outcomes: At the end of the course, the student should be able to

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

TEXT BOOKS:

1. Fundamentals of Heat Transfer by Incropera & Dewitt, John Wiley.
2. Heat Transfer by Necati Ozisik, TMH.
3. Heat Transfer: A Conceptual Approach by P K Sharma and K Rama Krishna.

REFERENCE BOOKS:

1. NOC:Heat transfer by Prof. Ganesh A. Viswanathan (IIT Bombay), NPTEL Course (Link: https://nptel.ac.in/courses/103/101/103101137/#)
2. 2. NOC:Convective Heat Transfer by Prof. Saptarshi Basu (IISc Bangalore), NPTEL Course (Link: https://nptel.ac.in/courses/112/108/112108246/)
3. Heat Transfer by Holman J.P, Mc Graw Hill Publication.
4. Heat Transfer by Gregory Nellis & Sanford Klein, Cambridge University Press.
5. Principals of Heat Transfer by Frank Kreith, Cengage Learning.
6. Introduction to Heat Transfer by SK Som, PHI.
7. Heat Transfer by Nellis & Klein, Cambridge University Press, 2012.
8. Engineering Heat & Mass Transfer by Sarit K. Das, Dhanpat Rai.
9. Heat Transfer by P. K. Nag, TMH.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE13) COMPUTATIONAL FLUID DYNAMICS
(Professional Core – IV)

M.Tech - I Year II Sem

L	T	P	C
3	0	0	3

Pre-requisite: Heat Transfer, Fluid Mechanics

Course Objective: To apply the principles of Heat Transfer and Fluid Mechanics to solve simple heat transfer and fluid flow problems using different numerical techniques

UNIT - I:

Review of Governing Equations in Heat Transfer and Fluid Flow: Conservation Laws – Differential Form of Equations – Characteristics of Governing Equations - Solution Methods: Analytical, Experimental and Numerical Methods – Review of Boundary Conditions

Introduction to Numerical Methods - Brief about Finite Difference, Finite Element and Finite Volume Methods – Solution of Linear Algebraic Equations – Direct and Iterative Approaches

Mathematical Behavior of Partial Differential Equations: Classification of Partial Differential Equations - Illustrations

Finite Difference Method: Taylor's series – Derivation of Finite Difference Formulae for Partial Derivative Terms - FD formulation of 1D Elliptic PDEs - 1D steady state heat transfer problems – Cartesian, cylindrical and spherical co-ordinate systems –- boundary conditions

UNIT - II:

Finite Difference Method: 2D Elliptic PDEs – 2D Steady State Heat Conduction Problems.

Parabolic PDEs - Transient heat conduction – Errors and Stability - Explicit Method – Stability Analysis – Implicit and Crank Nickolson method – 2-D Parabolic PDEs - Finite Difference formulation – ADI Method and explicit Method – Finite Difference Formulation of 1D Hyperbolic PDEs - Wave Equation

UNIT - III:

Finite Volume Method: Formation of Basic rules for Finite Volume approach – General Nodal Equation - Interface Thermal Conductivity -– Treatment of Source Term and Treatment of Nonlinearity.

Solution of 1D and 2D Elliptic PDEs - Heat conduction problems - Solution of 1D Parabolic PDEs – Explicit Method and Implicit Methods- Transient Heat conduction problems

UNIT - IV:

FVM to Convection and Diffusion: General Form of Governing Equations for Fluid Flow and Heat transfer - Burger's equation - Steady 1D Convection Diffusion – Discretization Schemes and their assessment – Treatment of Boundary Conditions

UNIT - V:

Calculation of Flow Field: Vorticity & Stream Function Method – Advantages and Disadvantages – Treatment of Boundary Conditions - Staggered Grid as Remedy for representation of Flow Field - Pressure Velocity Coupling - SIMPLE & SIMPLER (revised algorithm) Algorithms.

Compressible Flows: Introduction - Pressure, Velocity and Density Coupling.

Course Outcomes: At the end of the course, the student should be able to

- Differentiate between different types of Partial Differential Equations and to be able to apply appropriate numerical techniques
- Solve the simple heat transfer and fluid flow problems using different numerical techniques
- Understand and to appreciate the need for validation of numerical solution
- Improve the student's understanding of the basic principles of fluid mechanics
- : Improve the student's research and communication skills using a self-directed, detailed study of a complex fluid-flow problem and to communicate the results in written form

TEXT BOOKS:

1. Numerical heat transfer and fluid flow – S.V. Patankar (Hemisphere Pub. House)
2. An Introduction to Computational Fluid Dynamics – FVM Method – H.K. Versteeg, W. Malalasekhara (PHI)
3. Computational Fluid Flow and Heat Transfer by Muralidharan & Sundarajan (Narosa Pub)
4. Computational Fluid Dynamics and Heat Transfer by P. S. Ghoshdastidar, Centage Pub

REFERENCE BOOKS:

1. https://archive.nptel.ac.in/courses/112/107/112107079/
2. https://nptel.ac.in/courses/112105045
3. Computational Fluid Dynamics by Hoffman and Chiang, Engg Education System
4. Computational Fluid Dynamics by Anderson, TMH
5. Computational Methods for Fluid Dynamics by Ferziger, Peric, Springer
6. Computational Fluid Dynamics by T.J. Chung, Cambridge University
7. Computational Fluid Dynamics by A Practical Approach – Tu, Yeoh, Liu, Elsevier
8. Text Book of Fluid Dynamics by Frank Chorlton, CBS Publishers

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE14) FINITE ELEMENT ANALYSIS
(Professional Elective – III)

M.Tech - I Year II Sem

L	T	P	C
3	0	0	3

Prerequisite: Strength of Materials, Mathematics, Heat Transfer and Vibrations.

Course Objectives:

- To Introduce the basic concepts of the finite element method, the boundary element method
- To discuss the advantages and limitations of each method
- To Demonstrate the capabilities of each method on a variety of problems

UNIT– I:

One Dimensional Problems: Formulation of Stiffness Matrix for a Bar Element by the Principle of Minimum Potential Energy, Properties of Stiffness Matrix, Characteristics of Shape Functions, Quadratic shape functions.

Analysis of Trusses: Derivation of Stiffness Matrix for Trusses, Stress and strain Calculations, Calculation of reaction forces and displacements.

Analysis of Beams: Derivation of Stiffness matrix for two noded, two degrees of freedom per node beam element, Load Vector, Deflection, Stresses, Shear force and Bending moment, Problems on uniform and stepped beams for different types of loads applied on beams.

