



DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

II YEAR
IV SEMESTER

32041 – HEAT POWER ENGINEERING

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING
Course Code : 1020
Subject Code : 32041
Semester : IV
Subject Title : HEAT POWER ENGINEERING

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			Duration
	Hours/ Week	Hours/ Semester	Marks			
Heat Power Engineering	6	90	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit	Topics	Hours
I	BASICS OF THERMODYNAMICS AND THERMODYNAMIC PROCESSES OF PERFECT GASES	17
II	THERMODYNAMIC AIR CYCLES AND FUELS & COMBUSTION	17
III	AIR COMPRESSORS AND GAS TURBINES	17
IV	FORMATION & PROPERTIES OF STEAM AND STEAM CALORIMETERS	16
V	STEAM BOILERS AND PERFORMANCE OF BOILERS	16
	TEST AND REVISION	7
	Total	90

RATIONALE:

The knowledge on the concept of Thermodynamics, Thermodynamic Processes, Steady flow energy equation and steam properties and performance of Boilers are vital.

OBJECTIVES

- Explain a basics of systems, laws of thermodynamics and thermodynamic processes.
- Explain different types of Air Cycles.
- Explain the fuels and combustion.
- Explain a air compressors and gas turbines.
- Explain a formation and properties of steam and steam calorimeters.
- Explain a steam boilers and performance of boilers.

HEAT POWER ENGINEERING

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
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, Charle’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.	17

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.

II THERMODYNAMIC AIR CYCLES AND FUELS & COMBUSTION 17

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.

III AIR COMPRESSORS AND GAS TURBINES 17

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.

IV FORMATION & PROPERTIES OF STEAM AND STEAM CALORIMETERS 16

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 - Mollier chart.

Expansion process of Steam: Constant Volume process – Constant Pressure Process – Constant Temperature process – Hyperbolic Process – Isentropic process – Polytropic process – Throttling process. – Simple problems.

Steam Calorimeter: Determination of dryness fraction of steam – bucket calorimeter - combined separating and throttling calorimeters.

V STEAM BOILERS AND PERFORMANCE OF BOILERS 16

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,
- 3) New Delhi .
- 4) Thermal Engineering, R.S. Khurmi and J.K. Gupta, 18th Edition,S.Chand&Co,NewDelhi

Reference Books:

- 1) Thermal Engineering ,P.LBallaney , 24th Edition ,Khanna Publishers, New Delhi.
- 2) Thermal Engineering ,B.K. Sarkar , 3rd Edition , DhanpatRai& Sons New Delhi .
- 3) Applied Thermodynamics, Domkundwar and .P.Kothandaraman, 2ndEdition, Khanna publishers, New Delhi.