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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2019

Programme Name: B.Tech. Mechanical **Semester : V**
Course Name : I. C. Engines
Time : 03 Hrs **Max. Marks: 100**
Course Code : MEAD3005
Nos. of page(s) : 3

Instructions: *Read the questions carefully and attempt as per section. Assume suitable data as required and mention in the solution. Support the answers with suitable diagrams as applicable.*

SECTION A

	Attempt all questions.	**Marks**	**CO**
Q 1	Explain the important factors affecting the flame front propagation in SI Engines? Support your answer with diagrams if any.	**5**	**CO1**
Q 2	Explain ignition delay. Discuss any two factors to reduce the ignition delay.	**5**	**CO1**
Q 3	Explain the Zeldo-wich reaction related to formation of NOx	**5**	**CO3**
Q 4	Compression ignition engine at rated condition develops 7.5 kW brake power. The mechanical losses are 1.5 kW. The indicated thermal efficiency is 42% , air fuel ratio is 22:1 and calorific value of the fuel is 43260 kJ/kg. Determine the brake specific fuel consumption and brake thermal efficiency.	**5**	**CO2**

SECTION B

	Attempt four question where internal choice is in Q 8.		
Q 5	Explain the stages of combustion in CI Engines with help of heat release rate and p-θ diagram	**10**	**CO2**
Q 6	Explain various principles of combustion chamber design? Write in brief. To achieve the objectives of the maximum power, maximum efficiency and no knocking, draw the suitable diagram of combustion chamber and justify your answer.	**5+5**	**CO1**
Q 7	Explain the working principle ***"Three way catalytic converter"*** used in SI engines with construction details. Also discuss the characteristics and roles of catalyst used.	**10**	**CO3**
Q 8	In an air standard diesel cycle, the compression ratio is 16 and at the beginning of isentropic compression , the temperature is 15 ^{0}C and pressure is 0.1 MPa . Heat is added until the temperature at the end of constant pressure process is 1500^0 C. Calculate (i) cut off ratio (ii) heat supplied per kg of air (iii) Cycle efficiency	**10**	**CO2**

Q 8	(iv) 'the m.e.p.. Also plot the p-v diagram by indicating the properties at salient points. **OR** An engine working on Otto cycle has a volume of 0.45 m^3 , pressure 1 bar and temperature 30^0 C at the beginning of compression stroke. At the end of compression stroke the pressure is 11 bar. Heat of amount 210 kJ is added at constant volume. Determine: (i) Pressures, temperatures and volumes at salient points in the cycle. (ii) Percentage clearance (iii) Efficiency (iv) Net work per cycle (v) Mean effective pressure	**10**	**CO2**
SECTION-C **There is choice in Q 10/ Q 11. Do any one completely.**			
Q 9	(i)It is proposed to design a carburetor for Maruti car. The four stroke petrol engine has a displacement of 796cm^3 and development maximum power at 5500 rev/min. the volumetric efficiency at this speed is assumed to be 70% and the air fuel ratio is 13.5:1. It is expected that at peak power the theoretical air speed at the choke will be 105m/s. the coefficient of discharge for the venturi assumed to be 0.85 and that of the main petrol jet is 0.66. An allowance should be made for the emulsion tube, the diameter of which can be taken a 1/2.5 of the choke diameter. The petrol surface is 6 mm below the choke at this engine condition. Calculate the sizes of a suitable choke and main jet. The specific gravity of petrol is 0.74 atmospheric pressure and temperatures are 1bar and 27^0c respectively. (ii) Calculate for four cylinder, four stroke CI engine, the quantity of fuel to be injected per cylinder per cycle, if engine consumes 0.3 kg/ kWh . The power developed by engine is 375 kW at a speed of 200 rpm. Specific gravity of fuel is 0.9	**14** **6**	**CO3**
Q. 10	(i) Following particulars refer to full load test of a single cylinder petrol engine working on four stroke cycle; *Cylinder diameter* = *110mm* *Stroke* = *120mm* *Brake power* = *118 kW* *Torque* = *410 N-m* *Speed* = *2500 rpm* *Oil consumption* = *40 Kg/ h* *Calorific value of fuel* = *41150 kJ/kg* *Cooling water flow rate* = *2800 kg/h* *Fuel Air ratio* = *1:16* *Hydrogen in fuel by mass* =*15%* *Rise in cooling water temperature* = 50^0 *C* *Temperature of exhaust gases* = 400^0 *C* *Room temperature* = 20^0 *C* *Mean specific heat of exhaust gas* = *1 kJ/kg-K* *Specific heat of water* = *4.18 kJ/kg-K*	**14**	**CO4**

	Specific heat of water vapour = *1.838 kJ/kg-K* Draw up the heat balance sheet for the test in terms of KW & % of heat supplied. Support with the suitable diagram. Also calculate the brake thermal efficiency and volumetric efficiency of the engine. (ii) Compression ignition engine at rated condition develops 7.5 kW brake power. The mechanical losses are 1.5 kW. The indicated thermal efficiency is 42% , air fuel ratio is 22:1 and calorific value of the fuel is 43260 kJ/kg. Determine the brake specific fuel consumption and brake thermal efficiency.	**6**	**CO4**
Q 11	(i) A four-cylinder engine running at 1200 rpm delivers 20 kW. The average torque when one cylinder was cut is 110 Nm. Find the indicated thermal efficiency if the calorific value of the fuel is 43 MJ/kg and the engine uses 360 grams of gasoline per kWh.	**6**	**CO4**
	(ii) During the trial of a single cylinder , four stroke oil engine , the following results were obtained: *Cylinder diameter* = *20 cm* *Stroke* = *40 cm* *Indicated Mean effective pressure* = *6 bar* *Torque* = *410 N-m* *Speed* = *250 rpm* *Hydrogen in fuel by mass* = *14%* *Oil consumption* = *4 Kg/ h* *Calorific value of fuel* = *45 MJ/kg* *Cooling water flow rate* = *4.5 kg/min* *Air used per kg of fuel* = *30 kg* *Rise in cooling water temperature* = 45^0 *C* *Temperature of exhaust gases* = 430^0 *C* *Room temperature* = 30^0 *C* *Mean specific heat of exhaust gas* = *1 kJ/kg-K* *Specific heat of water* = *4.18 kJ/kg-K* *Specific heat of water vapour* = *2.1 kJ/kg-K* Draw up the heat balance sheet for the test in terms of KW & % of heat supplied. Support with the suitable diagram.	**14**	**CO4**