

COURSE NAME: DIPLOMA IN MECHANICAL ENGINEERING

COURSE CODE: ME

SEMESTER: FIFTH

SUBJECT TITLE: POWER ENGINEERING

SUBJECT CODE:

Teaching & Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	TOTAL
03	-	02	03	100	25#	--	25@	150

Abbreviations:

TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Termwork, SW- Sessional Work.

- External

@ - Internal

* On Line Examination

NOTE:

- Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.
- Total of tests marks for all theory subjects are to be converted out of 100 and to be entered in mark sheet under the head Sessional Work. (SW)

Rationale:

I.C.Engines find applications in almost all sectors of industry and in automobiles. Diploma technicians deal with working, testing and maintenance of I.C. Engines. I.C. Engines are one of the major contributors of air pollution. Hence I.C. Engine pollution control plays a vital role in protecting the environment. Use of air compressors is increasing due to automation. Hence it is necessary to understand constructional features and thermodynamic aspect of air compressor. Gas turbine is used for power generation and for jet propulsion. Diploma engineer should understand the fundamentals of refrigeration and air- conditioning as there are many industrial applications and also many entrepreneurial opportunities in this field.

General Objectives:

The Student will be able to:

1. Describe construction and working of I.C.Engines.
2. Calculate various performance parameters by conducting trial on I.C.Engines.
3. Explain working and applications of gas turbines.
4. Explain different types of air compressors and conduct trial on air Compressor.
5. Describe construction, working and application of vapor compression cycle.
6. Appreciate psychometric processes and air conditioning systems.

Learning Structure:

Application :

Understand, analyze and apply various aspects of Power Engineering in practical application area in relation with construction and working of IC engine, gas turbine, air compressor, refrigeration and air conditioning.

Procedures :

Construction, assembly, dismantling, fault finding & troubleshooting and analysis of IC engine, working of turbine, boiler, condenser, cooling tower

Engine testing, combustion, propulsion

Principles :

Laws of conservation of energy
Laws of thermodynamics.
Continuity equation Valve timing diagram
Dalton's Law

C.O.P.
Steady flow energy equation
Boyle's and Charles law
Avogadro's law,
psychometric,

Concept :

Process, strokes, stages, heat transfer, pressure drop, positive displacement, enthalpy drop, humidity

C.O.P Enthalpy, power, Entropy, Cycles, Internal energy, Efficiency, work

Facts :

I.C. Engine, gas turbine, Air compressor, Refrigerator and air conditioner, Jet propulsion

Theory:

Topic and content	Hrs.	Marks
<p>1. I.C. Engine 20 marks</p> <p>Specific objectives</p> <ul style="list-style-type: none"> ➤ Draw air standard cycles. ➤ Explain the combustion and ignition method of I.C.Engine. <p>1.1 Power Cycles</p> <ul style="list-style-type: none"> • Carnot, Otto, Diesel, Dual, Brayton Cycle, representation on P-V, T-S diagram and Simple numerical on Otto cycle &Carnot cycle. <p>1.2 Classification and Application of I.C.Engines.</p> <ul style="list-style-type: none"> • Four stroke Engines, Construction and working, valve timing Diagram, Turning moment diagram • Brief description of I.C. Engine combustion (SI & CI), scavenging, preignition, detonation, supercharging, turbo charging, air fuel ratio requirements, M.P.F.I., Types of sensors, fuel injection pump, battery ignition in SI Engines 	10	20
<p>2. I.C. Engine Testing and Pollution Control 24 marks</p> <p>Specific objectives:</p> <ul style="list-style-type: none"> ➤ List lubricant and additive ➤ State the pollutants and their effect ➤ Calculate various efficiencies <p>2.1 Engine terminology: Stroke, bore, piston speed, MEP, compression & cut-off ratio . Engine Testing - I.P., B.P. Mechanical, Thermal , relative efficiency and , BSFC, Heat Balance sheet. Morse Test, Motoring test</p> <p>2.2 List of fuel, lubricant additives and their advantages.</p> <p>2.3 Pollution Control</p> <p>Pollutants in exhaust gases of petrol and diesel engines, their effects on environment, exhaust gas analysis for petrol and diesel engine, Catalytic Converter, Bharat stage III, IV norms.</p>	10	24
<p>3. Air Compressor 20marks</p> <p>Specific objectives</p> <ul style="list-style-type: none"> ➤ Explain the concept of single and multistage compressor. ➤ List the methods of energy saving. 	10	20

