BOS meeting held on 27-05-2025

Samrat Ashok Technological Institute (Engg. College) VIDISHA (M.P.)
(An Autonomous Institute Affiliated to RGPV, Bhopal)

**Departmental Electives (for batch admitted 2023-24) w.e.f. 2025-26**

**B Tech V -Sem**

| | |
|---|---|
| DE -IME-504(A) Energy Conversion Devices | ME-504(A) |
| (B) Power Plant Engineering | ME-504(B) |
| (C)Gas Dynamics | ME-504(C) |

**SAMRAT ASHOK TECHNOLOGICAL INSTITUTE**
**(Engineering College), VIDISHA M.P.**
**(An Autonomous Institute Affiliated to RGPV Bhopal)**
**Mechanical Engineering Department**

| Semester/Year | | V/III | Program | | | | B.Tech. | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Subject Category | DE-I | Subject Code: | OE-504 (A) | Subject Name: | | | Energy Conversion Devices | | | |
| | Maximum Marks Allotted | | | | | | Contact Hours | | | Total Credits |
| | Theory | | | Practical | | | Total Marks | | | |
| End Sem | Mid-Sem | Assignment | Quiz | End Sem | Lab-Work | Quiz | | L | T | P |
| 60 | 20 | 10 | 10 | 30 | 10 | 10 | 150 | 3 | 0 | 2 | 3 |

**Course Objective:** Students undergoing this course are expected to

- This course provides a simple understanding of the basic components of steam turbines, hydraulic turbines and the various combustion processes in spark-ignition (SI) and compression-ignition (CI) engines. The course contains Energy transfer in turbo machines, Steam turbines, water turbines, normal combustion and abnormal combustion of internal combustion engines.

**Course Outcomes:**

After completion of the course, students would be able to -

1. Understand the principles and application of Turbo Machines.
2. Analysis of steam turbine Machines.
3. Understand various types of hydraulic turbines and its applications.
4. Understand the Combustion phenomena and design for S.I. and C.I. Engines.
5. Understand the workings of various I.C. engine systems such as Fuel systems, and Lubrication systems.

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 3 | 3 | 3 | | | | | | 3 |
| CO2 | 3 | 3 | | 2 | 3 | 2 | | | | | | 3 |
| CO3 | 2 | 2 | 3 | | | 2 | | | | | | |
| CO4 | 3 | 1 | 2 | 1 | | 1 | 2 | | | | | 1 |
| CO5 | 2 | 3 | 3 | 2 | 2 | 3 | 1 | | | | | |

**Contents:**

| UNITs | Descriptions | Hrs. | CO's |
|---|---|---|---|
| I | **Energy transfer in turbo machines:** application of first and second laws of thermodynamics to turbo machines, moment of momentum equation and Euler turbine equation, principles of impulse and reaction machines, degree of reaction, energy equation for relative velocities, one dimensional analysis only. | 6 | 1 |
| II | **Steam turbines:** impulse staging, velocity and pressure compounding, utilization factor, analysis for optimum U.F Curtis stage, and Rateau stage, include qualitative analysis, effect of blade and nozzle losses on vane efficiency, stage efficiency, analysis for optimum efficiency, mass flow and blade height. | 9 | 2 |

| | | | |
|---|---|---|---|
| | **Reactions staging:** Parson's stages, degree of reaction, nozzle efficiency, velocity coefficient, stator efficiency, carry over efficiency, stage efficiency, vane efficiency, conditions for optimum efficiency, speed ratio, axial thrust, reheat factor in turbines, problem of radial equilibrium, free and forced vortex types of flow, flow with constant reaction, governing and performance characteristics of steam turbines. | | |
| III | **Water turbines:** Classification, Pelton, Francis and Kaplan turbines, vector diagrams and work-done, draft tubes, governing of water turbines.<br>**Centrifugal Pumps:** classification, advantage over reciprocating type, definition of mano-metric head, gross head, static head, vector diagram and work done.<br>**Performance and characteristics:** Application of dimensional analysis and similarity to water turbines and centrifugal pumps, unit and specific quantities, selection of machines, Hydraulic, volumetric, mechanical and overall efficiencies, Main and operating characteristics of the machines, cavitations. | 9 | 3 |
| IV | **Combustion in S.I. engines:**Flame development and propagation, ignition lag, effect of air density,temperature, engine speed, turbulence and ignition timings, physical and chemicaldetonation, effect of engine and fuel variables on knocking tendency, knock rating of volatile fuels,octane number, H.U.C.R., action of dopes, pre-ignition, its causes and remedy, salient features ofvarious type combustion chambers, valve timing and firing order, MPFI and its features | 8 | 4 |
| V | **Combustion in C.I. Engines:** Times base indicator diagrams and their study, various stages ofcombustion, delay period, diesel knock, octane number, knock inhibitors, salient features of varioustypes of combustion chambers,fuel, ignition, cooling, exhaust and lubrication systems; Simpleproblems on fuel injection, various types of engines, their classification and salient features. Rotary I.C. engines, their principles of working, CRDI and its features | 8 | 5 |
| **Guest Lectures (if any)** | | | |
| **Total Hours** | | 40 | |

