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Branch	Mechanical Engineering	Semester	III
Course Code	302	Course Name	THERMAL ENGINEERING

Course Outcome 1	Explain renewable sources of energy	Teach. Hrs	Marks
Learning Outcome 1	Classify renewable and non-renewable energy sources.	2	3
Contents	Definition and Classification of energy sources- Renewable and Non-Renewable, Examples of renewable and non renewable sources.		
Method of Assessment	Paper-Pen Test (Part of Prg 1)		
Learning Outcome 2	Sketch the schematic diagram of solar, bio-gas, tidal, geothermal power generation.	8	10
Contents	Flat plate and concentrating solar collectors, their application. Photovoltaic Cell, Solar Distillation system, solar cooker. Wind energy horizontal and vertical wind mill, site selection for wind energy power plants, introduction to Tidal energy, Geothermal energy, Biogas energy, Bio-gas plant.		
Method of Assessment	Theory Exam		
Learning Outcome 3	Identify components of Solar systems	9	8
Contents	Demonstration of components of Flat plate and concentrating solar collectors. Photovoltaic Cell, Solar Distillation system, solar cooker.		
Method of Assessment	Laboratory Test by Observation (Part of LW)		
Course Outcome 2	Solve simple problems based on basic concepts of thermodynamics, and its laws.	Teach Hrs	Marks
Learning Outcome 1	Explain thermodynamic systems, properties, processes, cycles, gas equation and modes of heat transfer.	6	7
Contents	Concept of thermodynamic System– definition, classification and applications, State, processes, cycles, Properties- Intensive and Extensive with examples, Point and Path function, Concept of Work and Heat, Definitions: Enthalpy, Internal energy, Entropy, Specific heat at constant pressure (C_p), specific heat at constant volume (C_v), relation between C_p & C_v, characteristic gas equation, Universal gas constant, Definition of quasi-static process, flow work, Modes of Heat transfer - definition and types.		
Method of Assessment	Paper-Pen Test (Part of Prg 1)		
Learning Outcome 2	Solve given problems based on thermodynamic systems, properties and gas equation.	4	10
Contents	Numerical problems based on Thermodynamic System, Properties, gas equation.		

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Method of Assessment	Theory Exam		
Learning Outcome 3	Solve given problems based on the laws of thermodynamics.	8	10
Contents	Laws of thermodynamics- Zeroth law, concept of work and heat, statement of first law- internal energy, enthalpy, relationship between heat transfer, work transfer and change in internal energy, Concept of conservation of mass and control volume, Steady and steady flow energy equation (without proof). Limitation of first law. Second law – Clausius and Kelvin-Planck Statements, concept of heat pump, refrigerator, heat engine, thermal efficiency , COP, reversible process, factors which make a process irreversible, Carnot cycle, its efficiency and limitation, Clausius inequality, entropy		
Method of Assessment	Theory Exam		
Course Outcome 3	Solve numerical problems based on thermodynamic processes, air standard cycles.	Teach. Hrs	Marks
Learning Outcome 1	Compare thermodynamic processes, air standard cycle using P-V and T-S diagram.	8	10
Contents	Thermodynamic processes- Definition, classification and representation on P-V and T-S diagram for Constant pressure, Constant volume, Constant Temperature, Adiabatic, Polytropic, throttling processes. Thermodynamic cycle – definition, classification- reversible and irreversible cycles, Air Standard Cycles: Carnot cycle, Otto Cycle, Diesel Cycle, Dual Cycle, their representation on P-V and T-S diagrams		
Method of Assessment	Paper-Pen Test (TW)		
Learning Outcome 2	Calculate mean effective pressure, work done, efficiency for a given Air Standard cycle.	7	10
Contents	Problems on calculation of work done, change in internal energy, heat transfer, change in entropy for thermodynamic processes. Problems on calculation of Mean Effective Pressure, work done, air standard efficiency for Air Standard cycle.		
Method of Assessment	Theory Exam		
Course Outcome 4	Explain steam generation processes, steam generators.	Teach. Hrs	Marks
Learning Outcome 1	Solve given problems based on thermodynamic properties of steam.	9	10

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Contents	Two Phase System: Pure substance, steam as a two phase system, its representation on P-V, T-S plane for isobaric, isochoric, isothermal, isentropic, polytrophic, throttling process, dryness fraction of steam, methods of determination of dryness fraction separating and throttling calorimeter. Steam tables, Mollier's diagram and its uses for calculation of changes in properties of steam such as enthalpy, internal energy, entropy; heat, work in various processes.		
Method of Assessment	Paper-Pen Test (Part of Prg 2)		
Learning Outcome 2	Determine dryness fraction using throttling, separating calorimeters.	6	12
Contents	Experimental determination of dryness fraction using separating, throttling calorimeter.		
Method of Assessment	Laboratory Test by Observation (Part of LW)		
Learning Outcome 3	Explain construction, working of a given steam generator.	9	10
Contents	Steam Generator- Definition, classification, construction, working, mountings and accessories of (a) low pressure boilers- Babcock and Wilcox boiler, Lancashire boiler (b) high pressure boilers - La-Mont, Velox boiler.		
Method of Assessment	Theory Exam		
Learning Outcome 4	Identify components, mountings, accessories of a given steam generator.	24	18
Contents	Demonstration of steam generator components, mountings and accessories.		
Method of Assessment	Laboratory Test by Observation (Part of Practical Exam)		
Course Outcome 5	Explain steam nozzles, steam turbines, steam condensers.	Teach. Hrs	Marks
Learning Outcome 1	Explain construction, working of steam nozzle, steam turbine, steam condenser.	10	10
Contents	Steam nozzle- construction, working Flow of steam through convergent-divergent nozzle Steam turbine –classification, construction, working principle with line diagram of a Impulse turbine-De Laval turbine, reaction turbine-Parsons turbine, velocity diagram of impulse, reaction turbine. Compounding of turbines. Pressure compounding, velocity compounding, pressure-velocity compounding Steam condenser- classification construction and working.		

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Method of Assessment	Theory Exam		

Learning Outcome 2	Solve given problems based on discharge and area of nozzle.	4	10
Contents	Flow of steam through convergent-divergent nozzle, Friction in a nozzle, Discharge of steam through nozzles, Critical pressure ratio (no derivation), Calculation of cross sectional areas at throat and exit for maximum discharge.(simple problems)		
Method of Assessment	Theory Exam		
Learning Outcome 3	Identify components of D- Laval and Parsons Turbine.	6	12
Contents	Demonstration of the components of De-Laval and Parsons steam turbine.		
Method of Assessment	Laboratory Test by Observation (Part of Practical Exam)		