B.E. Mechanical Engineering Seven Semester

ME703 - I.C. Engine and Gas Turbines

P. Pages : 3 **GUG/W/18/1838**

Time : Three Hours * 1 4 3 7 * Max. Marks : 80

Notes :
1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Diagrams and Chemical equation should be given wherever necessary.
5. Illustrate your answers wherever necessary with the help of neat sketches.
6. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.

1. a) Explain the working of 4-stoke petrol engine. Draw theoretical and actual P.V. and valve timing diagram for petrol engine. **10**

b) Explain briefly the different kinds of fuels used in I.C. engines. How are SI engine fuel rated? **6**

OR

2. a) Describe the two types of general injection systems. Why the air injection system is not used now a days? **6**

b) A simple carburetor under a certain condition delivers 5.45 kg/h of petrol with an air, fuel ratio of 15. the fuel jet area is 2 mm^2 with a coefficient of discharge of 0.75. If the tip of the fuel Jet is 0.635 cms above the level of petrol in the float chamber and the venturi throat coefficient of discharge is assumed to be 0.80, calculate: **10**

i) The venturi depression in Cm of H_2O necessary to cause air and fuel flow at the desired rate.

ii) The venturi throat diameter.

iii) The velocity of air across the venturi throat.
Take density of air = 1.29 Kg/m^3 and specific gravity of petrol = 0.72

3. a) Explain the phenomenona of knocking is SI engine. What are the different factors which influence the knocking? Describe the methods used to suppress it. **8**

b) Describe various combustion stages in SI engine. **4**

c) Discuss the methods of turbocharging. **4**

OR

4. a) What do you mean by delay period in C.I. engine? What are the factors which affect delay period in CI engine? **6**

b) Discuss in detail Air-Fuel ratio in CI engines. **4**

c) Discuss detonation in CI engine. Explain factors which affect detonation in CI engines. **6**

5. During the testing of 4-stroke 8-cylinder petrol engine following data is obtained. **16**
Load on hydraulic dynamometer = 950 N,
Speed = 1250 rpm, bore = 70 mm, stroke = 89 mm
Fuel consumption = 19.5 Kg/h, CV = 43542 $\frac{kJ}{kg}$

Jacket water flow = 1400 kg/h

temp rise in Jacket water = 30ºc,

Exhaust gas temp. = 400ºc, A: F = 32,

Room temp = 30ºc,

Fuel analysis = 15% H_2 and 85% C,

Partial pressure of water vapour in exhaust gases = 0.02 bar, Cp of vapour = 2.09, cp of dry exhaust gases = 1.005,
The constant of hydraulic,
dynamometer = 17280,
Draw Heat balance sheet.

OR

6. a) In a test of a 4-cylinder, 4-stroke engine 75 mm bore and 100 mm stroke, the following results were obtained at full throttle at a particular constraint speed and with fixed setting of fuel supply of 6.0 kg/h. **8**
BP with all cylinder working = 15.6 Kw
BP with cylinder no. ϕ cut-off = 11.1 Kw
BP with cylinder no. 2 cut off = 11.03 Kw
BP with cylinder no. 3 cut off = 10.88 kw
BP with cylinder no. 4 cut off = 10.66 kw

If the C.V. of the fuel is 83600 KJ/kg and clearance volume = 0.0001m^3, calculate;

i) Mechanical efficiency.

ii) Indicated thermal efficiency.

iii) Air standard efficiency.

b) Describe the method commonly used in laboratory for measuring the air supplied to an IC engine. **8**

7. a) Discuss function of impeller and diffuser in centrifugal compressor, Also explain change in velocity and pressure of air through impeller and diffuser. **8**

b) Explain isentropic efficiency of centrifugal compressor. What are the various losses that reduces W.D by compressor? What are methods of improving it? **8**

OR

8. a) Differentiate between centrifugal compressor and Reciprocating compressor. **8**

b) What do you mean by axial flow compressor? Discuss it with neat sketch. **8**

9. a) A closed cycle gas turbine consists of two compressors & two turbines. At components are mounted on the same shaft. The pressure and temperature of the inlet of the first stage are 2 bar and 25ºC. the maximum cycle pressure and temperature are limited to 8 bar and 8.50ºC. perfect cooler and perfect heates are used between two compressors and two Turbines respectively. **10**

Assuming the compressor and turbine efficiencies as 83%

Find

i) The cycle efficiency without regenerator

ii) With regenerator whose effectiveness is 0.65 and

iii) If the IP developed by the plant is 310 Kw, Find Mass of fluid circulated. Air is used as working fluid $r = 1.4 \& cp = 1.0\ kJ/kg\ ^{\circ}k$.

b) Derive expression for thermal efficiency of constant pressure gas turbine works on Brayton or Joule Cycle. **6**

OR

10. a) State the principle of jet propulsion classify propulsion system & explain with neat sketch T-S diagram of gas turbine plant for turbo jet. **8**

b) Explain with neat sketch following efficiencies of Jet propulsion. **8**

i) Thermal efficiency.

ii) Propulsive efficiency.

iii) Overall efficiency.

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