**Suggestive list of experiments:**

1. Study of Steam Power Plant Model (Steam Engine with Boiler) working
2. Study of Impulse Turbine and Pure Reaction Turbine.
3. Performance of Pelton wheel turbine.
4. Performance of Francis turbine.
5. Performance of Kaplan turbine.
6. Study of Draft tubes.
7. Performance and analysis of four-stroke single-cylinder diesel engine test rig with electric dynamometer.
8. Performance and analysis of four-stroke four-cylinder petrol engine test rig with hydraulic dynamometer.
9. Load test in Ruston engine.
10. Load test in Variable compression ratio engine (VCR Engine ).

Text Books-


1. Kadambi V Manohar Prasad; An introduction to EC Vol. III-Turbo machinery; Wiley Eastern Delhi.
2. Turbo Machines by A ValanArasu
3. Internal Combustion Engines by V. Ganeshan
4. Internal Combustion Engines by R.K. Rajput

Reference Books-

1. Venkanna BK; Turbomachinery; PHI

2. Shepherd DG; Turbo machinery

3. Bansal R. K; Fluid Mechanics & Fluid Machines;

4. Kearton W. J; Steam Turbine: Theory & Practice

5. A course in I.C. engines by M.L. Mathur& R.P. Sharma

6. Internal Combustion Engines by Domkundwar, Dhanpat Rai Publications

| **Modes of Evaluation and Rubric** | |
|---|---|
| **There will be continuous evaluation for during the semester for 40 sessional marks and 60 semester End term Marks. Subjects where laboratory work is prescribed, the practical marks are 50, out of which 30 marks will be awarded for viva voce and 10 marks for lab work and 10 marks for quiz. Out of 40 sessional marks, 20 shall be awarded for Mid semester, 20 marks to be awarded for day to day performance and Quiz/Assignments. For the 60 Marks, there will be a semester – End examination as per the norms of AICTE.** | |
| **Recommendation by Board of studies on** | **Date: 27.05.2025** |
| **Approval by Academic council on** | **Date:** |
| **Compiled and designed by** | **Dr.KamleshKumar Sharma** |
| **Checkedby** | **Dr. Pankaj Agarwal** |

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**Mechanical Engineering Department**

| Semester/Year | | V/III | Program | | | | B.Tech. | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Subject Category | DE-I | Subject Code: | ME-504 (B) | Subject Name: | | | Power Plant Engineering | | | |
| | Maximum Marks Allotted | | | | | | | Contact Hours | | | Total Credits |
| | Theory | | | Practical | | | Total Marks | | | | |
| End Sem | Mid-Sem | Assignment | Quiz | End Sem | Lab-Work | Quiz | | L | T | P | |
| 60 | 20 | 10 | 10 | 30 | 10 | 10 | 150 | 3 | 0 | 2 | 4 |

**Prerequisites:(Only for open electives)**

**Course Objective:**

Power Plant Engineering basically focuses on power generation principles for real world applications, basic knowledge of Different types of Power Plants, site selection criteria of each one of them.Understanding of Thermal Power Plant Operation, Basic knowledge of Different types of Nuclear power plants , Power Plant Economicsetc.

**Course Outcomes:**

At the end of the course, the students will able to:
1. Describe and analyze different sources of energy, demand supply, and energy conversion cycle.
2. Understand and analyze the working layout of steam power plant, different systems of the plant, equipments.
3. Understand and analyze Nuclear Power Plant, Atomic Structure and Radioactivity, its components and safetyissues.
4. Understand and analyze Hydro power stations and related equipments and rainfall data.
5. Formulate and Solve problems on Power stations economics and rainfall data and storage.

