

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)**

**CLASS: BTECH  
BRANCH: MECHANICAL**

**SEMESTER : V  
SESSION : MO/2023**

**SUBJECT: ME301 IC ENGINE AND GAS TURBINE**

**TIME: 3 Hours**

**FULL MARKS: 50**

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
  2. Attempt all questions.
  3. The missing data, if any, may be assumed suitably.
  4. Before attempting the question paper, be sure that you have got the correct question paper.
  5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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		CO	BL
Q.1(a)	An air-standard Otto cycle has a compression ratio of 8. The initial temperature and pressure are 293 K and 1 bar. The heat added during constant volume heating is 1.8 MJ/kg. Find the air standard efficiency and mean effective pressure of the cycle.	[5] 1	M
Q.1(b)	Explain with a neat sketch the valve timing diagram of SI engine.	[5] 1	L
Q.2(a)	Discuss the phenomena of knocking in CI engine with the factors affecting it.	[5] 2	L
Q.2(b)	Explain various stages of combustion in SI engine.	[5] 2	L
Q.3(a)	Air-fuel ratio of a mixture supplied to an engine by a carburetor is 15. The fuel consumption of the engine is 7.5 kg/hr. The diameter of the venturi is 2.2 cm. Find the diameter of fuel nozzle if the lip of the nozzle is 4 mm. Take $\rho_f = 750 \text{ kg/m}^3$ , $C_{d_a} = 0.82$ , $C_{d_f} = 0.7$ and atmospheric pressure = 1.013 bar and temperature = 25° C. Neglect compressibility effect of the air.	[5] 3	M
Q.3(b)	Describe the working principle of water cooling system with a suitable diagram.	[5] 3	L
Q.4(a)	A six-cylinder, 4 stroke petrol engine consumes 0.4 kg/min fuel when running at 4000 RPM. The bore is 8 cm and stroke is 10 cm. Clearance volume = 65 cm <sup>3</sup> . The torque developed = 150 Nm Find (i) brake power (ii) brake mean effective pressure (iii) brake thermal efficiency and (iv) relative efficiency. Take C.V. of fuel = 40 MJ/ kg.	[5] 4	M
Q.4(b)	Discuss the causes of hydrocarbon emission in SI engine.	[5] 4	L
Q.5(a)	In an open cycle constant pressure gas turbine, air enters the compressor at 1.02 bar and 27° C. The pressure of air after the compression is 4.08 bar. The isentropic efficiencies of compressor and turbine are 80% and 85% respectively. Take A: F ratio used is 80:1. Find the indicated power and thermal efficiency of the cycle if the flow rate of air is 2.5 kg/sec. Take $C_p = 1 \text{ KJ/kg}$ and $\gamma = 1.4$ for air and gases. C.V. of fuel used = 41720 kJ/kg.	[5] 5	M
Q.5(b)	Explain the working principle of a Turbo-fan engine with a neat sketch.	[5] 5	L

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