UNIT– II:

Finite element – formulation of 2D Problems: Derivation of Element stiffness matrix for two-dimensional CST Element, Derivation of shape functions for CST Element, Elasticity Equations, constitutive matrix formulation, Formulation of Gradient matrix. Two dimensional Isoparametric Elements and Numerical integration.

Finite element – formulation of 3D problems: Derivation of Element stiffness matrix for Tetrahedron Element, Properties of Shape functions for 3D Tetrahedral Element, Stress-Strain Analysis for 3D Element, Strain Displacement for Relationship Formulation.

UNIT– III:

Steady state heat transfer analysis: One Dimensional Finite Element analysis of fin and composite slabs.

Two-dimensional steady state heat transfer problems: Derivation of Thermal Stiffness matrix for 2D heat transfer problems-CST, Derivation of thermal force vector for 2D heat transfer problems.

Dynamic Analysis: Formulation of mass matrices for uniform bar and beam Elements using lumped and consistent mass methods, Evaluation of Eigen values and Eigen vectors for a stepped bar and beam Problems.

UNIT– IV:

Plate Bending: Introduction – Plate behavior – C^1 (Kirchhoff) Plate elements – C^0 (Mindlin) Plate elements - Mindlin beam – More devices for C^0 Plate elements – Boundary conditions - Analytical problems.

Nonlinear finite element of solids: Material Nonlinearities, objective rates, nonlinear elasticity, Plasticity, viscoplasticity, viscoelasticity

UNIT–V:

Boundary Element Method: Potential Problems: Introduction, boundary Element Approach-Fundamental solution. Numerical Implementation - Determination of Ci, Final Relation, Three-dimensional analysis, tackling kernel singularity.

Boundary Element Formulation for Electrostatic Problems: Introduction, Basic Relation-Boundary condition, other relations. Discretization and Matrix Formulation – Determination of term C(p)m.

Course outcomes: After completing this course, the student should be able to

- Understand the background of mathematical equations used for development of modeling software modules to develop the various structural related applications
- Identify mathematical model for solution of common engineering problems.
- Solve structural, thermal, fluid flow problems.
- Use professional-level finite element software to solve engineering problems in Solid mechanics, fluid mechanics and heat transfer.

TEXT BOOKS:

1. Finite and Boundary Element Methods in Engineering by O.P. Gupta, Oxford & IBH Publishing Co. Pvt. Ltd
2. The finite element methods in Engineering by S.S. Rao, Elsevier, 4th edition

REFERENCE BOOKS:

1. https://nptel.ac.in/courses/105105041
2. Finite Element Methods by Alavala, PHI.
3. Introduction to Finite Elements in Engineering by Tirupathi K. Chandrupatla and Ashok D. Belagundu.
4. An Introduction to Finite Element Methods by J. N. Reddy, Mc Graw hill
5. The Finite element method in engineering science by O.C. Zienkowitz, Mc Graw hill.
6. Concepts and Applications of Finite Element Analysis by Robert Cook, Wiley

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE15) OPTIMIZATION TECHNIQUES & APPLICATIONS
(Professional Elective – III)

M.Tech - I Year II Sem

L	T	P	C
3	0	0	3

Pre-requisites: Operations Research

Course Objectives: The main objectives of the course are:

- Numerical optimization techniques for single variable and multi variable non- linear optimization problems.
- Sensitivity analysis on LPP queuing
- Simulation of annexing problem & inventory problem.
- Geometry cutting plane method & branch bound method for linear IPP.
- Meaning of stochastic programming problem simple problems for finding mean variance of random variables chance constrained algorithm.
- Formulation of GP model and solving it using arithmetic geometric inequality theorem.
- State of art nontraditional optimization technique, namely genetic algorithm simulated annealing & particle swarm optimization.

UNIT- I:

Single Variable Non-Linear Unconstrained optimization: Elimination methods: Uni-Model function-its importance, Fibonacci method & Golden section method. Interpolation methods: Quadratic & Cubic interpolation methods.

UNIT- II:

Multi variable non-linear unconstrained optimization: Direct search methods – Univariant method, Pattern search methods – Powell's, Hook -Jeeves, Rosenbrock search methods. **Gradient methods:** Gradient of function& its importance, Steepest descent method, Conjugate direction methods: Fletcher- Reeves method & variable metric method.

UNIT- III:

Linear Programming – Formulation, Simplex method & Artificial variable optimization techniques: Big M & Two-Phase methods. Sensitivity analysis: Changes in the objective coefficients, constants& coefficients of the constraints. Addition of variables, constraints.
Simulation – Introduction – Types- steps – applications: inventory & queuing – Advantages and disadvantages

UNIT- IV:

Integer Programming- Introduction – formulation – Geometry 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 programming: Chance constrained algorithm.

UNIT- V:

Geometric Programming: Posynomials – Arithmetic - Geometric inequality – unconstrained G.P- constrained G.P (≤ type only)

Non-Traditional Optimization Algorithms: Genetics Algorithm-Working Principles, Similarities and Differences between Genetic Algorithm & Traditional Methods. Simulated Annealing- Working Principle- Simple Problems. Introduction to Particle Swarm Optimization (PSO) (very brief)

Course Outcomes: At the end of the course, the student is able to apply appropriate optimization techniques and solve.

- Based on the type of optimization problem like single variable or multivariable,
- Make sensitivity analysis to study effect of changes in parameters of LPP on the optimal solution without reworking.
- Simulate the system to estimate specified performance measures.
- Solve integer programming problem by either geometry cutting plane algorithm or branch band method.
- Apply chance constrained algorithm and solve stochastic linear programme.

TEXT BOOKS:

1. Optimization theory & Applications by S. S. Rao, New Age International.
2. Optimization for Engineering Design by Kalyanmoy Deb, PHI

REFERENCE BOOKS:

1. https://nptel.ac.in/courses/111105039
2. Operations Research by S. D. Sharma
3. Operation Research by H. A. Taha, TMH
4. Optimization in operations research by R. L Rardin
5. Optimization Techniques by Benugundu & Chandraputla, Pearson Asia.
6. Optimization Techniques theory and practice by M. C. Joshi & K. M. Moudgalya, Narosa Publications.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE16) UTILIZATION OF SOLAR ENERGY
(Professional Elective – III)

M.Tech - I Year II Sem

L	T	P	C
3	0	0	3

Course Objectives

- Understand basic terminology applicable to solar energy study
- Create Awareness on solar cells and PV technology
- Explore to solar instruments /devices for utilization of solar energy
- Discuss the utilization of solar energy in building and industry applications

UNIT- I:

Solar Radiation: Irradiation and Peak Sun Hours, Solar Radiation Data, Sun path Diagram, Defining the Position of the Sun, Sun Tracking, Solar Altitude, Geometric Effects, Tilting Solar Modules.