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | 3 | | | | | | | | 1 |
| CO2 | 3 | 3 | 3 | 1 | 2 | 2 | 2 | | | | | 1 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | | | | 1 |
| CO4 | 3 | 2 | 2 | 3 | 3 | 3 | 1 | | | | | 1 |
| CO5 | 3 | | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 1 |

**Contents:**

| UNITs | Descriptions | Hrs. | CO's |
|---|---|---|---|
| I | Introduction:(A) Review of power development in India, Review of world an Indian energy situation in respect of demand, supply and resources in the histor context. Generalized energy conversion system: Primary and secondary energ source, their inter-convertibility. Introduction to methods of converting variou energy sources to electric power.<br>(B) Non Conventional energy sources, a review on non conventional energy conversions. new source of energy (e.g.) solar, wind, tidal, geothermal, bio- | 8 | 1 |

| | | | |
|---|---|---|---|
| | thermal, biogas and hybrid energy systems, fuel cells, thermoelectric modules, MHD-Converter. | | |
| II | Fossil fuel steam stations: Basic principles of site selection and station design, effect of climatic factors on station and equipment design, choice of steam cycle and main equipment, recent trends in turbine and boiler sizes and steam conditions, plant design and layout, outdoor and indoor plant, system components, fuel handling, burning systems, element of feed water treatment plant, condensing plant and circulating water systems, cooling towers, turbine room and auxiliary plant equipment, instrumentation, testing and plant heat balance. | 8 | 2 |
| III | Nuclear Power Station: Importance of nuclear power development in the world and Indian context, Review of atomic structure and radio activity, binding energy concept, fission and fusion reaction, fissionable and fertile materials, thermal neutron fission, important nuclear fuels, moderators and coolants, their relative merits, thermal and fast breeder reactors, principles of reactor control, safety and reliability features. | 8 | 3 |
| IV | Hydro-Power Station: Elements of Hydrological computations, rainfall run off, flow and power duration curves, mass curves, storage capacity, salient features of various types of hydro stations, component such as dams, spillways, intake systems, head works, pressure tunnels, penstocks, reservoir, balancing reservoirs, Micro and mini hydro machines, selection of hydraulic turbines for power stations, selection of site. | 8 | 4 |
| V | Power Station Economics: Estimation and prediction of load. Maximum demand, load factor, diversity factor, plant factor and their influence on plant design, operation and economics; comparison of hydro and nuclear power plants typical cost structures, simple problems on cost analysis, economic performance and tariffs, interconnected system and their advantages, elements of load dispatch in interconnected systems. | 8 | 5 |
| **Guest Lectures (if any)** | | | |
| **Total Hours** | | 40 | |

**Suggestive list of experiments:**

1.To make survey about need of energy in India.
2. To study about steam based power plant.
3. To study about gas turbine power plant.
4. To study about solar power plant.
5. To study about wind power plant.
6.To Study about the Various Types of Fuel & Ash Handling Systems
7. To study about nuclear power plant.
8. To study about economic analysis of power plants.

**Text and Reference Books-**

1- Nag PK; Power plant Engg; TMH
2- Al-Wakil MM; Power plant Technology; TMH
3- Sharma PC; Power plant Engg; Kataria and sons, delhi
4- Domkundwar; Power Plant Engg; Dhanpatrai& sons.
5- Rajput RK; A text book of Power plant Engg.; Laxmi Publications.
6- Yadav R; Steam and gas turbine and power plant

| Modes of Evaluation and Rubric | |
|---|---|
| There will be continuous evaluation for during the semester for 40 sessional marks and 60 semester End term Marks. Subjects where laboratory work is prescribed, the practical marks are 50, out of which 30 marks will be awarded for viva voce and 10 marks for lab work and 10 marks for quiz. Out of 40 sessional marks, 20 shall be awarded for Mid semester, 20 marks to be awarded for day to day performance and Quiz/Assignments. For the 60 Marks, there will be a semester – End examination as per the norms of AICTE. | |
| Recommendation by Board of studies on | Date: 27.05.2025 |
| Approval by Academic council on | Date: |
| Compiled and designed by | Dr.Kamlesh Kumar Sharma |
| Compiled by | Dr. Pankaj Agarwal |

