# E.G.S. PILLAY ENGINEERING COLLEGE

**(Autonomous)**

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai

Accredited by NAAC with 'A' Grade | Accredited by NBA (CSE, EEE, MECH)

NAGAPATTINAM – 611 002

## B.E MECHANICAL ENGINEERING

**Fourth Year – Eighth Semester**

| Course Code | Course Name | L | T | P | C | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | CA | ES | Total |
| **Theory Course** | | | | | | | | |
| | PC Elective IV | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| | PC Elective V | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| **Laboratory Course** | | | | | | | | |
| 1904ME851 | Project Viva Voce | 0 | 0 | 14 | 7 | 50 | 50 | 100 |

**L – Lecture | T – Tutorial | P – Practical | CA – Continuous Assessment | ES – End Semester**

| 1903ME021 | APPLIED HYDRAULICS AND PNEUMATICS (PC Elective IV) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

| MODULE I | FLUID POWER PRINICIPLES AND HYDRAULIC PUMPS | 9 Hours |
|---|---|---|

Introduction to Fluid power – Advantages and Applications – Fluid power systems – Types of fluids - Properties of fluids and selection – Basics of Hydraulics – Pascal's Law – Principles of flow - Friction loss – Work, Power and Torque Problems, Sources of Hydraulic power : Pumping Theory – Pump Classification – Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criteria of Linear and Rotary – Fixed and Variable displacement pumps – Problems.

| MODULE II | HYDRAULIC ACTUATORS AND CONTROL COMPONENTS | 9 Hours |
|---|---|---|

Hydraulic Actuators: Cylinders – Types and construction, Application, Hydraulic cushioning – Hydraulic motors - Control Components : Direction Control, Flow control and pressure control valves – Types, Construction and Operation – Servo and Proportional valves – Applications – Accessories : Reservoirs, Pressure Switches – Applications – Fluid Power ANSI Symbols – Problems.

| MODULE III | HYDRAULIC CIRCUITS AND SYSTEMS | 9 Hours |
|---|---|---|

Accumulators, Intensifiers, Industrial hydraulic circuits – Regenerative, Pump Unloading, Double- Pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-Safe, Speed Control, Hydrostatic transmission, Electro hydraulic circuits, Mechanical hydraulic servo systems.

| MODULE IV | PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS | 9 Hours |
|---|---|---|

Properties of air – Perfect Gas Laws – Compressor – Filters, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit – Cascade method – Electro Pneumatic System – Elements – Ladder diagram – Problems, Introduction to fluidics and pneumatic logic circuits.

| MODULE V | TROUBLE SHOOTING AND APPLICATIONS | 9 Hours |
|---|---|---|

Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems, Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications. Design of Pneumatic circuits for Pick and Place applications and tool handling in CNC Machine tools – Low cost Automation – Hydraulic and Pneumatic power packs.

**TOTAL: 45 HOURS**

**COURSE OUTCOMES:**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1:** | Define and explain the basic principles of Pneumatics and Hydraulics |
| **CO2:** | Perform the operating principles of pumps, valves and actuators, and their circuits. |
| **CO3:** | Design pneumatic and hydraulic circuits and predict the responses. |
| **CO4:** | Construct the working of different pneumatic circuits and systems |
| **CO5:** | Summarize the various trouble shooting methods and applications of hydraulic and pneumatic systems. |

**COs Vs POs MAPPING:**

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

**COs Vs PSOs MAPPING:**

| COs | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | | 1 | 2 |
| **CO2** | | 2 | 3 |
| **CO3** | | 2 | 3 |
| **CO4** | | 2 | 3 |
| **CO5** | | 2 | 3 |

**REFERENCES:**

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education 2005.
2. Majumdar S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata McGrawHill, 2001

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|---|
| 3. Anthony Lal, “Oil hydraulics in the service of industry”, Allied publishers, 1982. |
| 4. Dudelyt, A. Pease and John T. Pippenger, “Basic Fluid Power”, Prentice Hall, 1987. |
| 5. Majumdar S.R., “Pneumatic systems – Principles and maintenance”, Tata McGraw Hill, 1995 |
| 6. Michael J, Prinches and Ashby J. G, “Power Hydraulics”, Prentice Hall, 1989. |
| 7. Shanmugasundaram.K, “Hydraulic and Pneumatic controls”, Chand & Co, 2006. |

| 1903ME013 | POWERPLANTENGINEERING (PC Elective V) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

| MODULE I | COAL BASED THERMAL POWER PLANTS | 9 Hours |
|---|---|---|

Layout of Steam power plant - Components, Selection. Steam Boilers and Cycles - High Pressure and Super Critical Boilers, Fluidized Bed Boilers. Fuel and Ash Handling - Combustion Equipment for burning coal, Mechanical Stokers, Pulveriser, Electrostatic Precipitator, and Mechanical Collectors. Draught - different types. Surface Condenser types. Cooling Towers. Pollution controls.

| MODULE II | DIESEL AND GAS TURBINE POWER PLANTS | 9 Hours |
|---|---|---|

Layout of Diesel Power Plant - Components, Selection of Engine Type, applications. Gas Turbine Power Plant - Layout, Fuels, Gas Turbine Material. Open and Closed Cycles - Reheating, Regeneration and Intercooling - Integrated Gasifier based Combined Cycle systems

| MODULE III | NUCLEAR POWER PLANTS | 9 Hours |
|---|---|---|

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium-Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

| MODULE IV | POWER FROM RENEWABLE ENERGY | 9 Hours |
|---|---|---|

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, Solar Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems

| MODULE V | ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS | 9 Hours |
|---|---|---|