UNIT- II:

PV / Solar Cell and Solar Lighting: Introduction, Characteristics of a Solar Cell, Power Characteristics of a Solar Cell, Fill factor and Equivalent Solar cell Circuit, STC and NOCT, Factors Which Affect the Performance of Solar Cells, Types of Solar Cells, Different PV Technology, solar lanterns, home lighting systems, solar lanterns, solar PV pumps.

UNIT- III:

Solar thermal Applications: Solar collectors & its types-Flat plate, Concentrating solar collectors, Evacuated Tube Collector, advanced collectors and solar concentrators, Collector Efficiency, solar water heating System, solar cooking, solar drying, , solar thermal power generation.

UNIT- IV:

Solar Building Applications: Solar heating, cooling & its types, Active and Passive heating and cooling of buildings

UNIT- V:

Solar Storage & Industrial Applications: Solar Energy Storage, Industrial process heat systems, Low Temperature application

Course Outcomes: After successful completion of this course, students shall be able to;

- Understand and learn the basic knowledge of tracking the Sun for Solar Energy Utilization
- Explore to different techniques for Solar Energy Conversion into useful Energy i.e. Electrical Energy Thermal Energy etc.
- Explain the working of different Instruments/Devices used for Convert/Measuring Solar Energy
- Elaborate Designing concept of different Solar Thermal Devices for building applications i.e. Different Thermal Collectors, Their Orientations etc.
- Analyse the solar heating / cooling and storage concepts with regard to industrial Applications

TEXT BOOKS:

1. S. P. Sukhatme, Solar Energy - Principles of thermal collection and storage, second edition, Tata McGraw-Hil, New Delhi, 1996.
2. J. A. Duffie and W. A. Beckman, Solar Engineering of Thermal Processes, second edition, John Wiley, New York, 1991.

REFERENCE BOOKS:

1. https://nptel.ac.in/courses/115103123
2. D. Y. Goswami, F. Kreith and J. F. Kreider, Principles of Solar Engineering, Taylor and Francis, Philadelphia, 2000.
3. M. S. Sodha, N. K. Bansal, P. K. Bansal, A. Kumar and M. A. S. Malik, Solar Passive Building: science and design, Pergamon Press, New York, 1986.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE17) COGENERATION & WASTE HEAT RECOVERY SYSTEMS
(Professional Elective – IV)

M.Tech - I Year II Sem

L	T	P	C
3	0	0	3

Course Objectives:

- To detail on the importance of Total Energy Concept, its advantages, cost effectiveness
- To analyze the basic energy generation cycles
- To detail about the concept of cogeneration, its types and probable areas of applications
- To study the significance of waste heat recovery systems and carry out its economic analysis

UNIT - I:

Introduction – principles of thermodynamics – cycles – topping – bottoming – combined cycle – organic Rankine cycles – performance indices of cogeneration systems – waste heat recovery – sources and types - concept of tri generation.

UNIT - II:

Co-Generation Technologies: Configuration and thermodynamic performance – steam turbine co- generation systems – gas turbine cogeneration systems – reciprocating IC engines cogeneration systems - combined cycles cogeneration systems – advanced cogeneration systems: fuel cell, Stirling engines etc.,

UNIT - III:

Issues and Applications of Cogeneration Technologies: Cogeneration plants electrical interconnection issues – utility and cogeneration plant interconnection issues – applications of cogeneration in utility sector – industrial sector – building sector – rural sector – impacts of cogeneration plants – fuel, electricity and environment.

UNIT - IV:

Waste Heat Recovery Systems: Selection criteria for waste heat recovery technologies – recuperators – Regenerators – economizers – plate heat exchangers – thermic fluid heaters – Waste heat boilers – classification, location, service conditions, design Considerations – fluidized bed heat exchangers – heat pipe exchangers – heat pumps – sorption systems.

UNIT - V:

Economic Analysis: Investment cost – economic concepts – measures of economic performance – procedure for economic analysis – examples – procedure for optimized system

selection and design – load curves – sensitivity analysis – regulatory and financial frame work for cogeneration and waste heat recovery systems.

Course outcomes: The student can

- Explain the basics of cogeneration and Waste heat recovery
- Apply the concepts of Cogeneration technologies and functions of its components
- Analyse the issues and applications of Co-generation technologies
- Choose the appropriate criteria for waste heat recovery systems and its components
- Understand the Economic aspects of cogeneration and Waste heat recovery

TEXT BOOKS:

1. Charles H. Butler, Cogeneration, McGraw Hill Book Co.,
2. EDUCOGEN – The European Educational tool for cogeneration, Second Edition, 2001

REFERENCES:

1. https://nptel.ac.in/courses/112105221
2. Horlock JH, Cogeneration - Heat and Power, Thermodynamics and Economics, Oxford, 1987.
3. Institute of Fuel, London, Waste Heat Recovery, Chapman & Hall Publishers, London, 1963.
4. Seagate Subrata, Lee SS EDS, Waste Heat Utilization and Management, Hemisphere, Washington, 1983.
5. De Nevers, Noel, Air Pollution Control Engineering, Mc Graw Hill, New York, 1995.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE18) RENEWABLE ENERGY SOURCES
(Professional Elective – IV)

M.Tech - I Year II Sem

L	T	P	C
3	0	0	3

Prerequisites: Basics concepts of solar, wind, hydro, biomass, fuel cells and geothermal systems.

Course Objectives: The course is intended to

- To provide an introduction to energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternate energy sources and their technology and application.
- To explore society's present needs and future energy demands, examine conventional energy sources and systems, including fossil fuels and nuclear energy.
- To focus on alternate, renewable energy sources such as solar, biomass (conversions), wind power, geothermal, and hydro, Energy conservation methods.

UNIT - I:

Introduction: Overview of the course. Classification of energy resources, energy scenario in the world and India.

Basic sun-earth relationships: Definitions. Celestial sphere, altitude-azimuth, declination-hour angle and declination-right ascension coordinate systems for finding the position of the sun, celestial triangle and coordinates of the sun. Greenwich Mean Time, Indian Standard Time, Local Solar Time, sun rise and sun set times & day length. Numerical problems

Solar radiation: Nature of solar radiation, solar radiation spectrum, solar constant, extra-terrestrial radiation on a horizontal surface, attenuation of solar radiation, beam, diffuse and global radiation. Measurement of global, diffuse and beam radiation. Prediction of solar radiation; Angstrom model, Page model, Hottel's model, Liu and Jordan model etc. Insolation on an inclined surface, angle of incidence, Illustrative problems

UNIT - II:

Solar thermal systems: Principle of working of solar water heating systems, solar cookers, solar desalination systems, solar ponds, solar chimney power plant.