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| Semester/Year | | V/III | Program | | B.Tech. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Subject Category | DE-I | Subject Code: | ME-504 (C) | Subject Name: | Gas Dynamics | | | | | |
| | Maximum Marks Allotted | | | | | | | Contact Hours | | | Total Credits |
| | Theory | | | Practical | | | Total Marks | | | | |
| End Sem | Mid-Sem | Assignment | Quiz | End Sem | Lab-Work | Quiz | | L | T | P | |
| 60 | 20 | 10 | 10 | 30 | 10 | 10 | 150 | 3 | 0 | 2 | 4 |

**Prerequisites:(Only for open electives)**

**Course Objective:**

This course provides the fundamentals of compressible fluid flow, emphasising a wide variety of steady, one-dimensional flow problems and a general understanding of the principles of multi-dimensional flow

**Course Outcomes:**

At the end of the course, the students will able to:
1. Solve flow equations for quasi one dimensional flow through variable area ducts.
2. Analyze the flow through constant area ducts with friction and heat transfer.
3. Analyze flows with normal and oblique shocks.
4. Solve flow problems with supersonic velocities using shock-expansion theory.
5. Design experimental setup.

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | 2 | 2 | | | | | 1 |
| CO2 | 3 | 3 | 3 | 1 | 2 | 2 | 2 | | | | | 1 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | | | | 1 |
| CO4 | 3 | 3 | 2 | 3 | 3 | 3 | 1 | | | | | 1 |
| CO5 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 1 |

**Contents:**

| UNITs | Descriptions | Hrs. | CO's |
|---|---|---|---|
| I | Introduction: Review of basic fluid dynamic and thermodynamic principles, Conservation equations for inviscid flows. | 8 | 1 |
| II | One Dimensional flow: One-dimensional wave motion, normal shock waves, Oblique shock waves, Prandtl-Meyer expansions and applications, Generalized one-dimensional flow | 8 | 2 |
| III | Nozzle Flow: Isentropic flow with area change, Flow with friction (Fanno flow), Flow with heat addition (Rayleigh flow), Method of characteristics (application to one-dimensional unsteady isentropic flow) | 8 | 3 |

| | | | |
|---|---|---|---|
| IV | Supersonic Flow: Velocity Potential Equation, Numerical Techniques for Steady Supersonic Flow, Time Marching Technique for Supersonic Blunt Bodies and Nozzles | 8 | 4 |
| V | Experimental setups: Shock Tubes, Compressible flow facilities, Measurement Techniques, Experiment Design | 8 | 5 |
| **Guest Lectures (if any)** | | | |
| **Total Hours** | | **40** | |

**Suggestive list of experiments:**

1) To study the energy equation for flow and non-flow process, significance of Mach number, Mach cone, Mach angle and various regions of flow.
2) To study the static and stagnation properties of compressible fluid in terms of Mach number and its effect on compressibility
3) To study the expansion in nozzle, compression in diffuser, variation of area ratio with Mach number and impulse function for the isentropic flow.
4) To study the effect of pressure ratio and isentropic flow through convergent, convergent-divergent nozzle and diffuser.
5) To study the different types of wind tunnels.
6) To study the development of shock wave, Rare fraction of wave and develop the Prandtl-Mayer equation for normal shock wave.
7) To study the effect of Mach number on static and stagnation properties across the normal shock.
8) To develop the governing equation for Fanno flow and its solution.
9) To study the variation of flow properties for Fanno flow.
10) To study the frictionless flow process with heat transfer in constant area duct and develop Rayleigh flow relations.

**Text Books-**

1. Balachandran P; Gas Dynamics for Engineers; PHI Learning
2. R. Yadav, Steam and Gas Turbines

**Reference Books-**

1. Mahesh M Rathore, Thermal Engineering, TMH
2. Anderson, J.D Jr., Modern Compressible Flows. Tata McGraw Hill, 2012.
3. Yahya, S.M., Fundamentals of Compressible Flow, New Age International Pub., 2013.
4. Zucrow, M., Gas Dynamics, Wiley India, 2013

**Modes of Evaluation and Rubric**

**There will be continuous evaluation for during the semester for 40 sessional marks and 60 semester End term Marks. Subjects where laboratory work is prescribed, the practical marks are 50, out of which 30 marks will be awarded for viva voce and 10 marks for lab work and 10 marks for quiz. Out of 40 sessional marks, 20 shall be awarded for Mid semester, 20 marks to be awarded for day to day performance and Quiz/Assignments. For the 60 Marks, there will be a semester – End examination as per the norms of AICTE.**

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