Total No. of Questions : 8]

SEAT No. :

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S.E. (Automobile & Mechanical Engg.)

APPLIED THERMODYNAMICS

(2019 Pattern) (Semester - IV) (202048)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Figures to the right side indicate full marks.*
3) *Use of an electronic calculator is allowed.*
4) *Assume Suitable data if necessary.*

Q1) a) Draw P - θ diagram and explain the different stages of combustion in SI engine. **[8]**

b) List down the various sensors used in the Electronic Fuel Injection system. Draw and explain D-MPFI system. **[9]**

OR

Q2) a) What is knocking in CI Engine? Differentiate knock in SI and CI engines. **[8]**

b) What is ignition delay in CI engines? Explain any three factors affecting the ignition delay. **[9]**

Q3) a) What are the different methods used to measure friction power? Explain anyone method with a neat sketch. **[9]**

b) In a test of four cylinder, four stroke Petrol engine 75 mm bore and 100 mm stroke, the following results were obtained at full throttle at a particular constant speed and with a fixed setting of fuel supply 6.0 kg/hr. **[9]**

BP with all cylinders = 15.24 kW

BP with cylinder no. 1 cut out = 11. kW

BP with cylinder no. 2 cut out = 11.03 kW

BP with cylinder no. 3 cut out = 10.88 kW

BP with cylinder no. 4 cut out = 10.66 kW

Calorific value of the fuel = 43600 kJ/kg

Clearance volume = 0.0001 m^3.

P.T.O.

Calculate :

i) Mechanical efficiency

ii) Indicated thermal efficiency

iii) Air standard efficiency

OR

Q4) a) Define the following terms with their formula (any four) : **[9]**

i) Indicated power

ii) Friction power

iii) Mean effective pressure

iv) Volumetric efficiency

v) Brake specific fuel consumption

vi) Brake thermal efficiency

b) During the trial of a single cylinder, four stroke oil engine, the following results were obtained : **[9]**

Cylinder diameter = 20 cm,

Stroke = 40 cm,

Mean effective pressure = 6 bar,

Torque = 407 Nm,

Speed = 250 rpm,

Fuel consumption = 4 kg/hr,

C.V. of fuel = 43 MJ/kg,

Cooling water flow rate = 4.5 kg/min,

Air used per kg of fuel = 30 kg of air/kg of fuel,

Rise in cooling water temperature = 45 °C,

Temperature of exhaust gases = 420 °C,

Room temperature = 20 °C,

Mean specific heat of exhaust gas = 1 kJ/kg-K,

Specific heat of water = 4.18 kJ/kg-K.

Calculate :

i) Indicated power

ii) Brake power

iii) Also, thaw a heat balance sheet for the test.

Q5) a) Explain with neat sketch pump assisted thermo-syphon water-cooling systems. Differentiate between air-cooling and water-cooling system. **[8]**

b) Draw neat sketch wet sump lubrication system. Differentiate between wet sump and dry sump lubrication system. **[9]**

OR

Q6) a) Explain magneto ignition system and state its advantages and disadvantages. **[8]**

b) What is supercharging? Differentiate between supercharging and turbocharging. **[9]**

Q7) a) Write a short note on capacity control of compressors. **[9]**

b) A single acting reciprocating air compressor has cylinder diameter and stroke of 200 mm and 300 mm respectively. The compressor sucks air at 1 bar and 27 °C and delivers at 8 bar while running at 100 rpm. Find : **[9]**

i) Indicated power of the compressor

ii) Mass of air delivered by the compressor per minute and

iii) Temperature of the delivered by the compressor.

The compression follows the law $PV^{1.25} = C$. Take R = 287 J/kg K.

OR

Q8) a) What is multi-stage compression? Justify it save power required for compression as compared to single stage compression. **[9]**

b) 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, R = 0.287 kJ/kgK and Cp = 1 kJ/kgK. Calculate : **[9]**

i) Power required to drive the compressor

ii) Power required to compress the air in single compression

iii) Isothermal efficiency for multistage

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