

SEMESTER EXAMINATION, 2022 – 23
3rd Year, B. Tech Mechanical Engineering
Internal Combustion Engines

Duration: 3:00 hrs

Max Marks: 100

Note: - Attempt all questions. All Questions carry equal marks. In case of any ambiguity or missing data, the same may be assumed and state the assumption made in the answer.

Q 1.	<p>Answer any four parts of the following.</p> <p>a) Explain the valve timing diagram of a 4-stroke petrol engine.</p> <p>b) Elucidate the phenomenon of knocking in the SI engine with the help of a neat sketch?</p> <p>c) List the different types of injection systems? Describe MPFI.</p> <p>d) List down the qualities of engine fuel.</p> <p>e) What is a supercharged engine? Explain different types of supercharging arrangements.</p> <p>f) Determine the diameter of a fuel orifice for a 4-stroke engine developing 15kW per cylinder at 2000 rpm, using 0.272 kg/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 the coefficient of velocity as 0.9 and $SG = 141.5/(131.5 + ^\circ API)$.</p>	5x4=20
Q 2.	<p>Answer any four parts of the following.</p> <p>a) What are the important considerations in selecting fuels for a CI Engine?</p> <p>b) Derive an expression for determining the air-fuel ratio in a carburetor by considering air compressibility.</p> <p>c) Draw the characteristic curves for the SI engine.</p> <p>d) Discuss the characteristics of nozzles used in CI engines.</p> <p>e) “Supercharging increases the power output of the engine, it does not increase the fuel consumption” Explain the preceding sentence.</p> <p>f) Discuss the various stages of combustion of a spark Ignition engine with the help of a pressure crank angle diagram.</p>	5x4=20
Q 3.	<p>Answer any two parts of the following.</p> <p>a) A simple jet carburetor is required to supply 5 kg of air and 0.5 kg of fuel per minute. The fuel specific gravity is 0.75. The air is initially at 1 bar and 300 K. Calculate the throat diameter of the choke for a flow velocity of 100 m/s. Velocity coefficient is 0.8. If the pressure drop across the fuel metering orifice is 0.8 of that of choke, calculate orifice diameter assuming $C_d = 0.6$ and $\gamma = 1.4$.</p> <p>b) In a trial of a single-cylinder oil engine working on dual cycle, the following observations were made:</p> <p style="padding-left: 40px;">Compression ratio = 15, Oil consumption= 10.2kg/h, Calorific value of fuel= 43890 kJ/kg, Air consumption = 3.8 kg/min, Speed= 1900 r.p.m., Torque on the brake drum= 186 N-m, Quantity of cooling water used = 15.5 kg/min, Temperature rise= 36°C, Exhaust gas temperature= 410°C, Room temperature = 20°C, C_p for exhaust gases = 1.17kJ/kg-K</p>	10x2= 20

	<p>Calculate: Brake power, (ii) Brake specific fuel consumption, and, (iii) Brake thermal efficiency, (iv) Draw heat balance sheet on minute basis.</p> <p>c) Discuss the stages combustion, knocking and factors affecting ignition delay in CI engines.</p>	
Q 4.	<p>Answer any two parts of the following.</p> <p>a) Explain the phenomenon of knocking in SI engine with the help of a neat sketch? What is the effect of compression ratio, engine speed and retardation of spark timing on knocking?</p> <p>b) Discuss the IC engine fuels classification and write a short note on any alternative fuel used in SI engines.</p> <p>c) Explain the reasons for cooling an engine and the working of thermosiphon and evaporative cooling systems used in IC engines.</p>	10x2= 20
Q 5.	<p>Answer any two parts of the following.</p> <p>a) Why the actual cycle efficiency is much lower than the air standard cycle efficiency? List the major losses and differences in actual engine and air standard cycles.</p> <p>b) Briefly explain the working of the following: (i) Centrifugal supercharger, (ii) Vane type supercharger Compare the above superchargers.</p> <p>c) Explain the method of generating air swirl in CI engine and discuss the direct, indirect injection designs in contrast to CI engine.</p>	10x2= 20
