	Information of every subject	
1	Unit name:	-Engineering Thermodynamics
2	Code:	ME-31013
3	Classification:	Engineering subject
4	Credit value:	2.5
5	Semester/ Year Offered:	1/2
6	Pre-requisite:	
7	Mode of delivery:	Lecture, Practical, Tutorial, Viva
8	Practical	20%
	Tutorials	5%
	Viva	5%
	Mid-term/ final Examination	35% / 35%
9	Academic staff teaching unit:	
10	Course outcome of unit: In this course, students will be able **Semester (I)** a. To calculate the expressions for the thermal efficiencies and coefficients of performance for reversible heat engines, heat pumps and refrigerators. b. To apply the entropy changes that take place during processes for pure substances, incompressible substances and ideal gases. c. To calculate the thermal efficiency, quality of steam, mass flow rate of steam, heat supply, heat rejected and pump work. **Semester (II)** d. To apply the fuel chemistry, combustion equations, air fuel ratio, percent theoretical air and flue gas. e. To calculate the free- air -delivery, volumetric efficiency, actual and isothermal work done per cycle and isothermal efficiency. f. To explain heat and mass balance of the steam generator. g. To calculate the power, work done, tangential thrust, axial thrust on the blade and efficiency of steam turbine.	
11	Synopsis of unit: This unit deals with the relationship between the thermodynamic and transport	

	properties of pure substances and a discussion of some basic concepts such as closed and open systems, isolated and adiabatic systems, working substance, continuum, property state, path, process, cycle, equilibrium, pressure and temperature.
12	Topic: **Semester (I)** 6 SECOND LAW OF THERMODYNAMICS 6.1 Limitations of the first law of Thermodynamics 6.2 Thermal Reservoir 6.3 Heat Engine 6.4 Refrigerator 6.5 Heat Pump 6.6 Statements of the Second Law of Thermodynamics 6.6.1 Kelvin-Planck Statement 6.6.2 Clausius Statement 6.6.3 Equivalence of two statements 6.7 Perpetual motion machine of the second kind 6.8 Reversible process; ideal process 6.9 Irreversible process; actual processes 6.10 Carnot Cycle,(or) Carnot Engine 6.11 Reversed Carnot Cycle 6.12 Carnot Theorem 6.13 Thermodynamic temperature scale 6.13.1 The Carnot Refrigerator and Heat Pump 6.13.2 Effect of Temperature T_H and T_L on efficiency of Carnot Cycle 7 Entropy 7.1 Definition 7.2 Two Isentropic Lines cannot intersect each other 7.3 Clausius' Theorem 7.4 Clausius; Inequility 7.5 Entropy; A Property of the System 7.6 Change of the Entropy in a Reversible Process 7.7 Temperature Entropy Diagram 7.8 The Increase of Entropy Principle

	12.12.2 Regeneration with Open Feed Water Heater 12.12.3 Carnotisation of Rankine Cycle 12.12.4 Regeneration with Closed Feed Water Heater 12.12.5 Regeneration with Multiple Feed Water Heaters 12.12.6 Advantages and Disadvantages of Regenerative Cycle over simple Rankine Cycle 12.13 Modified Rankine Cycle 12.14 Characteristics of the working fluid in Vapour Power Cycle 12.15 Cogeneration 12.16 Binary Vapour Cycle 12.17 Combined Gas-Vapour Power Cycle **Semester (II)** 25 Reciprocating Air Compressor 25.1 Uses of Compressed Air 25.2 Classification 25.3 Reciprocating Compressor Terminology 25.4 Compressed Air Systems 25.5 Reciprocating Air Compressor 25.6 Minimizing Compression Work 25.7 Clearance Volume in a Compressor 25.8 Actual Indicator Diagram 25.9 Volumetric Efficiency 25.10 Free Air Delivery (FAD) 25.11 Limitations of Single-Stage Compression 25.12 Multistage Compression 25.13 Cylinder Dimensions of a Multistage Compressor 17 Steam Generators 17.1 Indian Boiler Regulation (IBR) 17.2 Boiler Systems 17.2.1 Classification of Boilers 17.2.2 Principal Parts and their Functions 17.2.3 Characteristics of a Good Boiler 17.2.4 Factors Affecting the Selection of Boilers

- 17.3 Comparison between Fire Tube and Water Tube Boilers
- 17.4 Fire-Tube Boilers
  - 17.4.1 Simple Vertical Boiler
  - 17.4.2 Cochran Boiler
  - 17.4.3 Lancashire Boiler
  - 17.4.4 Cornish Boiler
  - 17.4.5 Locomotive Boiler
  - 17.4.6 Scotch Marine Boiler
- 17.5 Water Tube Boilers
  - 17.5.1 Babcock and Wilcox Boiler
  - 17.5.2 Stirling Boiler
- 17.6 Some Industrial Boilers
  - 17.6.1 Packaged Boiler
  - 17.6.2 Pulverized Fuel Boiler
  - 17.6.3 Fluidised Bed Combustion Boiler
  - 17.6.4 Supercharged Boiler
- 17.7 High-Pressure Boiler
  - 17.7.1 Features of High Pressure Boilers
  - 17.7.2 Advantages of High-Pressure Boiler
  - 17.7.3 La Mont Boiler
  - 17.7.4 Loeffler Boiler
  - 17.7.5 Velox Boiler
  - 17.7.6 Benson Boiler
  - 17.7.7 Ramsin Boiler
  - 17.7.8 Supercritical Boiler

22 Steam Turbines

- 22.1 History of Steam Turbines
- 22.2 Working Principle of a Steam Turbine
- 22.3 Classification of Steam Turbines
- 22.4 The Simple Impulse Turbine
- 22.5 Optimum Operating Conditions from Blade –Velocity Diagram
- 22.6 Effect of Blade Friction on Velocity Diagram
- 22.7 Condition for Axial Discharge

	22.8 Compounding of Impulse Turbine 22.9 Reaction Turbine (Impulse Reaction Turbine) 22.10 Comparison between Impulse and Reaction Turbines 22.11 Losses in Steam Turbines 22.12 Governing of Steam Turbine 22.13 Special Forms of Turbines 16 Fuels and Combustion 16.1 Fuels 16.2 Characteristic of an Ideal Fuel 16.3 Coal 16.4 Liquid Fuels 16.5 Gaseous Fuel 16.6 Conversion of Volumetric Analysis to Gravimetric Analysis 16.7 Conversion of Gravimetric Analysis to Volumetric Analysis 16.8 Combustion 16.9 Composition of Dry Air 16.10 Amount of Air Required for Combustion 16.11 Air-Fuel Ratio 16.12 Air-Fuel Ratio from Analysis of Fuel Gases 16.13 Flue Gas Analysis- Orsat Apparatus 16.14 Heat Generated by Combustion 16.15 Calorific Value, or Heating Value of Fuel 16.16 Bomb Calorimeter
14	Main references: "Thermal Engineering" by MAHESH M RATHORE
15	Additional references: Thermodynamics An Engineering Approach Yunus A.Cengel Michael A.Boles Basic And Applied Thermodynamics Second Edition