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B.Tech. 5th Semester (F) Scheme (ME)

Examination, December-2018

INTERNAL COMBUSTION ENGINE AND GAS
TURBINE

Paper- ME-307-F

Time allowed : 3 hours *[Maximum marks : 100]*

Note : Attempt five questions. Question no. 1 is compulsory. Attempt any one question from each section.

1. (a) Explain the detail of firing order.
(b) What are the various factors that reduce the possibility of knocking?
(c) Explain the principle involved in the measurement of brake power.
(b) Discuss application of gas turbine. $4 \times 5 = 20$

Section- A

2. (a) Draw the Otto cycle on p-V and T-s diagrams, mark the various processes. 10
(b) Explain mixture requirement for various operating conditions in S.I. engines. 10
3. (a) Determine the ideal efficiency of the diesel engine having a cylinder with bore 250 mm, stroke 375 mm and a clearance volume of 1500 cc, with fuel cut-off occurring at 6% of the stroke. Assume ratio of specific heat to be 1.4 of air. 10
(b) Derive an expression for the calculation of air fuel ratio for the carburetor. 10

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Section- B

4. (a) What is meant by abnormal combustion? Explain the phenomenon of knock in S.I. engines. 10
- (b) What are the desired properties of a lubricant? Explain how additives help to achieve the desired properties. 10
5. (a) Why fins and baffles are required in an air-cooled engine? Explain various characteristics of an efficient cooling system. 10
- (b) What is delay period and what are the factors that affect the delay period? 10

Section- C

6. The air flow to a four cylinder, four-stroke oil engine is measured by means of a 5 cm diameter orifice having a coefficient of discharge of 0.6. During a test on the engine the following data were recorded: bore = 10 cm; stroke = 12 cm; speed = 1200 rpm; brake torque = 120 Nm; fuel consumption = 5 kg/h; calorific value of fuel = 42 MJ/kg; pressure drop through orifice is 4.6 cm of water; ambient temperature and pressure are 17°C and 1 bar respectively. Calculate (i) the thermal efficiency on brake power basis (ii) the brake mean effective pressure and (iii) the volumetric efficiency based on free air condition. 20
7. (a) List the parameters by which performance of an engine is evaluated. 10
- (b) Explain the current pollution scenario on the pollution front. 10

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Section- D

8. (a) Explain open and closed types of a gas turbine plants. 10
- (b) Explain the following: 10
- (i) Slip factor
- (ii) Ratio of compression
- (iii) Pressure coefficient
9. The pressure - ratio of an open-cycle constant pressure gas turbine plant is 6. The temperature range of the plant is 15°C and 800°C. 20

Using the following data:-

$$C_{pa} = 1 \text{ kJ/kg-K}, C_{pg} = 1.075 \text{ kJ/kg-K}$$

and $r = 1.4$ for air and gases.

C.V. of fuel = 44,000 kJ/kg.

$$\eta_c = 0.85, \eta_t = 0.90 \text{ and } \eta_{\text{combustion}} = 0.95$$

Find:

- (i) Thermal efficiency of the plant
- (ii) I.P. of the plant, if the circulation of air is 5 kg/s
- (iii) A/F ratio
- (iv) Specific fuel-consumption
- Neglect the losses in the system.