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

**TOTAL: 45 HOURS**

**COURSE OUTCOMES:**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1:** | Understand and acquire knowledge about basics of Power plants and Boiler functions |
| **CO2:** | Know the functions and components of the Diesel and gas turbine Power plants and its components |
| **CO3:** | Know the functions and components of the of Nuclear Power plants. |
| **CO4:** | Know the functions and components of renewable energy resources power plants such as Geothermal Plant, Ocean Thermal Plant, Hydel Plant, Solar |
| **CO5:** | Gain the knowledge about Energy and economics associated with Power plants and its components |

**COs Vs POs MAPPING:**

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

**COs Vs PSOs MAPPING:**

| COs | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | | 3 | |
| **CO2** | | 3 | |
| **CO3** | | 3 | |
| **CO4** | | 2 | |
| **CO5** | | 2 | |

**REFERENCES:**

1. S. C. Arora, S. Domkundwar, A course in Power Plant Engineering, Dhanpatrai& Sons, New Delhi,2008.
2. K.K. Ramalingam, Power Plant Engineering, Scitech Publications (India) Private Limited, 2002

3. P. K. Nag, Power plant Engineering, Tata McGraw Hill Company Private Limited, New Delhi, 2014.
4. G. R. Nagpal, Power Plant Engineering, Khanna Publishers, New Delhi,2002.
5. G. D. Rai, Introduction to Power Plant Technology, Khanna Publishers, New Delhi,2013
6. http://nptel.ac.in/courses/108105058/8

| 1903ME016 | RENEWABLE ENERGY SOURCES (PC Elective V) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

| MODULE I | INTRODUCTION | 9 Hours |
|---|---|---|

World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilisation – Renewable Energy Scenario in Tamilnadu, India and around the World – Potentials - Achievements /Applications – Economics of renewable energy systems.

| MODULE II | SOLAR ENERGY | 9 Hours |
|---|---|---|

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

| MODULE III | WIND ENERGY | 9 Hours |
|---|---|---|

Wind Data and Energy Estimation – Types of Wind Energy Systems – Performance – Site Selection – Details of Wind Turbine Generator – Safety and Environmental Aspects

| MODULE IV | BIO – ENERGY | 9 Hours |
|---|---|---|

Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters – Ethanol production –Bio diesel – Cogeneration - Biomass Applications

| MODULE V | OTHER RENEWABLE ENERGY SOURCES | 9 Hours |
|---|---|---|

Tidal energy – Wave Energy – Open and Closed OTEC Cycles – Small Hydro-Geothermal Energy –Hydrogen and Storage - Fuel Cell Systems – Hybrid Systems.

**FOR FURTHER READING – SEMINAR – CBS**

Solar pond ,types of pv panels, Thermal energy storage materials, Renewable energy harvesting by nanomaterials

**TOTAL: 45 HOURS**

**COURSE OUTCOMES:**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1:** | Understand the necessity of renewable energy sources and its potential in and around the world. |
| **CO2:** | Explain the concept of the various methods of solar thermal energy conversion system and Photovoltaic system |
| **CO3:** | To study about the potential and energy conversion process of Wind Energy . |
| **CO4:** | Explain bio gas sources, generation and its impact on environment. |
| **CO5:** | To impart fundamental knowledge about Ocean Thermal Energy and Geothermal Energy. |

**COs Vs POs MAPPING:**

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

**COs Vs PSOs MAPPING:**

| COs | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| CO1 | | | |
| CO2 | 2 | | |
| CO3 | | | |
| CO4 | | | |
| CO5 | | | |

**REFERENCES:**

1. Rai. G.D., “Non Conventional Energy Sources”, Khanna Publishers, New Delhi, 2018.
2. Twidell, J.W. & Weir, A.,“Renewable Energy Sources”, EFN Spon Ltd., UK, second edition
3. Boyle, Godfrey. 2004. “Renewable Energy (2nd edition)”. Oxford University Press.
4. J A Duffie and W A Beckman“Solar Engineering of Thermal Processes” 3rdedition
4. Sukhatme, Suhas P., and J. K. Nayak. “Solar energy”,McGraw-Hill Education, 2017.

| 1904ME851 | PROJECT VIVA VOCE | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 14 | 7 |

**GUIDELINE FOR REVIEW AND EVALUATION**

The students may be grouped into 2 to 4 and work under a project supervisor. The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department

**COURSE OUTCOMES:**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1:** | Identify the real world problems |
| **CO2:** | Develop design methodologies and its implementation |
| **CO3:** | Work as a responsible member and possibly a leader of a team in developing software engineering |
| **CO4:** | Express ideas and thoughts in oral setting and prepare technical reports |
| **CO5:** | Participate in and possibly moderate, discussions that lead to making decisions |
| **CO6:** | Evaluate the cost, environmental, safety, and ethical aspects in civil engineering projects. |

**COs Vs POs MAPPING:**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO6** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**COs Vs PSOs MAPPING:**

| COs | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 |
| **CO6** | 3 | 3 | 3 |