

For Notes, Syllabus, Question Papers and Many more  
**32041 HEAT POWER ENGINEERING**

**DETAILED SYLLABUS**

**Unit I BASICS OF THERMODYNAMICS AND THERMODYNAMIC PROCESSES OF PERFECT GASES**

Introduction:- Definitions and units of mass, weight, volume, density, specific weight, specific gravity and specific volume – pressure – units of pressure – temperature - absolute temperature – S.T.P and N.T.P conditions – heat - specific heat capacity at constant volume and at constant pressure – work – power – energy – types - law of conservation of energy – thermodynamic system – types – thermodynamic equilibrium - properties of systems – intensive and extensive properties – State of System - process – cycle – point and path functions - zeroth, first and second laws of thermodynamics.

**Perfect gases:** - laws of perfect gases – Boyle's, Charles's, Joule's, Regnault's and Avogadro's laws – General Gas Equation - Characteristic gas equation – relation between specific heats and gas constant – Universal gas constant – Change in Internal Energy- enthalpy – change in enthalpy – entropy.

**Thermodynamic processes:-** Constant volume, Constant pressure, Constant temp.(isothermal) , Isentropic ( reversible adiabatic ) and, Polytropic Processes – p-V and T-s diagrams, work done , change in internal energy , heat transfer , change in enthalpy, change in entropy for above processes – Simple problems – hyperbolic , Free expansion and throttling processes(Description only) . Steady flow system: – control volume – steady flow energy equation – assumptions – Engineering applications.

**Unit II THERMODYNAMIC AIR CYCLES AND FUELS & COMBUSTION**

**Air cycles:** – air standard efficiency – reversible and irreversible processes – assumptions in deriving air standard efficiency – Carnot cycle – Otto cycle – Diesel cycle - Comparison of ideal and actual p-v diagrams of Otto and Diesel cycles – Simple problems

**Fuels & Combustion:** Classifications of fuels - merits and demerits – requirements of a good fuel – Octane number – detonation - Pre-ignition – Cetane number – Diesel knock – comparison of detonation and diesel knock - fuel additives – Stages of Combustion – Delay period – Variables affecting delay period – Methods of generating air swirl in diesel engine combustion chambers – Types of combustion chambers – combustion equations – stoichiometric air required for complete combustion of fuels – excess air – products of combustion – analysis of exhaust gases - calorific value of fuels.

**Unit III AIR COMPRESSORS AND GAS TURBINES**

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**Air Compressors:** Uses of compressed air – classifications of Air compressor – reciprocating compressor - single stage reciprocating compressor – compression processes – clearance volume and its effects – volumetric efficiency – 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 – simple problems. Gas turbines – uses - classifications – merits and demerits -constant pressure combustion gas turbine – gas turbine with intercooler, reheater, regenerator - effects – closed cycle gas turbines - merits and demerits – jet propulsion - turbojet engines – turbo propeller engines – ramjet – Working principle - merits and demerits –Rocket engines – applications of rockets.

#### **Unit IV FORMATION & PROPERTIES OF STEAM AND STEAM CALORIMETERS**

Steam - Properties – formation of steam – saturation temperature – enthalpy of water – enthalpy of evaporation – conditions of steam – dryness fraction – enthalpy of wet, dry and superheated steam - advantages of superheated steam – p-v diagram - T-H diagram – T-S diagram - H-S diagram – P-H diagram – critical conditions of water – specific volume of water and steam – density of steam – external work done during evaporation – internal latent heat – internal energy of steam – entropy of water and steam – steam tables - Moller chart.

**Expansion process of Steam:** Constant Volume process – Constant Pressure Process – Constant Temperature process – Hyperbolic Process – Isentropic process – Polychromic process – Throttling process. – Simple problems. Steam Calorimeter: Determination of dryness fraction of steam –bucket calorimeter - combined separating and throttling calorimeters.

#### **Unit V STEAM BOILERS AND PERFORMANCE OF BOILERS**

**Steam Boilers:** Introduction - Classification of boilers – comparison of fire tube and water tube boilers – high pressure boilers –advantages of high pressure boilers - Lamont and BHEL high pressure boilers – boiler mountings and accessories - function - construction and working – comparison of mountings and accessories – feed water treatment – internal and external treatments - starting boiler from cold condition – safety precautions in boiler operation – causes of Indian boiler act.

**Performance of boilers:** Evaporation rate - actual, equivalent and factor of evaporation – boiler efficiency – factors influencing boiler efficiency - boiler power – Simple problems – boiler plant - efficiency of economizer and super heater – Simple problems - boiler trial – heat losses in a boiler- heat balance sheet – Simple problems

**Text Book:** 1) Thermal Engg, R.K .Rajput, 8th Edition, Laxmi publications, Pvt Ltd , New Delhi. 2) Applied Thermodynamics, P.K. Nag, 2nd Edition, TATA Mcgraw - Hill Publishing Company