

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

**CLASS: BTECH
BRANCH: Mechanical**

**SEMESTER: V
SESSION: MO25**

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)	Compare the theoretical and actual valve timing diagrams of a four-stroke diesel engine. [5]	1	3
Q.1(b)	An air standard diesel cycle has a compression ratio of 14. The pressure at the beginning of the compression stroke is 1 bar and the temperature is 27°C. The maximum temperature is 2500°C. Determine the thermal efficiency and the mean effective pressure. [5]	1	4
Q.2(a)	With the support of pressure - crank angle diagram, explain the various stages of combustion in C.I. engines. [5]	2	2
Q.2(b)	Compare the delay period in C.I. engines with ignition lag in S.I. engines. Explain how both affect combustion stability and efficiency. [5]	2	3
Q.3(a)	Sketch, the construction of simple carburetor and explain its working principle. Also list the drawbacks of Simple carburetor [5]	3	3
Q.3(b)	Explain the need for engine cooling and compare air-cooling and water-cooling systems. [5]	3	2
Q.4	The following data is given for a 4-Stroke, 4- cylinder diesel engine: Diameter of the cylinder = 35 cm, Piston stroke = 40 cm, Speed of the engine = 315 r.p.m. Indicated mean effective pressure = 7 bar, B.P. of the engine = 260 kW, Fuel consumption = 80 kg/hr. C.V. of fuel used = 43000 kJ/kg, Hydrogen content in fuel = 13% and remaining is carbon. Air-consumption = 30 kg/min. Cooling water circulated = 90 kg/min. Rise in temperature of cooling water = 38°C, Piston cooling oil used = 45 kg/min. Rise in temperature of cooling oil = 23°C, C_p for cooling oil = 2.2 kJ/kg-K, Exhaust gas temperature = 322°C, for exhaust gases = 1.1 kJ/kg-K. Ambient temperature = 22°C, C_p of superheated steam = 2 kJ/kg-K. Latent heat of steam = 2520 kJ/kg. Find: (i) The mechanical and indicated thermal efficiency. (ii) Draw up heat balance sheet on minute basis and percentage basis. [10]	4	4
Q.5(a)	Explain with neat sketch the working of Gas turbine with reheat. Show the various processes in T-s diagram. Also write the expression for efficiency. [5]	5	3
Q.5(b)	Find the required air-fuel ratio in a gas turbine whose turbine and compressor efficiencies are 85% and 80%, respectively. Maximum cycle temperature is 875°C. The working fluid can be taken as air($C_p=1.0$ kJ/kgK, $\gamma=1.4$) which enters the compressor at 1 bar and 27°C. The pressure ratio is 4. The fuel used has a calorific value of 42000 kJ/kg. There is a loss of 10% of calorific value in the combustion chamber. [5]	5	4