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Total Number of Pages: 02

BTech
RME4D001

4th Semester Regular/Back Examination: 2022-23
SUBJECT: IC Engines and Gas turbines
BRANCH(S): MECH
Time: 3 Hour
Max Marks: 100
Q.Code : M100

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right-hand margin indicate marks.

Part-I

Q1 Answer the following questions : (2 x 10)

- Distinguish between Indicated power and Brake power.
- What are the assumptions made in analyzing the air-standard cycle?
- Define Clearance volume, swept volume, Cylinder volume and compression ratio.
- What are the differences between the analysis of the air-standard cycle and that of the fuel-air cycle?
- What are the advantages and disadvantages of using gaseous fuels in IC engines?
- What is the function of an ignition system?
- Which engine is more suitable for supercharging? Justify your answer.
- What is meant by slip factor in compressors?
- What are the basic propellants used in rockets?
- Draw T-S diagram of a gas turbine cycle with intercooled compression.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- An IC engine working on Otto cycle has a cylinder of diameter 100 mm and stroke 125 mm. The clearance volume is 300 cc. Find the air standard efficiency. Assume $C_p = 1.004$ kJ/kgK and $C_v = 0.717$ kJ/kgK for air.
- A diesel engine has a compression ratio of 20 and cut-off taking place at 5% of the stroke. Assume $\gamma = 1.4$ and calculate the air standard efficiency.
- Explain the phenomenon of knock in CI engines.
- What is meant by ignition limit?
- Describe the pintle nozzle with the help of a neat sketch.
- What is natural gas? What are the advantages and disadvantages of using natural gas as alternative fuel?
- What are the requirements for an ideal carburettor?

- h) A test on a single cylinder, four stroke oil engine having bore 18cm and stroke 36 cm yielded the following results:
- Speed: 285 RPM, Brake torque: 393 N-m
 Indicated m.e.p: 7.2 bar, Fuel consumption: 3.5 kg/hr,
 Cooling water flow: 4.5 kg/minute, Cooling water temperature rise: 36°C
 Air-fuel ratio by mass: 25, Exhaust gas temperature: 415°C
 Barometric pressure: 1.013 bar, Room temperature: 21°C
- The fuel has a calorific value of 45200 kJ/kg and contains 15% by mass of hydrogen. Determine:
- The indicated thermal efficiency and
 - The volumetric efficiency based on atmospheric conditions.
- Take $R = 0.287 \text{ kJ/kgK}$, C_v for dry exhaust gases = 1.005 kJ/kgK and for superheated steam $C_p = 2.05 \text{ kJ/kgK}$
- List down the requirements of a good spark plug.
 - Discuss the relative advantages and disadvantages of closed cycle and open cycle gas turbine plants.
 - What is the technique used in the measurement of particulate?
 - What is the cause of the formation of NO_x in petrol engine exhaust? Discuss the effect of air-fuel ratio and spark advance on NO_x emission.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3 a) In an SI engine, working on the ideal Otto cycle, the compression ratio is 5.5. The pressure and temperature at the beginning of compression are 1 bar and 27°C respectively. The peak pressure is 30 bar. Determine the pressure and temperature at the salient points, the air standard efficiency and mean effective pressure. Assume ratio of specific heats to be 1.4 for air. (8)
- b) What will be the percentage change in the efficiency of an Otto cycle having a compression ratio 10, when the specific heat at constant volume increases by 1.5%? (8)
- Q4 a) Describe the capacitive-discharge ignition with the help of a circuit diagram. (8)
- b) Describe the factors that affect spark advance. (8)
- Q5 Describe with suitable sketches the combustion phenomenon in SI engines and explain the two phases of combustion. (16)
- Q6 Derive the expressions for efficiency and specific work output for a simple gas turbine cycle in terms of pressure ratio. State the assumptions taken. (16)