

II B. Tech II Semester Supplementary Examinations Jan/Feb - 2015**THERMAL ENGINEERING - I**

(Com. to ME, AME)

Time: 3 hours

Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks

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1. a) Briefly explain major losses and differences in actual engine cycle and air-standard cycle.  
b) Explain following: i) exhaust blow down loss factor ii) Loss due to gas exchange process.
2. a) With a neat sketch explain the working of four stroke diesel engine.  
b) Explain briefly about important qualities of SI engine fuel.
3. a) Explain about the mixture requirements at different loads and speeds for a IC engine.  
b) Explain the phenomenon of knock in SI engines.
4. a) Explain about the stages of combustion in CI engine.  
b) Explain different types of combustion chambers for SI engine.
5. a) Explain the procedure to estimate the friction power of a multi cylinder engine by using Morse test.  
b) Explain Retardation method to evaluate the friction power of an engine.
6. a) What are the methods employed to achieve near isothermal compression for high speed compressor.  
b) A three stage compressor is used to compress hydrogen from 1.04 bar to 35 bar. The compression in all stages follows the law  $PV^{1.3} = C$ . The temperature of hydrogen at inlet is  $288^0\text{K}$ . Neglecting clearance and assuming perfect inter cooling, find i) indicated power required to deliver  $14\text{ m}^3$  of hydrogen per minute measured at the inlet conditions.  
ii) Intermediate pressures. Take  $R = 4125\text{ J/Kg K}$ .
7. a) Explain the construction, working of Vane type compressor.  
b) Explain about effect of impeller blade shape on performance of centrifugal compressor.
8. a) In detail explain about the performance curves of axial flow compressors.  
b) What is degree of reaction? Draw and explain the velocity diagrams of an axial flow Compressor when the degree of reaction is 0.5.



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1. a) Compare the actual and fuel-air cycles of a gasoline engine.  
b) Explain with a neat diagram the typical fuel feed system of a CI engine.
2. a) With a neat sketch explain the working of Wankle engine.  
b) With a neat sketch explain the working of four petrol diesel engine.
3. a) Explain the factors influencing the flame speed in an SI engine.  
b) Explain the stages of combustion in SI engines.
4. a) Explain about the factors that affect the delay period in CI engine.  
b) With neat diagram explain about different direct injection chambers.
5. a) Explain the heat balance diagram of a typical CI engine.  
b) In a test of four cylinders, four stroke petrol engine of 75mm bore and 100mm stroke, the following results were obtained at full throttle at a constant-speed and with a fixed a setting of the fuel supply of 0.082 kg/min.  
BP with all cylinder working =15.24 KW  
BP with Cylinder number 1 cut off =10.45 KW  
BP with Cylinder number 2 cut off =10.38 KW  
BP with Cylinder number 3 cut off =10.23 KW  
BP with Cylinder number 4 cut off =10.45 KW  
Estimate the indicated power of the engine under this condition. If the calorific Value of the fuel is 44000 KJ/Kg, find the indicated thermal efficiency of the engine. Compare this with the air standard efficiency, the clearance volume of one Cylinder being 115 CC.
6. a) Derive the equation for shaft work for single stage air compressor with clearance  
i) When law of compression followed is isothermal.  
ii) When law of compression followed is  $PV^n = C$   
c) A single acting compressor has zero clearance, stroke of 200 mm and piston diameter 150 mm. When the compressor is operating at 250 rpm and compressing air from  $10\text{N/cm}^2$  to  $40\text{N/cm}^2$ , find: i) The volume of air handled ii) The ideal power required
7. a) In two stage compressor, prove that the work done on 1 kg of air is minimum with perfect inter cooling when the intermediate pressure is the geometric mean of the suction and delivery pressure or  $P_i = \sqrt{P_d P_s}$   
b) Explain the construction, working of Roots blower and derive the expression for roots efficiency.
8. a) Show that for axial flow compressors if the degree of reaction is 50% the compressors have symmetrical blades.  
b) Explain about surging, choking and stalling in a axial flow compressor.

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1. a) What are the merits and demerits of two stroke IC engines over the four stroke I.C Engines.
b) Explain the following: i) time loss factor, ii) heat loss factor
2. a) Explain briefly about valve timing diagram of four stroke petrol engine.
b) Explain briefly about important qualities of CI engine fuel.
3. a) With a neat sketch explain the working of a simple carburetor.
b) Explain about flame front propagation in a SI engine.
4. a) Explain how Rating of CI engine fuels is done
b) Compare the Knock in SI engine with CI engine
5. a) Explain the analytical method to evaluate the engine performance
b) A four stroke four cylinder gasoline engine has a bore of 60 mm and a stroke of 100 mm. On test it develops a torque of 66.5 Nm when running at 3000 rpm. If the clearance volume in each cylinder is 60 cc the relative efficiency with respect to brake thermal efficiency is 0.5 and the calorific value of the fuel is 42 MJ/Kg, determine the fuel consumption in Kg/h and the brake mean effective pressure.
6. a) Explain the factors that affect the volumetric efficiency of a reciprocating compressor.
b) A three stage reciprocating air compressor compresses the air from 1 bar 17°C to 35 bar. The law of compression is $PV^n=C$ and is same for all the stages of compression. Assuming perfect inter cooling and neglecting the clearance and valve resistance, find the minimum power required to compress $15\text{ m}^3/\text{min}$ of free air. Also find the intermediate pressures.
7. a) With a neat diagram explain the working of a centrifugal compressor.
b) With help of velocity diagram derive expression for work done for a centrifugal compressor.
8. a) With a neat diagram explain the construction and working of an axial flow compressor.
b) Make comparison between reciprocating and centrifugal compressors.



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1. a) What are the merits and demerits of four stroke petrol engines over the four stroke Diesel Engines  
b) Define volumetric efficiency and discuss about various factors affecting the volumetric efficiency
2. a) Explain briefly about port timing diagram of two stroke petrol engine  
b) Explain the working of a simple carburetor with a neat sketch
3. a) Explain how Rating of SI engine fuels is done  
b) Explain about the effect of engine variables on knock
4. a) Explain about the factors that affect the delay period in CI engine  
b) With a neat diagram explain the working of forced circulation cooling system
5. a) Explain procedure to estimate the friction power of an engine by using Willan's line method  
b) By means of sankey diagram explain the energy flow through an engine
6. a) Derive the equation for shaft work for single stage air compressor with clearance  
b) A two stage air compressor with complete inter cooling delivers air to the mains at a pressure of 30 bar, the suction condition being 1 bar and  $27^{\circ}\text{C}$ . If both cylinders have same stroke, find the ratio of cylinder diameters, for the efficiency of compressor to be maximum. Assume the index of compression to be 1.3.
7. a) A centrifugal compressor handles 150 kg/min. of air. The suction pressure and temperature are 1 bar and  $20^{\circ}\text{C}$ . The suction velocity is 80m/s. After compression in impeller the conditions are 1.5 bar and  $70^{\circ}\text{C}$  and 220m/s. Determine i) Isentropic efficiency. ii) Power required to drive the compressor  
b) With a neat sketch explain the working of axial flow compressor.
8. a) With the help of velocity diagram derive the expression for work done in a stage of a axial flow compressor  
b) Make comparison between axial flow and centrifugal compressors

