Total No. of Questions : 8]

SEAT No. :

P-9190

[Total No. of Pages : 3

[6179]-322
S.E. (Mechanical/Automobile)
APPLIED THERMODYNAMICS
(2019 Pattern) (Semester - IV) (202048)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates :

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Make suitable assumption whenever necessary.*
5) *Scientific calculator is allowed.*

Q1) a) Outline the various phases involved in combustion in a compression-ignition engine. **[9]**

b) Illustrate and provide a concise explanation of the diverse types of combustion chambers in spark-ignition engines. **[8]**

OR

Q2) a) Define detonation in a spark-ignition engine and describe the different factors that influence detonation in such engines? **[8]**

b) Categorize the fuel injection systems employed in compression-ignition engines, and elucidate the operational mechanics of the Common Rail Diesel Injection system, accompanied by a clear diagram. **[9]**

Q3) a) The following data were recorded in a test of one-hour duration on a single cylinder oil engine working on four stroke cycle.
Bore = 300 mm, stroke = 450 mm, mean effective pressure = 5.8 bar, Brake friction load = 1860 N, Diameter of brake wheel = 1.22m, Fuel used = 8.8 Kg, CV. of fuel = 41800KJ/kg, Average speed = 200 RPM. Calculate **[10]**

i) Mechanical efficiency

ii) Brake thermal efficiency

b) Detail the operational process of the Non-Dispersive Infrared (NDIR) method for measuring emissions? **[8]**

OR

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Q4) a) In a test of a four-cylinder four stroke petrol engine of 75mm bore and 100mm stroke, the following results were obtained at full throttle at a constant speed and with a fixed setting of the fuel supply of 0.082 Kg/min. **[9]**

BP with all cylinder working = 15.24 kW,

BP with cylinder 1 is cut-off = 10.45 kW,

BP with cylinder 2 is cut-off = 10.38 kW,

BP with cylinder 3 is cut-off = 10.23 kW,

BP with cylinder 4 is cut-off = 10,45 kW,

Find,

i) Total indicated power of the engine,

ii) Total friction power and

iii) Indicated thermal efficiency of the engine if the CV of the fuel is 44MJ/Kg.

b) Explain the following : **[9]**

i) Mean effective pressure

ii) Air fuel ratio

iii) Heat balance sheet.

Q5) a) What is the magneto ignition system and what are its advantages and disadvantages? **[9]**

b) Illustrate a well-labeled diagram of a wet sump lubrication system and provide a comparative analysis distinguishing the features of wet sump and dry sump lubrication systems. **[8]**

OR

Q6) a) Elaborate on thermostatic water-cooling systems, providing a detailed illustration. Additionally, distinguish the characteristics of air-cooling and water-cooling systems. **[9]**

b) Define supercharging and outline the distinctions between supercharging and turbocharging? **[8]**

Q7) a) A single stage, single acting reciprocating air compressor delivers air 0.7 kg of air per minute at 6 bar. The suction temperature and pressure are 25 °C and 1 bar. The bore and stroke of the compressor are 100 mm and 150 mm respectively. The clearance is 3 % of swept volume. Assuming index of compression and expansion to be 1.3. **[9]**

Calculate,

i) Volumetric efficiency of compressor.

ii) Actual power required to run the compressor if η_{mech} = 85%.

b) Categorize various types of air compressors and provide a list of applications where air compressors are commonly utilized. **[9]**

OR

Q8) a) A two stage reciprocating air compressor takes in air at 1 bar and 27 °C. Air is delivered at 10 bar. The intermediate pressure is ideal and intercooling is perfect. The law of compression is $PV^{1.35} = C$. The rate of discharge is 0.1 kg/s. Take R = 0.287 KJ/Kg.K and C_p = 1 KJ/Kg.K. **[9]**

Calculate,

i) Power required to drive the compressor

ii) Power required to compress the air in single compression

iii) Isothermal efficiency for multistage.

b) Define the isothermal efficiency of compressors and elucidate the diverse methods and strategies employed to enhance compressor efficiency. **[9]**

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