Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– VI (NEW) EXAMINATION – WINTER 2021

Subject Code:2161902 Date:26/11/2021

Subject Name:Internal Combustion Engines

Time:10:30 AM TO 01:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	A four stroke S.I engine develops 37.5 KW at 85% mechanical efficiency. The specific fuel consumption is 0.365kg/ KWhr. The A: F ratio (used) =35:1. Taking C. V. of fuel =42.5 M J/ kg, calculate 1) I.P and F.P, 2) brake thermal efficiency and indicated thermal efficiency, 3) Fuel consumption and air consumption.	**03**
	(b)	A S.I. engine working on Otto cycle takes the air at 0.97 bar and 40 °C. The compression ratio is 7. The net heat supplied is 1.2 MJ/kg of working fluid. Calculate 1) Air standard efficiency 2) Maximum temperature attained in cycle 3) work done per kg of working fluid. Assume γ =1.4, C_v=720J/kg K	**04**
	(c)	Compare Otto, Diesel and Dual cycle for the 1) Same maximum pressure and heat input 2) Same maximum pressure and temperature 3) Same maximum pressure and output.	**07**
Q.2	**(a)**	In a diesel engine the combination starts at the end of compression stroke and takes place at constant pressure. A: F used is 29:1 and C.V. of fuel used is 48000 k J/ kg. The specific heat at constant volume of product is given by $C_v = (0.71+18 \times 10^{-5} T)$ KJ / kg K, where T is in K. If the compression ratio is 16 and temperature at the end of compression is 900 K, Calculate at what percentage of the stroke the combustion is completed, Assume R =0.29 K J/ kg K for gas.	**03**
	(b)	Dry exhaust gases from an oil engine has the following composition by volume, carbon dioxide 8.85% carbon monoxide 1.2% oxygen 6.8% and nitrogen 83.15% the fuel oil had a percentage composition of mass as carbon 82% hydrogen 14% and oxygen 2%. Determine (1) Mass of carbon per kg of dry flue gas. (2) Air: fuel ratio.	**04**
	(c)	Appraise the effect of following on performance of I. C engine. 1) Burning time loss factor, 2) Heat loss factor, 3) Exhaust blow down factor, 4) Effect of angle of advance, 5) Pump and friction losses.	**07**
		OR	
	(c)	Factors which increase detonation in S.I. engine tend to reduce knocking in C.I. engines. Justify the validity of above statement in the light of differences in nature of two phenomena and methods used to reduce detonation in both types of engines.	**07**
Q.3	**(a)**	Interpret the phenomenon of knocking and discuss different factors affecting knocking phenomena.	**03**
	(b)	A 4 cylinder 4 stroke petrol engine having bore 7.5 cm and stroke 9 cm develops 21 k W. A Morse test was carried out at constant speed of 3000	**04**

RPM and brake power is measured when each cylinder was cutoff are 14.8, 14.5, 14.6 and 14.75 k W respectively. Calculate Mechanical efficiency, and brake mean effective pressure.

(c) The diameter of venturi throat and fuel nozzle of a carburetor are 8cm and 5mm respectively the coefficient of discharge for air and fuel are 0.9 and 0.7 respectively, assuming the density of air is 1.3 kg/m^3 and density of air as 700 kg/m^3. Calculate 1) velocity of air and mass flow of air through the carburetor. 2) Velocity of fuel and mass flow of fuel through the carburetor. 3) Air : fuel ratio supplied by carburetor. Neglect the nozzle lip and air compressibility. Head causing the flow is 100 cm of water 4) If the nozzle lip is 5 mm them, calculate Air: Fuel ratio for above data 5) If head causing the flow during idling is 2 cm of water then calculate Air: Fuel ratio considering lip. **07**

OR

Q.3 **(a)** Defend the effects of the following parameters on flame propagation 1) Compression ratio 2) speed of Engine 3) turbulence **03**

(b) What do you understand by performance map? What are the advantages of performance map over performance curve of an engine? Draw performance map for SI and CI engines. **04**

(c) With neat sketch explain construction and working of Solex carburetor. **07**

Q.4 **(a)** Define smoke and discuss different factors which affect smoke formation in C.I. engines. **03**

(b) Examine the effect of supercharging on the following parameters 1) Power output 2) Mechanical efficiency 3) specific fuel consumption **04**

(c) Draw the neat diagram of Pintle and Pintaux nozzle also discuss their relative merits and demerits. **07**

OR

Q.4 **(a)** Describe the exhaust gas recirculation device for control of NO_X emissions from S. I. engines. **03**

(b) With near sketch explain electronically controlled common fuel injection system. **04**

(c) Explain significance of following parameters on performance of diesel injection system: 1) Automation 2) Penetration 3) Dispersion 4) Turbulence 5) Timing of injection. **07**

Q.5 **(a)** Draw a neat diagram of thermostatic controlled water cooling system and explain its working. **03**

(b) Differentiate between splash and pressure lubrication system and describe the operation of splash lubrication system with the help of neat sketch. **04**

(c) Appraise the significant effect of following factors on the volumetric efficiency of an engine operation 1) Influence of opening inlet valve 2) Influence of closing the inlet valve 3)Effect of opening the exhaust valve 4) Effect of closing the exhaust valve 5) overlap of inlet and exhaust valves 6) load of engine and engine speed. **07**

OR

Q.5 **(a)** What is function of fan in radiator system? Discuss its performance with change of speed and load on the engine. **03**

(b) Defend need of lubrication of following parts with the help of neat sketches 1) crank pin and gudgeon differentiate between flash and pressure lubrication system pin 2) main bearing 3) cylinder and piston. **04**

(c) Demonstrate requirements of injection system. Explain with neat sketch battery ignition system. **07**

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