**20ME504**

**Hall Ticket Number:**

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| **III/IV B.Tech. (Regular) DEGREE EXAMINATION** | | | |
| **February, 2023** | **Mechanical Engineering** | | |
| **Fifth Semester** | **I.C. Engines & Gas Turbines** | | |
| **Time:** Three Hours | | **Maximum: 7**0 Marks | |
| *Answer Question No. 1 Compulsorily.* | | | (14X1 = 14 Marks) |
| *Answer* ***ANY ONE*** *question from each Unit.* | | | (4X14=56 Marks) |

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| 1. | a) | What is an IC engine? State some of its applications. | CO1 | L1 | 1M |
|  | b) | What is meant by a Chemically correct air-fuel mixture? | CO1 | L1 | 1M |
|  | c) | Elaborate on MPFI and what are different MPFI systems used in SI engines. | CO1 | L1 | 1M |
|  | d) | Show Pressure Vs Crank angle diagram for normal combustion in SI engines and show various stages in it. | CO2 | L2 | 1M |
|  | e) | Define Ignition delay as applied to CI engines. | CO2 | L1 | 1M |
|  | f) | Define Brake thermal efficiency and Specific fuel consumption. | CO2 | L1 | 1M |
|  | g) | Define Isothermal and Volumetric efficiencies as applied to reciprocating compressor. | CO3 | L1 | 1M |
|  | h) | List any two advantages of multistage compressor. | CO3 | L1 | 1M |
|  | i) | What is Pre-Whirl? | CO3 | L1 | 1M |
|  | j) | Define polytropic efficiency. | CO3 | L1 | 1M |
|  | k) | List important components of closed cycle gas turbine power plant. | CO4 | L1 | 1M |
|  | l) | What is the principle in Regeneration method used in gas turbine units? | CO4 | L1 | 1M |
|  | m) | What is the basic principle used in Atmospheric jet air crafts. | CO4 | L1 | 1M |
|  | n) | Define thrust and propulsive efficiency. | CO4 | L1 | 1M |
| **Unit -I** | | | | | |
| 2. | a) | Show Actual and Ideal Valve timing diagrams used for CI engines. | CO1 | L2 | 7M |
|  | b) | Illustrate the possibility of Hydrogen as fuel for IC engines list its advantages and disadvantages. | CO1 | L2 | 7M |
|  |  | **(OR)** |  |  |  |
| 3. | a) | Explain the mixture strength requirements during idling, normal cruising speeds and at high speeds | CO1 | L2 | 7M |
|  | b) | Explain the working of CRDI system with the help of a neat sketch and state its merits and demerits. | CO1 | L2 | 7M |
|  |  | **Unit -II** |  |  |  |
| 4. | a) | Demonstrate briefly the normal combustion in SI engines and explain the various stages in it. | CO2 | L2 | 7M |
|  | b) | Explain the variables affecting SI engine performance. | CO2 | L2 | 7M |
|  |  | **(OR)** |  |  |  |
| 5. | a) | What is meant by Ignition delay as applied to CI engines and explain how it leads to detonation in CI engines. | CO2 | L1 | 7M |
|  | b) | The following details were noted in a test on a four cylinder four stroke engine, diameter = 100mm, speed of the engine = 1600rpm, stroke= 120mm, fuel consumption = 0.2kg/min, calorific value= 44000kJ/kg, difference in tension on either side of the brake pulley= 40kgf, brake circumference is 300cm. If the mechanical efficiency is 80%. Find   1. Brake thermal efficiency 2. Indicated thermal efficiency 3. Indicated mean effective pressure 4. Brake specific fuel consumption**.** | CO2 | L1 | 7M |
|  |  | **P.T.O**    **20ME504**  **Unit -III** | |  |  |
| 6. | a) | Derive the expression for volumetric efficiency of Reciprocating compressor in terms of clearance ratio. | CO3 | L2 | 7M |
|  | b) | A single cylinder, single-acting air compressor running at 300 rpm is driven by a 23kW electric motor. The mechanical efficiency of the drive between motor and compressor is 87%.The air inlet conditions are 1.013 bar and 15 0C and the delivery pressure is 8 bar. Find the free-air delivery in m3/min, the volumetric efficiency, and the bore and stroke of the compressor. Assume that the index of compression and expansion is n = 1.3, that the clearance volume is 7% of the swept volume and that the bore is equal to the stroke. | CO3 | L1 | 7M |
|  |  | **(OR)** |  |  |  |
| 7. | a) | Define degree of reaction as applied to axial flow compressor and show that for 50% of degree of reaction compressor the blades are symmetrical. | CO3 | L1 | 7M |
|  | b) | Distinguish between Reciprocating and Rotary compressors. | CO3 | L4 | 7M |
|  |  | **Unit -IV** |  |  |  |
| 8. | a) | Explain the working of closed cycle gas turbine and derive an expression for its thermal efficiency. | CO4 | L2 | 7M |
|  | b) | Air is drawn in a gas turbine at 150C and 1.01 bar and pressure ratio is 7:1. The isentropic efficiencies of compressor turbines are 0.82, and 0.85 respectively. If the max cycle temp is 6100C, Find net power developed by the unit per kg/s mass and thermal efficiency of the unit. Neglect the mass of fuel and assume for air Cpa = 1.005 kJ/kg K and r = 1.4 and for gas Cpg = 1.15 kJ/kg and r = 1.333. | CO4 | L1 | 7M |
|  |  | **(OR)** |  |  |  |
| 9. | a) | Sketch and explain the working of turbojet engine. | CO4 | L1 | 8M |
|  | b) | Describe the working of rocket propulsion system with a neat sketch. . | CO4 | L4 | 6M |

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