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

CLASS: BTECH   SEMESTER: V
BRANCH: MECHANICAL   SESSION: MO24

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.

			CO	BL
Q.1(a)	With the neat sketch, explain the valve timing diagram of 4 Stroke SI Engine.	[5]	1	3
Q.1(b)	A gas engine operating on the ideal Otto cycle has a compression ratio of 6:1. The pressure and temperature at the commencement of compression are 1 bar and 27$°C$. Heat added during the constant volume combustion process is 1170 kJ/kg. Determine the peak pressure and temperature, work output per kg of air and air-standard efficiency. Assume C_v = 0.717 kJ/kg K and γ = 1.4 for air.	[5]	1	4
Q.2(a)	Explain the phenomenon of Knocking and Detonation. Also explain how knocking differs from detonation.	[5]	2	3
Q.2(b)	With the support of pressure – crank angle diagram, explain the various stages of combustion in S.I. engines.	[5]	2	2
Q.3(a)	Derive an expression for actual air- fuel ratio supplied by simple carburetor (neglect the compressibility of fuel).	[5]	3	3
Q.3(b)	Argue, why MPFI system is better than throttle body injection system. Support your answer with a suitable diagram	[5]	3	2
Q.4(a)	A gas engine working on a constant volume cycle gave the following results during a 1 hour test run. Cylinder diameter= 24 cm, stoke= 48 cm, effective diameter of the brake wheel= 1.25 m. Net load on the brake is 1236 N, average speed is 226.7 r.p.m., average expansion per minute 77, mean effective pressure of indicator cards is 7.5 bar, gas used= 13 m^3 at 15$°C$ and 771 mm of mercury pressure, lower calorific value of gas is 22000 kJ/ m^3 at NTP. Cooling water used 625 kg, inlet temperature 25$°C$ and outlet temperature 60 $°C$. Determine: a) Mechanical efficiency b) The gas consumption in m^3 at NTP per ip hour c) The indicated thermal efficiency Draw up a heat balance sheet for the engine on minute basis.	[10]	4	4
Q.5(a)	Explain the construction and working of turbofan engine with suitable sketch.	[5]	5	3
Q.5(b)	In a gas turbine plant operating on joule cycle, maximum and minimum temperatures are 825$°C$ and 25^0C. The pressure ratio is 4.5. Calculate the specific work output, cycle efficiency, and work ratio. Assuming isentropic efficiencies of the compressor and the turbine to be 85 and 90% respectively. What is the heat rate in kJ/kW-hr.	[5]	5	4

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