

B. TECH.
(SEM-V) THEORY EXAMINATION, 2019-20
I C ENGINES AND COMPRESSORS

[Time: 3hrs]

[Total Marks: 100]

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION -A

1. Attempt all questions in brief.

[2x10=20]

- a) What do you mean by mean effective pressure?
- b) What is the use of air standard cycle?
- c) Define (i) rich mixture, (ii) Stoichiometric mixture and (iii) lean mixture.
- d) What do you mean by MPFI?
- e) What do you understand by supercharging
- f) What are the various types of injection system that are commonly used?
- g) What do you mean by surging and stalling?
- h) Mention the various assumptions made in air standard cycle analysis?
- i) Define (i) work, (ii) power and (iii) efficiency.
- j) What do you understand by air swirl?

SECTION-B

2. Attempt any three parts of the following:

[10X3=30]

- a) Compare the Otto, Diesel and Dual cycles for the
 - i. same compression ratio and heat input
 - ii. same maximum pressure and temperature
- b) Define with suitable sketch the two stroke cycle SI engine. Also discuss the valve timing diagram.
- c) Describe the stages of combustion in SI engine with the help of a pressure crank angle diagram. Explain the terms flame speed and ignition delay
- d) What is ignition delay in case if CI engine? Discuss the variables affecting ignition delay.
- e) A four stroke diesel engine is operating at 2400 r.p.m. Fuel injection starts 15° before TDC and ends at 5° after TDC. The quantity of fuel injected in a cycle is 400 mg. Find the fuel injection rate in kg/sec. If this engine works on Air Standard Cycle and compression ratio is 20 and cut-off ratio of 1.75, find the power developed by the engine in kW.

SECTION-C

3. Attempt any one part of the following:

[10x1=10]

- a) What do you mean by fuel injection system? What are the requirements a CI fuel injection system? Sketch a common rail injection system and explain its working.
- b) In an ideal Diesel cycle the pressure and temperature at the beginning of compression are 98.5 kN/m² and 60°C respectively. The maximum pressure attained during the cycle is 4.5 MN/m² the heat received during the cycle is 580 kJ/kg of working fluid. Determine: (i) The compression ratio (ii) The temperature at the end of compression, (iii) The temperature at the end of combustion.
 Assume $\gamma=1.4$ and $C_p = 1.003$ kJ/kg.

4. Attempt any one part of the following: [10x1=10]

- a) (i) State the function of lubricants in IC engine. Differentiate between splash and pressure lubrication system with the help of neat sketch.
(ii) What do you mean by crankcase ventilation? Explain in detail.
- b) An 8-cylinder, 4-stroke SI engine of 80 mm bore and 100 mm stroke length is tested at 4000 rpm on a dynamometer. The brake torque reading of the dynamometer is 215 N-m. The time for 100 c.c. of fuel consumption is 15 seconds. Calorific value of fuel is 48 MJ/kg. The air consumption of the engine is measured by air-box method having orifice diameter = 30 mm, coefficient of discharge for orifice = 0.6 and manometer reading across orifice = 18 cm of Hg column. Density of the fuel is 0.7 gm/c.c. Clearance volume of each cylinder is 65 c.c. Air is supplied to the carburetor at 1 bar and 27°C. Find the brake power, bsfc, A/F ratio, volumetric efficiency and efficiency ratio.

5. Attempt any one part of the following : [10x1=10]

- a) What is meant by abnormal combustion in S.I. engine? Explain the phenomenon of knock in S.I. engine. Sketch three combustion chambers that reduce the knocking.
- b) (i) Discuss, how catalytic converter reduces the pollutants from the engine and why unleaded petrol is required in case of catalytic converter fitted vehicle.
(ii) Compare gasoline engine with a diesel engine regarding their pollution emission.

6. Attempt any one part of the following : [10x1=10]

- a) Explain the principle of carburetion. Derive an expression for air- fuel ratio of a simple carburetor.
- b) A simple carburetor is designed to supply 6 kg of air per minute and 0.4 kg of fuel per minute. The density of the fuel is 770 kg/m³. The air initially at 1 bar and 300 K. Calculate the venturi throat diameter if the velocity of air at throat is 100 m/s. Assume Coefficient of discharge for air is 0.84, Coefficient of discharge for fuel is 0.65 and $\gamma=1.4$. If the drop across the fuel metering orifice is 0.85 of the pressure at the throat.

7. Attempt any one part of the following : [10x1=10]

- a) Differentiate between centrifugal compressor and axial flow compressor with neat sketch.
- b) Show advantages of multistage compression with help of PV and TS diagram. Derive optimum pressure ratio for 2 stage minimum work of compression.