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Total Number of Pages : 02

B.Tech
PME4I103

4th Semester Regular / Back Examination 2018-19

IC ENGINE & GAS TURBINE

BRANCH : MECH

Max Marks : 100

Time : 3 Hours

Q.CODE : F492

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 Only Short Answer Type Questions (Answer All-10) (2 x 10)

- What is *firing order* in a multi-cylinder engine?
- What are two major components of diesel engine emissions?
- Which parameter causes diesel knock??
- What is meant by *slip factor* in compressors?
- Distinguish between *indicated power* and *brake power*.
- For same compression ratio and heat input which air standard cycle gives higher thermal efficiency?
- Which type of charge is necessary in idling condition and why?
- Draw T-S diagram of a gas turbine cycle?
- Which engine is more suitable for supercharging? Justify your answer.
- What is the effect of high sulphur content on the performance of SI and CI engines?

Part- II

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

- Calculate the percentage loss in the ideal efficiency of a diesel engine with compression ratio 14 if the fuel cut-off is delayed from 5% to 8%.
- Explain how the flame-front travels in SI engine during normal combustion.
- Compare four stroke and two stroke cycle engines. Bring out clearly their relative merits and demerits.
- What are the assumptions made in analysis of air standard cycle? Write down the major losses in actual cycle
- Discuss the important qualities of S.I engine fuel
- Show that the efficiency of the diesel cycle is lower than that of Otto cycle for same compression ratio and heat addition.
- With neat sketch explain the working of a simple carburetor.
- Determine the diameter of a fuel orifice for a 4-stroke, two cylinder engine developing 18 kW per cylinder at 2500 rpm using 0.3Kg/kW-hr fuel of 32° API. The duration of injection is 30° of crank travel. The fuel injection pressure is 120 bar and the combustion chamber pressure is 30 bar. Take velocity coefficient and $\rho = \frac{141.5}{131.5 + \text{API}}$
- An engine runs on ideal Dual cycle with compression ratio of 10 and maximum pressure limited to 70 bar. At the commencement of compression, the pressure and temperature are 1 bar and 100°C respectively. If the heat supplied is 1680 kJ/kg, find the pressures and temperatures at various salient points of the cycle and the cycle efficiency. Assume $C_p = 1.004 \text{ kJ/kgK}$ and $C_v = 0.717 \text{ kJ/kgK}$ for air.
- What are the causes of hydrocarbon emission in SI and CI engines
- Explain the phenomenon of knock in C.I engines and compare it with S.I engine knock.
- Write short notes on :
 - Wet sump lubrication system
 - NO_x emission

Part-III

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

- Q3** a) An 6 cylinder, 4 stroke engine of 8.5cm bore and 7cm stroke with a compression ratio of 7 is tested at 4500 rpm on a dynamometer which has 54cm arm. During a 10 minutes test the dynamometer scale beam reading was 42Kg and the engine consumed 4Kg of petrol ($C_v=44000\text{kJ/Kg}$). Air at 28°C and 1bar was supplied to the carburetor at the rate of 6Kg/min. Find (i) The brake power delivered, (ii) The brake mean effective pressure, (iii) The brake specific fuel consumption. (8)
- b) Discuss the relative advantages and disadvantages of S.I and C.I engines. (8)
- Q4** a) An engine fitted with a single jet carburettor having a jet diameter of 1.25 mm has a fuel consumption of 6 Kg/hour. Take specific gravity of petrol as 0.7. The level of fuel in the float chamber is 5 mm below the top of the jet when the engine is not running. Ambient conditions are 1 bar and 17°C . The fuel jet diameter is 0.6 mm, discharge coefficient of air is 0.85, Air-Fuel ratio is 15. Determine the critical velocity of flow at throat and the throat diameter. Neglect compressibility effect. (8)
- b) How the power and efficiency of the S.I engine vary with (i) air-fuel ratio at full load; (ii) part load? (8)
- Q5** a) What are the functional requirements of an injection system? What is the difference between the pintle type and the pintaux type nozzle? (8)
- b) A gasoline engine working on 4-stroke develops a brake power of 20.9 kW. A Morse test was conducted on this engine and the brake power (kW) obtained when each cylinder was made inoperative by short circuiting the spark plug are 14.9,14.3,14.8 and 14.5 respectively. The test was conducted at constant speed. Find the indicated power, mechanical efficiency and bmep when all the cylinders are firing. The bore of the engine is 75 mm and the stroke is 90 mm. The engine is running at 3000 rpm. (8)
- Q6** a) Draw the T-s diagram of an ideal regenerative gas turbine cycle. Find the thermal efficiency of the regenerative cycle based on pressure ratio r_p , maximum temperature (T_{max}) and inlet temperature of the gas to the compressor, T_1 . (8)
- b) Air enters the compressor of a gas turbine plant operating on brayton cycle at 101 kPa and 30°C . The pressure ratio in the cycle is 8. Calculate the maximum temperature in the cycle and the cycle efficiency. Assume $W_T = 2.5W_C$ where W_T and W_C are the turbine and compressor work respectively. $\gamma = 1.4$ (8)