

32141 – THERMAL ENGINEERING

DETAILED SYLLABUS

I Thermodynamics :

Definition – fundamental units – derived units – SI units – Laws of motion – Newtons first law of motion - Newtons second law of motion – Newtons third law of motion – mass and weight – pressure – gauge and absolute pressure – temperature – absolute temperature – heat – specific heat – thermodynamic systems – properties of system – laws of thermodynamics – Zeroth law of thermodynamics – First law of thermodynamics – Second law of thermodynamics.

Properties of perfect gases :

Introduction – Laws of perfect gases – Boyle's law – Charle's law – general gas equation – Joule's law – characteristic equation of gas – Avogadro's law – Universal gas constant – Specific heats of a Gas – Specific heat at constant volume- Specific heat at constant pressure – relation between specific heats – ratio of specific heats.

Thermodynamics processes of perfect gases :

Constant volume process – constant pressure process – hyperbolic process – isothermal process – adiabatic process – polytropic process - throttling process- Derivation of heat transfer, change of internal energy, change of entropy and Work done – Simple problems.

II Air cycles :

Introduction – assumptions – classifications – efficiency of the cycle – reversible cycle – irreversible cycle – types of thermodynamic cycles – Carnot cycle – Joules cycle – Otto cycle – Diesel cycle – Dual combustion cycle – derivation – simple problems.

Fuels:

Classification – solid fuels – liquid fuels – gaseous fuels - merits and demerits – requirement of good fuel – calorific value of fuels – Higher calorific value – lower calorific value – Construction and working of bomb calorimeter and gas calorimeter.

Combustion :

Elements and compounds – atoms and molecules – atomic weight – molecular weight – combustion of solid fuels – combustion of gaseous fuels – theoretical weight of air required for complete combustion - theoretical volume of air required for complete combustion – Gravimetric analysis – Volumetric analysis – Weight of carbon in flue gases – weight of flue gases per kg of fuel burnt – Excess air supplied – weight of excess air supplied – flue gas analysis by Orsat Apparatus – simple problems.

III Properties of Steam:

Formation of steam –Temperature vs Heat – Important terms for steam – latent heat of steam - dryness fraction – wetness fraction – types of steam – dry and saturated steam, wet steam and superheated steam – advantages of super heated steam – steam tables and their uses – Total heat – volume –internal energy – entropy – simple problems using steam tables. Measurement of dryness fraction of steam – barrel calorimeter – combined separating and throttling calorimeter – working principle - problems.

Steam Boiler: Important terms – essentials of good steam boiler – selection of a steam boiler – classification – Working principle of Locomotive boiler – Lamont boiler – BHEL boiler – merits and demerits.

Steam engine: Classification – important parts of steam engine – working of a single cylinder double acting reciprocating steam engine – theoretical indicator diagram – actual indicator diagram.

Steam Condenser: Advantages of a condenser in steam power plant – Requirement – Classification – Working principle of Jet condenser – types – working principle of surface condenser - types.

IV IC Engines :Introduction- classifications – four stroke cycle petrol and diesel engines- merits and demerits – two stroke cycle – petrol and diesel engines – comparison

Performance of IC Engines :

Performance of I.C engines - indicated power - brake power – friction power efficiencies of I.C engines- indicated thermal, brake thermal, mechanical and relative efficiencies - Morse test- procedure - problems - heat balance sheet – problems.

Air compressors :Air Compressor – uses of compressed airclassifications of Air compressor-reciprocating compressor-single stage reciprocating compressor- multi stage compression – merits and demerits –Two stage compressor with imperfect

cooling – with perfect inter cooling – rotary compressors – Roots blower – vane blowers – centrifugal and axial flow air compressors

V REFRIGERATION : Refrigeration - refrigerators and heat pumps-types and applications of refrigeration - vapour compression refrigeration system – vapour absorption system – comparison – refrigerating effect - capacity of refrigerating unit - C.O.P - actual C.O.P – power required – mass of ice produced – problems - refrigerants-desirable properties - classification of refrigerants.

AIR CONDITIONING:

Air conditioning - psychrometric properties - dry air - moist air – water vapour - saturated air – dry bulb temperature - wet bulb depression - dew point depression - dew point temperature – humidity - specific and relative humidity – psychrometric chart – psychrometric processes – sensible heating and cooling – humidification – dehumidification – classification and applications of air conditioning system – room air conditioning - central air conditioning – comparison – differences between comfort and industrial air conditioning - factors to be considered in air conditioning - loads encountered in air conditioning systems

Text Books

1 Applied Thermodynamics, P.K. Nag, 2nd Edition, TATA McGraw - Hill Publishing Co., New Delhi.

2 Thermal Engineering, R.S. Khurmi and J.K. Gupta, 18th Edition, S.Chand & Co, New Delhi