Code No: 154CD

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, March - 2022
THERMAL ENGINEERING – I
(Mechanical Engineering)

Time: 3 Hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

1.a) Why the inlet valve is opened before TDC and closed after BDC in both SI and CI Engines? Explain the salient features.

b) What are the differences between air standard cycle and fuel-air cycle? Explain the significance of fuel-air cycle? [8+7]

2.a) Describe the mixture requirement in S.I. Engine for different speed conditions. How to achieve above requirements from the carburetor.

b) How to achieve cold starting in S.I. Engine? Explain the reasons for starting of engine cold conditions. [8+7]

3.a) Explain the effect of different operating parameters on flame propagation velocity and also suggested the suitable flame propagation velocity to avoid knocking.

b) Differentiate between uncontrolled combustion and controlled combustion in C.I. Engine and explain the percentage of heat release. [8+7]

4.a) What are different methods of obtaining air swirl in C.I. Engine combustion chamber? Explain in detail.

b) How the antiknock additives prevent detonation in S.I. Engine? What are different additives used in S.I. Engine? Explain. [7+8]

5.a) An engine is used on a job requiring 110 kW B.P., the mechanical efficiency of the engine is 80 % and the engine used 50 kg fuel per hour under the conditions of operation. A design improvement is made which reduces the engine friction by 5 kW. Assuming the indicated thermal efficiency remains the same, how many kg of fuel per hour will be saved.

b) Explain the method of conducting retardation test in internal combustion engine and compare this method with Willian's line method. [8+7]

6.a) Derive the expression for the volumetric efficiency of a reciprocating air compressor in terms of clearance ratio, pressure ratio and index of the compression.

b) A single stage single acting reciprocating air compressor running at 900 rpm delivers air at 12 bar. The induction and free air conditions can be taken as 1 bar and 300 K and the free air delivery as 0.5 m^3/min. Calculate the bore and stroke, the volumetric efficiency, the indicated power and the isothermal efficiency. Assume the index of compression and expansion is 1.3. [7+8]

7.a) An axial flow compressor with compression ratio as 5, draws air at 20^0C delivers it at 50^0C. Assuming 50% degree of reaction, find the velocity of flow if the blade velocity is 100 m/s. Also find the number of stages if work factor = 0.85, $\alpha = 10^0$, $\beta = 40^0$ and $C_p = 1.005$ kJ/kg K.

b) What is fluid slip? Define the slip factor and give three formulae to calculate the slip factor for the centrifugal compressor. [8+7]

8.a) In a simple gas turbine plant air enters the compressor at 1 bar and 27^0 C and leaves at 6 bar It is then heated in the combustion chamber to 700^0 C then enters in the turbine and expands to 1 bar. The isentropic efficiency of compressor and turbine are 80% and 85% respectively and combustion efficiency is 98%.The pressure drop in the combustion chamber is 0.1 bar Determine (i) Thermal efficiency (ii) Work ratio (iii) Specific fuel consumption (iv) Air fuel ratio.

b) Prove that the pressure ratio of a closed cycle for maximum work output is a function of limiting temperature ratio of the cycle i.e. $r_p = [T_3/T_1]^{\gamma/2(\gamma-1)}$. [8+7]

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