Solar concentrating collectors: Classification of solar concentrators, Basic definitions such as concentration ratio, angle of acceptance etc., Tracking of the sun; description of different tracking modes of a solar collectors and the determination of angle of incidence of insolation in different tracking modes. Illustrative problems

Photovoltaic energy conversion: Introduction. Single crystal silicon solar cell, i-v characteristics, effect of insolation and temperature on the performance of silicon cells. Different types of solar cells. Modern technological methods of producing these cells. Indian and world photovoltaic energy scenario.

UNIT - III:

Energy storage: Necessity for energy storage. Classification of methods of energy storage. Thermal energy storage; sensible heat storage, latent heat storage. Reversible chemical reaction storage.

Electromagnetic energy storage. Hydrogen energy storage. Chemical battery storage. Pumped hydel energy storage etc.

Wind energy: Origin of winds, nature of winds, wind data measurement, wind turbine types and their construction, wind-diesel hybrid system, environmental aspects, wind energy programme in India and the world.

UNIT - IV:

Ocean energy: Ocean thermal energy; open cycle & closed cycle OTEC plants, environmental impacts, challenges, present status of OTEC systems. Ocean tidal energy; single basin and double basin plants, their relative merits. Ocean wave energy; basics of ocean waves, different wave energy conversion devices, relative merits.

Fuel cells: Introduction, applications, classification, different types of fuel cells such as phosphoric acid fuel cell, alkaline fuel cell, PEM fuel cell, MC fuel cell. Development and performance fuel cells.

UNIT - V:

Biomass: Introduction, photosynthesis, biofuels, biomass resources, biomass conversion technologies, urban waste to energy conversion, biomass to ethanol conversion, biomass energy scenario in India.

Biogas: Biogas production, constant pressure and constant volume biogas plants, operational parameters of the biogas plant.

Geothermal energy: Origin, applications, types of geothermal resources, relative merits.

Course Outcomes: At the successful completion of course, the student is expected to have/be able to:

- Explain the main sources of energy including Solar energy and their primary applications in Global Context.
- Describe the challenges and problems associated with the use of solar energy sources and its Economic Evaluation
- Discuss significance of Wind energy systems and its components with basic working principles.
- Elaborate the sources of energy from waste by various means such as OTEC, Tidal energy etc.
- Narrate the importance and potential of geo thermal energy and MHD power generation

TEXT BOOKS:

1. Non-conventional Energy Resources by B. H. Khan, Tata McGraw Hill, New Delhi, 2012.
2. Energy Technology: Non-Conventional, Renewable and Conventional by S. Rao and B. B. Parulekar, Khanna Publishers, 2010.

REFERENCE BOOKS:

1. https://archive.nptel.ac.in/courses/121/106/121106014/
2. Solar Energy-Principles of Thermal Collection and Storage by S. P. Sukhatme and J. K. Nayak, TMH, 2008.
3. Solar Energy Thermal Processes by J. A. Duffie and W. A. Beckman, John Wiley, 2010.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE19) ENERGY CONSERVATION AND MANAGEMENT
(Professional Elective – IV)

M.Tech - I Year II Sem

L	T	P	C
3	0	0	3

Prerequisites: Environment Studies, Elements of Mechanical Engineering, Thermodynamics

Course Objectives:

- To understand the principles of energy conservation
- To understand thermal insulation & refractors.
- To know waste heat recovery systems.
- To gain knowledge about engineering economics.
- To impart knowledge Energy management programs.

UNIT - I:

Energy Conservation:

Rules for efficient energy conservation – technologies for energy conservation – outline of waste heat and material reclamation, load management, alternate energy sources, and energy storage.

UNIT - II:

Thermal Insulation:

Heat loss through un-insulated surfaces, effects of insulation on current carrying wires – economic thickness of insulation – critical radius of insulation –properties of thermal insulators classification of insulation materials – classification of refractors –properties of refractors – criteria for good refractory material – applications of insulating & refractory materials.

UNIT - III:

Waste Heat Recovery Systems:

Guideline to identify waste heat – feasibility study of waste heat – shell and tube heat exchanger – thermal wheel – heat pipe heat exchanger – heat pump – waste heat boilers – incinerators.

Heat Recovery Systems: Heat Exchanger Networks: Liquid to liquid heat exchangers – gas to liquid heat recovery systems, regenerators, recuperators, rotating regenerators – miscellaneous heat recovery methods – selection of materials for heat exchangers – combined radiation and convective heat exchanger, U tube heat exchanger, tube heat exchanger, fluidized bed heat exchanger – economizer.

UNIT - IV:

Engineering Economics:

Managerial objectives, steps in planning – efficiency of organization- capital budgeting – classification of costs – interest – types – nominal and effective interest rates – discrete and continuous compounding – discounting - time value of money – cash flow diagrams – present worth factor, capital recovery factor, equal annual payments – equivalent between cash flows. Energy Auditing: A definition – objectives – level of responsibility – control of energy – uses of energy – check lists – energy conservation schemes – energy index – cost index – pie charts – sankey diagrams – load profiles – types of energy audits – questionnaire – energy audit of industries – general energy audit – detailed energy audit – energy saving potential.

UNIT - V:

Project Management:

Method of investment appraisal – rate of return method, pay back method, net present value method (NPV) - adoption of the methods in energy conservation campaign – types of projects — propose of project management – classification – role and qualities of project manager – types of budgets - budget committee – budgeting.

Energy Management Programs: Necessary steps of energy management programme concepts of energy management – general principles of energy management – energy management in manufacturing and process industries – qualities and functions of energy managers – duties of energy manager - language of energy manager – checklist for top management.

