

Code No: 114DU

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year II Semester Examinations, November/December - 2015

THERMAL ENGINEERING - I

(Common to ME, AME)

Time: 3 Hours

Max. Marks: 75

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

Part- A (25 Marks)

- 1.a) What is meant by "pumping loss" in an I.C. Engine? [2]
- b) Explain the splash lubrication system. [3]
- c) What is Cetane Rating of fuels? Explain. [2]
- d) List out different types of antiknock additives added in diesel. [3]
- e) Where is frictional power accounted in heat balance sheet? [2]
- f) Why air box is used in the test rig of an IC engine? [3]
- g) Define isothermal efficiency of compressor. [2]
- h) What do you understand by slip in centrifugal compressor? [3]
- i) Write applications of refrigeration system. [2]
- j) Sketch the effect of sub cooling and super heating on T-S and P-h planes. [3]

Part-B (50 Marks)

- 2.a) With the aid of a sketch, explain the mixture requirements of an automotive engine under.
 - i) Idling range
 - ii) Normal running
 - iii) Power range
- b) Compare between battery Ignition and magneto Ignition regarding
 - i) Quality of Spark
 - ii) Maintenance. [5+5]

OR

- 3.a) Explain different types of cooling systems used in I.C. engines along with the suitable diagrams.
- b) Describe working of MPFI system used for the advanced engines and explain the significance. [6+ 4]
- 4.a) Discuss the effect of different operating parameters on the knocking tendency in SI and CI engines.
- b) Differentiate between the direct injections (DI) and indirect injection (IDI) combustion chambers of CI engine. [5+5]

OR

- 5.a) Discuss the stages of combustion for an SI Engine using pressure versus crank angle diagram.
- b) What is the significance of ignition delay in CI engine combustion process? Explain. [5+5]

6.a) What are the instruments or equipment used for measuring the following parameters of an I.C. Engine.

- i) Brake power ii) No emissions iii) Air flow rate
iv) Pressure of combustion gases v) Co emissions.

b) A six-cylinder petrol engine operates on four-stroke cycle and has the bore of each cylinder is 70 mm and stroke 100 mm. The clearance volume per cylinder is 67 cc. at a speed of 4000 rpm, the fuel consumption is 20 kg/h and the torque developed is 150 Nm. If C.V. = 44000 kJ/kg, Calculate:

- i) Brake power ii) bmep and iii) Brake thermal efficiency. [5+5]

OR

7. A four stroke Petrol Engine has Fuel Consumption of 0.3 kg/kW-hr of brake power. Fuel has calorific value 42000 kJ/kg. Engine's Mechanical efficiency is 80%, Brake Power is 20 kW and Air/Fuel ratio is 16. Calculate:

- a) Indicated Power b) Frictional Power
c) Mass flow rate of fuel in kg/hr d) mass flow rate of air in kg/hr
e) Indicated thermal efficiency and f) Brake thermal efficiency. [10]

8.a) Prove that the condition for intermediate pressure, P_2 in a two stage reciprocating air compressor with intake pressure, P_1 and delivery pressure, P_3 is $P_2 = \sqrt{P_1 P_3}$.

b) A double acting compressor of 50 kW in which the air is drawn in at 1 bar pressure and 15°C and compressed according to the law $pV^{1.2} = \text{Constant}$ to 6 bar, rpm is 100, average piston speed = 150 m/min. Neglect clearance volume. Determine the size of the cylinder. [5+5]

OR

9.a) Show that in an axial flow compressor the blades are symmetrical when the degree of reaction is 50%.

b) A centrifugal compressor develops a pressure ratio of 5 with an air consumption of 30 kg/s. The inlet temperature and pressure are 15°C and 1 bar respectively. Isentropic efficiency is 0.85. Calculate:
i) the work done, ii) the total temperature, and iii) the power required. [5+5]

10.a) An air refrigeration plant working on Bell-Coleman cycle operates between 1 bar and 5 bar. The adiabatic efficiency of compression is 85% and expansion is 90%. Find out the COP of the system and its tonnage when the air flow rate is 1 kg/sec. The cooler temperature is 27°C and refrigerant temperature is 0°C. Also draw the cycle on P-V and T-S diagrams.

b) What are commonly used refrigerants for vapour compression refrigeration system? Explain their characteristics. [5+5]

OR

11. A vapor compression refrigeration plant operates between evaporation and condensation temperatures of -10°C and 45°C respectively. The refrigerant is dry and saturated vapor at entry to the compressor. It is discharged at 102°C from the compressor. The bore and stroke of the compressor are 80 mm each. It runs at 720 rpm with a volumetric efficiency of 80%. The liquid refrigerant enters the expansion valve at 35°C . Determine a) COP b) mass flow rate of refrigerant c) Capacity of the plant in TR. Take specific heat of liquid refrigerant = 1.62 kJ/kg K . Consider the following properties of the refrigerant

S.No.	Sat.temp ($^{\circ}\text{C}$)	V_s (m^3/kg)	h_f (kJ/kg)	h_g (kJ/kg)	s_f (kJ/kg K)	s_g (kJ/kg K)
1	-10	0.233	45.4	460.7	0.183	1.762
2	45	0.046	133	488.6	0.485	1.587

[10]

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The following information was obtained from the records of the
 Department of the Interior, Bureau of Land Management, on
 12/15/1964. The land described herein is owned by the
 United States of America, and is located in the
 State of California, County of Santa Clara, and
 Township of San Jose, Range 12S, Section 11.

DEPARTMENT OF THE INTERIOR
 BUREAU OF LAND MANAGEMENT

ACRES	SECTION	TOWNSHIP	RANGE	COUNTY	STATE
1.00	11	San Jose	12S	Santa Clara	California

(11)