MANIPAL INSTITUTE OF TECHNOLOGY



(A constituent unit of MAHE, Manipal)

## I SEMESTER M.TECH. (AUTOMOBILE ENGINEERING) END SEMESTER EXAMINATIONS, NOV/DEC 2019

SUBJECT: AUTOMOTIVE ENGINES AND SUBSYSTEMS [AAE 5171]

## REVISED CREDIT SYSTEM (21/11/2019)

Time: 3 Hours

MAX. MARKS: 50

## Instructions to Candidates:

- ✤ Answer ALL the questions.
- Missing data may be suitably assumed.
- **1A.** List different mechanisms of engine valve actuation. With a neat sketch, **(02)** discuss the overhead camshaft mechanism with a pivoted rocker arm.
- **1B.** Define scavenging w r t engines. Enumerate the essential features of the schnuerle method of scavenging with a relevant diagram. (03)
- 1C. A four-stroke compression engine using 0.272 kg/kWh fuel develops 15 kW/cylinder at 2000 RPM. If the fuel injection pressure is 120 bar and cylinder pressure is 30 bar and injection last for 30 degrees of crank rotation and the coefficient of velocity is 0.9, determine (i) Diameter of the fuel injector orifice (ii) volume of fuel injected/ cycle (iii) Velocity of fuel injection.
- 2A. Define Ram effect in the engine intake systems. How does it affect the engines mixture preparation and performance in (i) Low speed engines (ii) (03) High speed engines
- **2B.** Discuss essential features and advantages of the following Engine control **(03)** strategies (i) Variable valve timing (ii) Tuned intake manifold.
- 2C. Find the air flow speed past an engine poppet valve having 150 mm bore diameter and 200 mm stroke at 2100 RPM. There are two Inlet valves per cylinder having a port diameter of 40 mm and a lift of 12 mm, which opens 15 degrees bTDC and closes 40 degrees aBDC. Coefficient of discharge= 0.6. Find the flow rate through an inlet valve.
- **3A.** Discuss the working principle of an economizer system when adapted in **(03)** carburetors.
- 3B. What are the various multiple injections strategies that can be programmed in Common Rail Direct injection systems? Discuss in what ways such injections are beneficial for the engine performance?
- 3C. A Spark Ignition engine when coupled to an absorption dynamometer applies a torque of 115 N-m at a speed of 2500 RPM to a floating brake lever. If its Bsfc= 0.36 kg/kWh, and fuel calorific value=45 MJ/kg, Determine the (04) following.

(i) Brake power (ii) Brake thermal efficiency (iii) Heat dispersed /min by the brake.

- **4A.** What are stratified charge engines? With a neat sketch, illustrate the features **(03)** of a TEXACO combustion process.
- 4B. Mention four main advantages of pressured cooling systems. what are the desirable qualities of anti-freezing solutions used in liquid cooled systems for engines?
- **4C.** The internal pressure in an engine cylinder is 900 kPa, when the crankshaft has rotated 40<sup>o</sup> aTDC. It is a square engine with cylinder dimensions as 80 mm and length of the connecting rod is 120 mm. construct the space and force diagram of the mechanism of the engine and hence determine the following.
  - (i) Angle between the axis of cylinder bore and center line of the connecting rod.
  - (ii) Force acting along the connecting rod
  - (iii) Force between the thrust face of the piston and the cylinder wall.
- **5A.** Differentiate the induction swirl and combustion induced swirl based on any (03) five parameters.
- **5B.** What are actual engine cycles? Discuss different losses considered during **(03)** the analysis of such cycles.
- **5C.** Quantity of heat dissipated to the water jacket of an engine is 104575 J/s. The water is required to be cooled from 338 K to 313 K in the radiator. The average wall temperature of radiator tube is 308 K. Calculate the required flow rate of water in the radiator and convective heat transfer area. Also determine the number of tubes to be used in the radiator core, if internal diameter of tube is 8 mm and mean velocity of water in the tube is 1.2 m/s.  $C_p=4.83$  kJ/kg K. overall heat transfer coefficient= 1200 W/m<sup>2</sup> K.

(04)