<p>3.1 Introduction</p> <p>Uses of compressed air, Classification of air compressors, Definitions of Pressure ratio, Compressor capacity, Free Air Delivered, Swept volume.</p> <p>3.2 Reciprocating air compressor</p> <p>Construction and working of single stage and two stage compressor</p> <p>Efficiency: - Volumetric , Isothermal and Mechanical</p> <p>Advantages of multi staging, Intercooling and after cooling.</p> <p>3.3 Rotary Compressor</p> <p>Construction and working of screw, lobe, vane, (No numericals)</p> <p>Comparison and applications of reciprocating and rotary compressors</p> <p>Purification of air to remove oil, moisture and dust, Methods of energy saving in air compressors.</p>		
<p>4. Gas Turbine And Jet Propulsion 16marks</p> <p>Specific objectives</p> <ul style="list-style-type: none"> ➤ Classify gas turbines. ➤ Describe method to improve the efficiency of gas turbine. ➤ Explain the principles of jet propulsion <p>4.1 Classification and applications of gas turbine, Constant pressure gas turbines. Closed cycle and open cycle gas turbines and their comparison.</p> <p>4.2 Methods to improve thermal efficiency of gas turbine</p> <p>Regeneration, inter- cooling, reheating ,representation on T-S diagram (no analytical treatment) ,</p> <p>4.3 Jet Propulsion, Principles of turbojet, turbo propeller, Ram jet.</p>	8	16
<p>5. Refrigeration and Air- Conditioning 20marks</p> <p>Specific objectives:</p> <ul style="list-style-type: none"> ➤ To describe the components and application of vapour compression system. ➤ Describe psychometric processes and air conditioning systems. 		

<p>5.1 Refrigeration</p> <p>Tonnes of Refrigeration, coefficient of performance.</p> <p>Vapour compression system, Vapour compression refrigeration cycle Subcooling and superheating, representation on p-h, T-S diagrams.</p> <p>Basic components of Vapour Compression Cycle, their function and location. Simple vapour absorption refrigeration system.</p> <p>Applications- Water cooler, Domestic refrigerator, Ice plant & cold storage.</p> <p>5.2 Psychrometry</p> <p>Properties of moist air-DBT, WBT, DPT, Specific humidity and relative humidity, Dalton's law of partial pressure psychrometric chart & psychrometric processes-sensible heating/cooling, humidification, dehumidification, evaporative cooling.</p> <p>5.3 Air conditioning systems</p> <p>Definition and classification of Air conditioning Systems.</p> <p>Construction and working of Window air conditioner and split air conditioner.</p>	10	20
	48	100

Practical:

Skills to be developed:

Intellectual Skills:

1. Identify components of IC Engines.
2. Understand working principals of IC Engines, Compressors and refrigeration systems.
3. Analyze exhaust gases and interpret the results.
4. Select tools and gauges for inspection and maintenance.

Motor Skills:

1. Assemble and dismantle engine according to given procedure.
2. Operate IC Engine test rig, refrigeration test rig for measuring various parameters and plotting them.
3. Operate exhaust gas analyzer for measuring pollutants.

List of Practical:

1. Dismantling & assembly of petrol/diesel engine

2. Construction and Working of four stroke engine
3. Construction and Working of simple carburetor. Draw labeled diagram
4. Trial on single/multi cylinder petrol or diesel engine with heat balance sheet and calculate different performance parameters.
5. Conduct Morse Test on Multi cylinder Petrol engine and find BP ,IP,FP.
6. Measure I.C.Engine pollutants with the help of Exhaust gas Analyzer .
7. Trial on two-stage Reciprocating compressor to calculate volumetric efficiency, overall efficiency, free air delivered.
8. Draw a labeled diagram of cooling and lubrication system of I.C.Engine available in laboratory.
9. Trial on Refrigeration Test Rig for calculation of power consumed, refrigerating Effect, C.O.P.
10. Trace the flow of refrigerant through various components in window air conditioner/ Split air conditioner. Draw the schematic diagram.

List of Assignments:

1. Study of manufacturer's catalogue for Reciprocating/Screw Compressor with respect to application, specifications and salient features.
2. Visit website- <http://library.think.quest.org>, <http://www.grc.nasa.gov> and prepare a brief report on gas turbine and jet propulsion.

Learning resources:

1. Books:

Sr. No.	Author	Title	Publisher
01	M.M.Rathore	Thermal Engineering	Tata McGraw Hill
02	V.Ganeshan	I.C.Engines	Tata McGraw Hill 3 rd edition
03	R. K. Rajput	Thermal Engg.	Laxmi Publication, Delhi
04	Patel, Karmchandani	Heat Engine Vol.I ,II& III	Acharya publication
05	P.K. Nag	Engg. Thermodynamics	Tata McGraw Hill 23 rd edition
06	S.K.Kulshrestha	Thermal Engineering	Vikas Publishing house pvt ltd.