Course Outcomes:

- Explain the basic concept of energy conservation and its role in energy management.
- Focus on thermal Insulation & refractors, classification and applications
- Discuss the energy conservation opportunities in the energy intensive industries by waste heat recovery system
- Analyze the quantum of electrical energy that can be saved by the use of energy efficient lighting systems and energy audit parameters
- Understand concept of Project management and energy management Programs

TEXT BOOKS:

1. Waste heat recovery systems -D.A. Reay/Pergmon Press
2. Energy Management -W.R. Murphy & G.Mickay, Butterworths

REFERENCE BOOKS:

1. https://nptel.ac.in/courses/112105221
2. https://sites.google.com/a/venusict.org/energy-conservation-and-management/ntpl-video-links
3. Energy Conservation -P.W.O’ Callaghan, Pargamon Press 1981
4. Engineering Heat Audits -C.P. Gupta & Rajendra Prakash, Nechand & Bros.
5. Hand book of energy audits -Albert Thumann, The F.Airmont Press Inc., Atlanta Georgia, 1979.
6. Energy Management Principles -Craig B. Smithm, Pergarmon Press

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE21) ADVANCED HEAT TRANSFER LAB

M.Tech - I Year II Sem

L	T	P	C
0	0	4	2

Prerequisites: Heat and Mass Transfer

Course Objective: To apply the principles of Heat Transfer to determine various Heat transfer and Fluid Flow Parameters

List of Experiments:

1. Determination of Thermal Conductivity of a Metal Rod.
2. Determination of thermal Conductivity of a thin disc.
3. Determination of Free Convective Heat Transfer Coefficient of air Using Vertical Rod
4. Determination of Forced Convective Heat Transfer Coefficient of air using Forced Convection Apparatus
5. Determination of Performance of a Heat Pipe
6. Determination of the effectiveness of Parallel and Counter Flow Heat Exchanger
7. Determination of Condensation Heat Transfer Coefficient under Film and Dropwise Condensation Conditions
8. Determination of Emissivity of Grey plate.
9. Determination of Stefan Boltzmann Constant.
10. Determination of critical heat flux.
11. Determine the rate of heat transfer through pin fin.

Course Outcomes: At the end of the course, the student should be able to

- Determine the thermal property of the solids using energy balance and also using unsteady state analysis
- Determine the heat transfer coefficient of air in free and force convective conditions
- Determine the performance of Recuperative Type heat exchangers
- Determine the drag acting on different surfaces and its effects on pumping power.
- Determine performance of thermal equipment like Heat Pipe

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE22) COMPUTATIONAL METHODS LAB

M.Tech - I Year II Sem

L	T	P	C
0	0	4	2

Prerequisites: Heat Transfer and Fluid Mechanics

Course Outcomes: At the end of the course, the student should be able to

- Solve the simple heat transfer and fluid flow problems
- Understand and to appreciate the need for validation of numerical solution
- Understand the Analysis of fluid flow on over curved surface.
- Understand the impact of temperature and other properties on the rate of heat transfer.
- Read and analyze the any type of results obtained through analytical study.

List of Experiments:

1. Simulation of Couette flow when the upper plate is moving with a velocity of 40 m/s. Take the distance between the plates as 4 cm. Properties of fluid are, v = 0.000217 m^3/s, p= 800 kg/m^3 Make simulations for a pressure gradient of 0-30000 $N/m^3/m$ and 20000 N/m/m and report the variation of velocity contours for each case.
2. Simulation of a channel flow (Tube flow) for a tube of diameter, 5 om and take the fluid as water at 30°C at the entry of the tube of length 0.7 m. A heat flux of 30000 W/m is imposed along the wall. Obtain the contours of velocity and temperature along the length of the tube and also obtain the centre line temperature and velocity of fluid.
3. Simulation of a channel flow (Tube flow) for a tube of diameter, 5 cm and take the fluid as water at 30ºC at the entry of the tube of length 07 m. A constant wall temperature of 300°C is imposed along the wall Obtain the contours of velocity and temperature along the length of the tube and also obtain the centre line temperature and velocity of fluid.
4. Unsteady simulation of compressible flow of air through 20 a convergent-divergent nozzle, with inlet and outlet of 0.2m size and both are joined by a throat section where the flow area is reduced by 10% and is of sinusoidal shape Air enters the nozzle at a pressure of 0.9 atm and leaves at 0.73 atm Obtain the contoure of velocity, preccure and Mach number
5. Simulation of flow over a circular cylinder of size 5 cm for different Reynold's number values of air and plotting the contours of velocity and vorticity
6. Simulation of temperature contours for a square plate of size 0.2m and subjected to different types of boundary conditions
7. Simulation of temperature contours for a pin fin subjected to natural and forced convective conditions.
8. Simulation of Natural convection with and without radiation inside an enclosure
9. Simulation of Lid driven cavity problem.
10. Structural analysis for beams and trusses

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE23) REFRIGERATION & HVAC
(Professional Elective – V)

M. TECH - II Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites: Thermodynamics

Course Objectives:

- Apply the principles of thermodynamics to analyze different types of refrigeration and HAV
- To understand the functionality of the major components of the refrigeration and HAV
- To apply the knowledge in effective refrigeration and HAV systems for better performances in real context
- Discuss the heating procedure by Air-conditioning process
- Explain the requirement of ventilation devices/processes

UNIT– I:

Vapor Compression Refrigeration: Performance of Complete vapor compression system. Actual Vs Ideal cycle - Effect of operating parameters on COP, 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, Liquefaction of gases, Hydrogen and Helium, 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: Psychometric properties and processes – Construction of Psychometric chart. Requirements of Comfort Air –conditioning – Thermodynamics of human body – Effective temperature and Comfort chart – Parameters influencing the Effective Temperature.
Heating Load Calculations: Summer/ winter heating load calculation-heat losses through structure-heat losses due to infiltration. Effects of solar radiation and internal heat sources on heating loads. Air Heating System: Classification - gravity warm heating system, forced warm air heating system balancing a warm air heating system, warm air furnaces, air cleaners, humidifiers & De-humidifiers

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.
Ventilation: Ventilation and Infiltration: Requirement of ventilation air, various sources of infiltration air, ventilation and infiltration as a part of cooling load. Fans and Blowers: Types, performance characteristics, series and parallel arrangement, selection procedure. Equipments and Controls: Chillers, Condensing units, cooling coils, bypass factors, humidifiers, and dehumidifiers

Course Outcomes:

- Differentiate between different types of refrigeration systems with respect to application as well as conventional & unconventional refrigeration systems.
- Analyse thermodynamically low temperature refrigeration and Vapour absorption refrigeration for evaluation of performance parameters.
- Apply the air refrigeration principles for different types of Air craft refrigeration systems
- Elaborate the principles of psychometrics to design the air conditioning heating /cooling loads for industrial applications.
- explain the requirement of ventilation air, various sources of infiltration air, ventilation and infiltration as a part of cooling load

TEXT BOOKS:

