MARRI LAXMAN REDDY
INSTITUTE OF TECHNOLOGY AND MANAGEMENT
(AN AUTONOMOUS INSTITUTION)
(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)
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II B.Tech II Sem Supply End Examination, March 2022
Thermal Engineering – I
(MECH)

Time: 3 Hours.   Max. Marks: 70

Note: 1. Answer any FIVE questions.
2. Each question carries 14 marks and may have a, b as sub questions.

1		What are the major differences between S.I. Engine and C.I. Engine? Explain them with suitable examples	14M	CO1	L2
2	a)	Draw the schematic diagram of two S.I. Engine and explain its working along with the port timing diagram.	7M	CO1	L2
	b)	What are the important requirements of fuel injection system in a C.I Engine?	7M	CO1	L1
3	a)	What is detonation in C.I. Engine? Explain the phenomenon of detonation and its ill effects on engine performance.	7M	CO2	L3
	b)	What are different stages of combustion in C.I. Engine? Explain with p-θ diagram.	7M	CO2	L2
4	a)	Explain the desirable characteristics of a good combustion chamber for S.I. Engine.	7M	CO2	L2
	b)	In a test of a four-cylinder, four-stroke petrol engine of 75 mm bore and 100 mm stroke, the following results were obtained at full throttle at a constant speed and with a fixed setting of the fuel supply of 0.082 kg/min.	7M	CO3	L3

bp with all cylinders working   =   15.24 kW
bp with cylinder number 1 cut-off =   10.45 kW
bp with cylinder number 2 cut-off =   10.38 kW
bp with cylinder number 3 cut-off =   10.23 kW
bp with cylinder number 4 cut-off =   10.45 kW

Estimate the indicated power of the engine under these conditions. If the calorific value of the fuel is 44 MJ/kg, find the indicated thermal efficiency of the engine. Compare this with the air-standard efficiency, the clearance volume of one cylinder being 115 cc.

5 a) A four cylinder, two stroke cycle petrol engine develops 30 kW brake power at 2500 rpm. The mean effective pressure on each piston is 8 bar and the mechanical efficiency is 80 %. Calculate the diameter and stroke of each cylinder if the stroke to bore ratio is 1.5. Also calculate the brake specific fuel consumption of the engine, if brake thermal efficiency is 28 %. The calorific value of the fuel is 44100 kJ/kg.   7M   CO3   L3

   b) Derive the expression for the volumetric efficiency of a reciprocating air compressor in terms of clearance ratio, pressure ratio and index of the compression   7M   CO3   L3

6 a) Differentiate between positive displacement compressor and dynamic compressor.   7M   CO4   L2

   b) Derive the work input requirement for an axial flow air compressor and explain the salient points.   7M   CO4   L3

7 a) Draw the pressure and velocity variations across the centrifugal compressor and explain salient features.   7M   CO4   L2

   b) How does reheating improve thermal efficiency efficiency? Explain.   7M   CO5   L2

8 Air is drawn in a gas turbine unit at 15⁰C and 1.01 bar and pressure ratio is 7:1. The compressor is driven by H.P. turbine and L.P. turbine drives a separate power shaft. The isentropic efficiencies of compressor, and the H.P. and L.P. turbines are 0.82, 0.85 and 0.85 respectively. If the maximum cycle temperature is 610⁰C, calculate: 14M   CO5   L3
   (i) The pressure and temperatures of gases entering the power turbine.
   (ii) The net power developed by the unit per kg/s mass flow
   (iii) The work ratio
   (iv)   The   thermal   efficiency   of   the   unit.
   Neglect the mass of the fuel and assume the following:
   For Compression process: c_{pa}= 1.005 kJ/kg K and γ=1.4
   For combustion and expansion processes: c_{pg}= 1.15 kJ/kg K and γ=1.333

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