

B TECH**(SEM-VIII) THEORY EXAMINATION 2018-19
COMPUTER SIMULATION OF I.C. ENGINES****Time: 3 Hours****Total Marks: 100****Note: 1.** Attempt all Sections.**2.** If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 10 = 20**

- a. What is heat of reaction? What is the relationship between heat of reaction and heat of formation?
- b. Why does entropy remain constant during adiabatic compression?
- c. What is the difference between an actual cycle and an ideal cycle?
- d. What is the significant difference between a supercharger and a turbocharger?
- e. Why the power output of an engine reduces at high altitude compare to its rated output at sea level?
- f. What is the difference between instantaneous combustion and progressive combustion?
- g. What is validation of the computer code in SI engine simulation?
- h. What are the unbalanced forces acting on a single cylinder engine?
- i. What is the multi zone model for combustion?
- j. Write the two basic types and their subtypes of models for the processes that govern engine performance and emission?

SECTION B**2. Attempt any three of the following:****10 x 3 = 30**

- a. What is constant pressure adiabatic combustion? In an air standard Diesel cycle, the compression ratio is 16, the cylinder bore is 200 mm and the stroke is 300 mm. Compression begins at 1 bar and 27°C. The cut-off takes place at 8 % of the stroke. Determine:
 - (i). The pressure, the volume and the temperature at all salient points.
 - (ii). The cut-off ratio
 - (iii). The work done per cycle
 - (iv). The air standard efficiency
 - (v). The mean effective pressure
- b. How does the thermal efficiency vary with equivalence ratio for air standard, fuel-air and actual cycle? Explain in detail.
- c. An eight-cylinder four stroke SI engine of 80 mm bore and 100 mm stroke is tested at 4500 rpm on a dynamometer which has 55 cm arm. The dynamometer scale reading was 40 kg. The time for 100 cc of fuel consumption is recorded as 9.5 seconds. The calorific value of fuel is 40,000 kJ/kg. Air at 1 bar and 27°C was supplied to the carburetor at the rate of 6 kg/min. Assume specific gravity of fuel to be 0.7. clearance volume of each cylinder is 65 cc. Determine: Brake Power, Brake Mean Effective Pressure, The *bsfc*, *bsac*, Air/Fuel ratio, Brake thermal Efficiency, Volumetric Efficiency, Relative Efficiency.
- d. A four-cylinder vertical engine has cranks 150 mm long. The planes of rotation of the first, second and fourth cranks are 400 mm, 200 mm and 200 mm respectively from the third crank and their reciprocating masses are 50 kg, 60 kg and 50 kg respectively. Find the mass of the reciprocating parts for the third cylinder and the relative angular positions of the cranks in order that the engine may be in complete primary balance.
- e. Explain the different types of heat transfer models with neat diagrams? What are their effects on heat transfer?

SECTION C

3. Attempt any one part of the following: 10 x 1 = 10

- (a) Discuss the full throttle operation with neat sketch briefly and also show the effect of spark advance on power output for various duration of combustion with sketch.
- (b) Show that the compression ratio for maximum work in an Otto cycle is given by

$$r = \left(\frac{T_3}{T_1} \right)^{\frac{1}{2(\gamma-1)}}$$

Where T_1 & T_2 are lower and upper limits of absolute temperature respectively. Also, prove that the intermediate temperatures for this condition are

$$T_2 = T_4 = \sqrt{T_1 \times T_3}$$

4. Attempt any one part of the following: 10 x 1 = 10

- (a) Write down the IC engine performance simulation process with neat sketch.
- (b) A six cylinder, 4.8 litre, supercharged engine operating at 3500 rpm has an overall volumetric efficiency of 158%. The supercharger has an isentropic efficiency of 92% and a mechanical efficiency in its link with the engine of 87%. It is desired that the air be delivered to the cylinder at 65°C and 180 kPa, while ambient conditions are 23°C and 98 kPa. Calculate:
- Amount after cooling needed
 - Engine power lost to run supercharger

5. Attempt any one part of the following: 10 x 1 = 10

- (a) Explain the types of simulation. Write down the parameters of computer simulation.
- (b) Determine the molal analysis of the products of combustion when octane, C_8H_{18} , is burned with 200% theoretical air, and determine the dew point of the products if the pressure is 14.7 lbf/in.².

6. Attempt any one part of the following: 10 x 1 = 10

- (a) Discuss the simulation of unbalanced forces in two stroke engine and write down the advantages also.
- (b) A five cylinder in-line engine running at 750 r.p.m. has successive cranks 144° apart, the distance between the cylinder centre lines being 375 mm. The piston stroke is 225 mm and the ratio of the connecting rod to the crank is 4. Examine the engine for balance of primary and secondary forces and couples. Find the maximum values of these and the position of the central crank at which these maximum values occur. The reciprocating mass for each cylinder is 15 kg.

7. Attempt any one part of the following: 10 x 1 = 10

- (a) Define the multi zone model for combustion with different heat transfer modes also write down heat reaction process.
- (b) What is simulation for pollution estimation? Explain the methods of estimation for pollution.