1. Refrigeration & Air Conditioning by C.P. Aurora, TMH
2. Refrigeration & Air Conditioning by Aurora & Domkundwar, Dhanpat Rai
3. Refrigeration and Air Conditioning by Manohar Prasad

REFERENCE BOOKS:

1. https://nptel.ac.in/courses/112105129
2. Basic Refrigeration & Air Conditioning by P.N. Ananthanarayanan, McGraw Hill
3. Refrigeration and Air Conditioning by Stoecker, Mc Graw Hill
4. Refrigeration and Air Conditioning by Dr. S.S. Thipse, Jaico
5. Refrigeration and Air Conditioning by Jordan& Preister, Prentice Hall
6. Refrigeration and Air Conditioning by Dossat, Mc Graw Hill

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE24) GAS DYNAMICS
(Professional Elective – V)

M. TECH - II Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives

- The basic concept and importance of gas dynamics
- Understand of the Isentropic and non-isentropic flows
- Interpret the flow pattern in flow and non-flow systems
- Awareness on two-dimensional flow and related parameters
- Explore to Unsteady wave motions

UNIT- I: Basic Concepts: Introduction to compressible flow, A brief review of thermodynamics and fluid mechanics, Integral forms of conversion equations, Differential conversion equations, Continuum Postulates, Acoustic speed and Mach number, Governing equation for compressible flows.

UNIT – II: One- dimensional compressible flow: One dimensional flow concepts, Isentropic flows, Stagnation/ Total conditions, Characteristics speeds of gas dynamics, Dynamic pressure and pressure coefficients, Normal Shock waves, Rankine-Hugonoit equations, Rayleigh flow, Fanno flow, Crocco' theorem.

UNIT – III: Quasi-one dimensional flows: Governing equations, Area velocity relations, Isentropic flow through variable-area ducts, Convergent divergent (or De Laval) nozzles, Over-expanded and under expanded nozzle, Diffusers.

UNIT- IV: Two- dimensional Flow: Oblique shock wave and its governing equations, e-B-M relations, The Hodograph and Shock polar, Supersonic flow over wedges and cones, Mach line, Attached and Detached shock, Reflection and Interaction of oblique shock waves, Supersonic flow over convex and concave corners, Approximation of continuous expansion waves by discrete waves.

UNIT- V: Unsteady wave motions: Moving normal shock waves, Reflected shock waves, Physical features of wave propagation, Elements of acoustic Thermal Engineering theory, Incident and reflected expansion waves, Finite compression waves, Shock tube relations.

Course Outcomes

- Explain basic concepts of gas dynamics and describe the basic fundamental equations of one- dimensional flow of compressible fluid and isentropic flow of an ideal gas.
- Analyze the steady one-dimensional is entropic flow, frictional flow and isothermal flow and express the concepts of steady one-dimensional flow with heat transfer.
- Discuss the effect of heat transfer on flow parameters while passing through nozzles and diffusers
- Describe the significance two-dimensional flow, impact of Shock waves etc.
- Infer the salient features of Unsteady wave motions, Incident and reflected expansion waves

REFERENCES:

1. https://nptel.ac.in/courses/112106166
2. Gas Dynamics-S.M. Yahya
3. Gas Dynamics- Radha Krishnan
4. Compressible Fluid Dynamic – B K Hodge, Keith Koenig, Pearson Publications, I edition
5. Gas Dynamics- Zucker.
6. Dynamics and Thermodynamics of compressible fluid flow (Vol.: I, II)-Ascher H.Shapiro
7. Elements of Gas dynamics -H. W. Liepmann, A. Roshko
8. Fundamentals of Gas Dynamics-V.Babu
9. Modern compressible flow – John.D. Anderson, Jr.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE25) EQUIPMENT DESIGN FOR THERMAL SYSTEMS
(Professional Elective – V)

M. TECH - II Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites: Advanced Heat and Mass Transfer

Course Objective: The course is intended to

- Design and analyze the heat exchangers parallel flow, counter flow, multipass and, crossflow heat exchanger
- Design and analyze the Shell and tube heat exchanger
- Enable to carry out the performance of heat exchanger with the extended surfaces.
- Design and analyze the cooling towers.

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 Tubular fin.

Basic Design Methods of Heat Exchanger: Introduction, Basic equations in design, Overall heat transfer coefficient, LMTD method for heat exchanger analysis, Parallel flow, 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 Exchangers, Heat pipe:

Cooling towers, relation between wet bulb &dew bulb temperatures, and calculation of cooling tower performance.

Heat Pipe: Gravity assisted thermo-syphons, micro heat pipes, pulsating heat pipes, loop heat pipe operation & working principles.

Course Outcomes: At the end of the course, the student will be able to:

- Understand the physics and the mathematical treatment of typical heat exchangers.
- Apply LMTD and Effectiveness methods in the design of heat exchangers and analyze the importance of LMTD approach over AMTD approach.
- Analyze the performance of double-pipe counter flow (hair-pin) heat exchangers.
- Design and analyze the shell and tube heat exchanger.
- Understand the fundamental, physical and mathematical aspects of boiling and condensation.

TEXT BOOKS:

1. Process Heat Transfer by D.Q.Kern, TMH
2. Heat Exchanger Design by A.P.Fraas and M.N.Ozisick, John Wiely &sons, New York.

REFERENCE BOOKS:

1. Heat Exchangers: Fundamentals and Design Analysis by Prof. Indranil Ghosh, IIT Kharagpur, NPTEL Course (Link: https://nptel.ac.in/courses/112/105/112105248/)
2. Cooling Towers by J.D.Gurney and I.A. Cotter, Maclaren.
3. Heat Pipe Science & Technology, Amir Faghri, Taylor & Francis.
4. Heat Pipe Technology and Applications by J.P Peterson, John wiky & sons.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22MB29) BUSINESS ANALYTICS
(Open Elective)

M. TECH - II Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: None

Course objectives:

- Understand the role of business analytics within an organization.
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with processes needed to develop, report, and analyze business data.
- Use decision-making tools/Operations research techniques.
- Mange business process using analytical and management tools.
- Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

UNIT- I:

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview.

UNIT- II:

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT- III:

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT- IV:

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting.

Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT- V:

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, the Value of Information, Utility and Decision Making. Recent Trends in Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Course Outcomes: At the end of the course,

1. Students will demonstrate knowledge of data analytics.
2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
4. Students will demonstrate the ability to translate data into clear, actionable insights.
5. Students can predict the requirement using forecasting technology.

TEXT BOOKS:

1. https://nptel.ac.in/courses/110105089
2. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
3. Business Analytics by James Evans, persons Education.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE29) WASTE TO ENERGY
(Open Elective)

M. TECH - II Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites: An introductory knowledge of solid and hazardous waste along with some basic understanding of solid waste management at industries

Course Objectives:

- To prepare the students for successful career in the energy industry, energy service companies, and energy utility and consultancy agencies and in the academic and R&D institutions.
- To produce graduates strong in understanding on energy resources, technologies and systems, energy management fundamentals, and capable in innovative technological intervention towards the present and potential future energy issues.
- To produce energy professionals, who are sensitive to, and well aware of, the energy issues and concerns, and who can apply their specialized knowledge for the sustainable development.

UNIT-I:

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste – MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT-II:

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal- Methods – Yields and application- Manufacture of pyrolytic oils and gases, yields and applications. **Biomass Gasification:** Gasifiers- Fixed bed system- Downdraft and updraft gasifiers- Fluidized bed gasifiers- Design, construction and operation- Gasifiers burner arrangement for thermal heating Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT-III:

Biomass Combustion: Biomass stoves- Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, Inclined grate combustors, Fluidized bed combustors, Design, construction and operation- Operation of all the above biomass combustors.

UNIT-IV:

Biogas: Properties of biogas (Calorific value and composition)- Biogas plant technology and status- Bio energy system – Design and constructional features- Biomass resources and their classification- BIO MASS CONVERSION PROCESS

UNIT-V:

Thermo chemical conversion – Direct combustion – biomass gasification- pyroloysis and liquefaction- biochemical conversion- anerobic digestion- Types of biogas Plants- Applications Alcohol production from biomass- Bio diesel production- Urban waste to energy conversion Biomass energy programme in India.

Course Outcomes:

- Understood and acquired fundamental knowledge on the science and engineering of energy technologies and systems.
- Acquired the expertise and skills required for energy auditing and management, economical calculation of energy cost, development, implementation, maintenance of energy systems.
- Become capable of analysis and design of energy conversion systems.
- Acquired skills in the scientific and technological communications and project preparation, planning and implementation of energy project.
- Understand and apply the different methods of thermochemical conversion.

TEXT BOOKS:

1. Non-Conversional Energy by Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology – A Practical Hand Book by Khandelwal, K.C and Mahdi, S.S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd, 1983.

REFERENCE BOOKS:

1. https://archive.nptel.ac.in/courses/103/107/103107125/
2. Food, Feed and Fuel from Biomass by Challal, D.S., IBH Publishing Co. Pvt. Ltd., 1991.
3. Biomass Conversion and Technology by C.Y. WereKo- Brobby and E.B. Hagan, John Wiley & Sons, 1996.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE30) BASICS OF REFRIGERATION SYSTEM
(Open Elective)

M. TECH - II Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

- To understand the principles of refrigeration.
- To understand different vapor Absorption systems.
- To know Aircraft Air refrigeration systems.
- To gain knowledge about refrigerants.
- Ozone depletion potential and global warming potential.

UNIT- I:

Vapor Compression Refrigeration: Analysis of vapor compression refrigeration cycle - reversed Carnot cycle for vapour - effect of suction temperature and condensing temperature on cycle performance – Practical refrigeration cycle – sub-cooled liquid and super-heated vapor refrigeration cycles their effect on performance. Multi Pressure Systems- removal of flash gas-intercooling –compound compression (conversion)-multi vapor systems- cascade systems-dual compression- system practices.

UNIT- II:

Simple vapor Absorption systems- actual vapor absorption cycle- representation of the cycle on H-C diagram- common refrigerant- (Absorbent)Adsorbent) systems. Practical single effect Water- Lithium Bromide Absorption system- double effect system Electrolux refrigerator-newer mixtures for absorption systems.

UNIT- III:

Aircraft Air refrigeration – Functions – working conditions – types. Steam jet water vapor systems- thermoelectric refrigeration systems - vortex refrigeration system - pulse tube refrigeration.

UNIT- IV:

Refrigerants: Desirable properties- thermo dynamic-chemical and transport properties - designation of refrigerants - inorganic, halo carbon refrigerants - secondary refrigerants - Properties of mixtures of refrigerants

UNIT- V:

Ozone depletion potential and global warming potential – effect of refrigerants- alternative refrigerants- newer refrigerants.

Course Outcomes: On successful completion of the course, the student will be able to:

- Illustrate the basic concepts of refrigeration system.
- Analyze the vapour compression cycle and interpret the usage of refrigerants.
- Explain the components of vapour absorption system.
- Demonstrate the use of refrigerants.
- Discuss the theory Ozone depletion potential and global warming potential.

TEXT BOOKS:

1. R & A/C by F. Stoecker & Jerold. W. Jones-MGH Intl., 1982.
2. R & A/C by C. P. Arora, TMGH -2000.

REFERENCE BOOKS:

1. https://nptel.ac.in/courses/112105128
2. R & A/C by Manohar Prasad.
3. Principles of Refrigeration by Roy. J. Dossat, 1997.
4. Refrigeration by Gosney- Oxford University Press-1980

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22TE31) INTRODUCTION TO THERMAL STORAGE SYSTEMS
(Open Elective)

M. TECH - II Year I Sem.

L	T	P	C
3	0	0	3

Course objectives:

- To Understand the Necessity of Thermal Storage – Types-Energy Storage Devices
- To Understand Sensible Heat Storage System.
- To Know Parallel Flow and Counter Flow Regenerators.
- To Gain Knowledge about specific areas of Application of Energy Storage.
- Latent Heat Storage Systems.

UNIT – I:

Introduction: Necessity of thermal storage – types-energy storage devices – comparison of energy storage technologies - seasonal thermal energy storage - storage materials.

UNIT – II:

Sensible Heat Storage System: Basic concepts and modeling of heat storage units - modeling of simple water and rock bed storage system – use of TRNSYS – pressurized water storage system for power plant applications – packed beds.

UNIT – III:

Regenerators: Parallel flow and counter flow regenerators – finite conductivity model – non – linear model– transient performance – step changes in inlet gas temperature – step changes in gas flow rate – parameterization of transient response – heat storage exchangers.

UNIT – IV:

Latent Heat Storage Systems: Modeling of phase change problems – temperature-based model - enthalpy model - porous medium approach - conduction dominated phase change – convection dominated phase change.

UNIT – V:

Applications: Specific areas of application of energy storage – food preservation – waste heat recovery – solar energy storage – green house heating – power plant applications – drying and heating for process industries.

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

- state the types-energy storage devices – comparison of energy storage technologies.
- Identify and describe Basic concepts and modeling of heat storage units - modeling of simple water and rock bed storage system.
- Explain at a level understandable by a non-technical person how various Parallel flow and counter flow regenerators.
- Calculate phase change problems.
- Explain greenhouse heating – power plant applications – drying and heating for process industries.

TEXT BOOK:

1. Ibrahim Dincer and Mark A. Rosen, Thermal Energy Storage Systems and Applications, John Wiley & Sons 2002.

REFERENCE BOOKS:

1. https://archive.nptel.ac.in/content/storage2/courses/112105050/m1l1.pdf
2. Schmidt. F. W and Willmott. A. J, Thermal Storage and Regeneration, Hemisphere Publishing Corporation, 1981.
3. Lunardini. V. J, Heat Transfer in Cold Climates, John Wiley and sons 1981.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22AC01) ENGLISH FOR RESEARCH PAPER WRITING
(Audit Course - I & II)

L	T	P	C
2	0	0	0

Prerequisite: None

Course objectives: Students will be able to:

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

UNIT-I:
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT-II:
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT-III:
Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT-IV:
key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

UNIT-V:
skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT-VI:
useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Course Objectives:

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title
- Ensure the good quality of paper at very first-time submission
- Apply correct style(s) of in-text citation and bibliography.

TEXT BOOKS/ REFERENCES:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.
5. https://nptel.ac.in/courses/110105091

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22AC02) DISASTER MANAGEMENT
(Audit Course - I & II)

L	T	P	C
2	0	0	0

Prerequisite: None

Course Objectives: Students will be able to

- learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- critically understand the strengths and weaknesses of disaster management approaches,
- planning and programming in different countries, particularly their home country or the countries they work in

UNIT-I:

Introduction:

Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT-II:

Repercussions of Disasters and Hazards:

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT-III:

Disaster Prone Areas In India:

Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

UNIT-IV:

Disaster Preparedness and Management:

Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT-V:

Risk Assessment Disaster Risk:

Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co- Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

UNIT-VI:

Disaster Mitigation:

Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

Course Objectives:

- Explain disaster management basics and theory (cycle, phases, risk, crisis, emergency, disasters, resilience)
- Compare hazards, disasters and associated natural phenomena and their interrelationships, causes and their effects developing humanitarian Assistance before and after disaster
- Compare anthropogenic hazards, disasters and associated activities and their interrelationships of the subsystems Green House Effect, Global warming, Causes and their effects and development of humanitarian assistance before and after disaster
- Apply knowledge about existing global frameworks and existing agreements and role of community in successful Disaster Risk Reduction
- Evaluate by conducting DM study including data search, analysis and presentation of a disaster case study

TEXT BOOKS/ REFERENCES:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, Pardeep Et. Al. (Eds.), "Disaster Mitigation Experiences and Reflections", Prentice Hall of India, New Delhi.
3. https://archive.nptel.ac.in/courses/105/104/105104183/
4. https://www.iare.ac.in/sites/default/files/lecture_notes/dm%20notes.pdf
5. Goel S. L., Disaster Administration and Management Text and Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22AC03) SANSKRIT FOR TECHNICAL KNOWLEDGE
(Audit Course - I & II)

L	T	P	C
2	0	0	0

Prerequisite: None

Course Objectives:
- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

UNIT-I:
Alphabets in Sanskrit,

UNIT-II:
Past/Present/Future Tense, Simple Sentences

UNIT-III:
Order, Introduction of roots,

UNIT-IV:
Technical information about Sanskrit Literature

UNIT-V:
Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Course Outcomes: Students will be able to
- Understanding basic Sanskrit language
- Ancient Sanskrit literature about science & technology can be understood
- Being a logical language will help to develop logic in students

TEXT BOOKS/ REFERENCES:
1. "Abhyaspustakam" – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22AC04) VALUE EDUCATION
(Audit Course - I & II)

L	T	P	C
2	0	0	0

Prerequisite: None

Course Objectives: Students will be able to
- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

UNIT-I:
Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements

UNIT-II:
Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline

UNIT-III:
Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline, Punctuality, Love and Kindness.

UNIT-IV:
Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

UNIT-V:
Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation, Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

Course outcomes: Students will be able to
- Knowledge of self-development
- Learn the importance of Human values
- Developing the overall personality

TEXT BOOKS/ REFERENCES:
1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22AC05) CONSTITUTION OF INDIA
(Audit Course - I & II)

L	T	P	C
2	0	0	0

Prerequisite: None

Course Objectives: Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT-I:
History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working)

UNIT-II:
Philosophy of the Indian Constitution: Preamble, Salient Features

UNIT-III:
Contours of Constitutional Rights & Duties: Fundamental Rights Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT-IV:
Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualification, Powers and Functions

UNIT-V:
Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT-VI:

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Course Outcomes: Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

TEXT BOOKS/ REFERENCES:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22AC06) PEDAGOGY STUDIES
(Audit Course - I & II)

L	T	P	C
2	0	0	0

Prerequisite: None

Course Objectives: Students will be able to:

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

UNIT-I:

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.

UNIT-II:

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT-III:

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the scho curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT-IV:

Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes

UNIT-V:

Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Course Outcomes: Students will be able to understand:

- What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

TEXT BOOKS/ REFERENCES:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, ‘learning to read’ campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22AC07) STRESS MANAGEMENT BY YOGA
(Audit Course - I & II)

L	T	P	C
2	0	0	0

Prerequisite: None

Course Objectives:
- To achieve overall health of body and mind
- To overcome stress

UNIT-I:
Definitions of Eight parts of yoga. (Ashtanga)

UNIT-II:
Yam and Niyam.

UNIT-III:
Do`s and Don't's in life.
i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT-IV:
Asan and Pranayam

UNIT-V:
i) Various yog poses and their benefits for mind & body
ii) Regularization of breathing techniques and its effects-Types of pranayam

Course Outcomes: Students will be able to:
- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

TEXT BOOKS/ REFERENCES:
1. 'Yogic Asanas for Group Tarining-Part-I": Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata
3. https://nptel.ac.in/courses/121105009

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M22AC08) PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS
(Audit Course - I & II)

L	T	P	C
2	0	0	0

Prerequisite: None

Course Objectives:

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

UNIT-I:

Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)

UNIT-II:

Neetisatakam-Holistic development of personality

- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

UNIT-III:

Approach to day to day work and duties.

- Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

UNIT-IV:

Statements of basic knowledge.

- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta:

UNIT-V:

- Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

Course Outcomes: Students will be able to

- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neetishatakam will help in developing versatile personality of students

TEXT BOOKS/ REFERENCES:

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.