Set- 1

Code No:3220303

II B. Tech II Semester Regular Examinations, April/May 2009
THERMAL ENGINEERING-I
(Mechanical Engineering)

Time: 3 Hours **Max. Marks 80**

Answer any FIVE questions
All questions carry equal marks
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1. (a) Define volumetric efficiency and discuss the effect of various factors affecting the Volumetric efficiency.
   (b) In an engine working on the diesel cycle air fuel ratio is 50:1. The temperature of air at the beginning of compression is 60^0 C and the compression ratio used is 14:1.what is ideal efficiency of the engine? Calorific vale of fuel used is 42000 kJ/Kg , C_p =1.005 kJ/kg-K and C_V=0.717KJ/Kg-K for air .

2. With sketches explain various solid injection systems.

3. (a) How does detonation affect engine performance in SI engines.
   (b) What are the various types of combustion chambers used in SI engines? Explain them briefly.
4. (a) what are two general types of combustion chamber used in CI engines? Describe the process of mixing fuel and air in these chambers?
   (b) What are the effects of the following variables on the diesel knock.
      (i) Injection timing and rate of fuel the injection.
      (ii) Turbulence caused in the combustion chamber
      (iii) compression ratio.
5. (a) What is the significance of conducting the More Test ? Explain in detail.
   (b) The following observations were recorded during a trial of a four stroke , single cylinder oil engine. Duration of the test is 45 min ; oil consumption is 4 liters ; calorific value of the oil is 43MJ/Kg ; specific gravity of the fuel =0.8: area of the indicator is 8.5cm^2; length of the indicator diagram =8.5 cm spring constant = 5.5bar/cm ; brake load=150kg; Spring balance reading =21kg ; effective brake wheel diameter =1.5m ;

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speed =200 rpm; Cylinder dia.= 30cm; stroke = 45cm; jacket cooling water = 10 kg/min; temp rise is 36^0c Calculate i) indicated power ii) brake power iii) mechanical efficiency iv) indicated thermal Efficiency . v) brake specific fuel consumption.

6. (a) Describe with a neat sketch the construction and working of a single stage single acting Reciprocating air compressor.

   (b) A single acting compressor has zero clearance, stroke of 200 mn and piston diameter 150 mm. when the compressor is operating at 250 rpm and compressing air from $10N/cm^2$, 25^0 to $40N/cm^2$, find.

   i) The volume of air handled

   ii) The ideal power required .

7. (a) Compare centrifugal and axial flow compressors.

   (b) A roots blower compresses 0.06 m^3 of air from 1.0 to 1.45 bar per revolution. Calculate the compressor efficiency.

8. (a) state how a compressors classified?

   (b) Explain the velocity diagrams for finding work done of stage of axial flow compressors.

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II B. Tech II Semester Regular Examinations, April/May 2009
THERMAL ENGINEERING-I
(Mechanical Engineering)

Time: 3 Hours **Max. Marks 80**

Answer any FIVE questions
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1. (a) Compare the actual and fuel air cycles of a gasoline engine.
   (b) Why do designers go for multi cylinder engine for heavy loads and name some multi cylinder engine types.
2. With neat sketches explain the working principle of a simple carburetor.
3. (a) Describe the phenomenon of preignition in SI engines and discuss Its effect on the performance.
   (b) Discuss the factor that which promote pr-ignition
4. (a) The factors that promote knock in CI engine, reduce knock in SI engine .Explain and discuss the statement.
   (b) Explain clearly various stages of combustion in CI engines.
5. (a) Schematically explain the use of the study of the heat balance of an engine.
   (b) An indicator diagram taken from a single cylinder, four storke CI Engine has length of 100mm and an area of 2500 mm^2 .The Indicator pointer deflects a distance of 10 mm for pressure increment of 2 bar in the cylinder. If the bore and stroke are 100 mm and 125mm respectively and the engine speed is 1000rpm.Calculate the mean effective Pressure and the indicated power. If the mechanical efficiency is 80%, what is the brake power developed.
6. (a) Compare reciprocating and rotary air compressors.
   (b) A two stage air compressor with complete with complete Inter cooling delivers air to the mains at a pressure of 30bar, The suction conditions being 1bar and 27^0C. If both cylinders have the same storke , find the ratio of the cylinders diameters, for the efficiency of compression to be a maximum. Assume the

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index of compression to be1.3

7. (a) What is a centrifugal compressor? How does it differ from an axial flow compressor ?

   (b) Air at 1 bar and 15^0C is to compressed at rate of 5.6 m^3/min to 12bar. Two machines are considered : i) the roots blower, and (ii) a sliding vane rotary compressor . Compare the power required, assuming for the vane type that internal compression take place through 75% of the pressere rise before delivery takes place, and that and that the compressor is an ideal in cooled machine.

8. (a) Explain the working of an axial flow compressor with a sketch.

   (b) An 8 stage axial flow compressor takes in air at 20^0C at the rate of 180kg/min. The pressure ratio is 6 and isentropic efficiency is 0.9.Determine the power required.

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II B. Tech II Semester Regular Examinations, April/May 2009
THERMAL ENGINEERING-I
(Mechanical Engineering)

Time: 3 Hours **Max. Marks 80**

Answer any FIVE questions
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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) For a diesel engine, give the layout of the fuel system naming the essential components and explain their roles.

2.(a) Mention the various parameters which affect the engine heat transfer and explain their effect.

(b) Clearly explain dry sump lubrication system with a sketch.

3.(a) what is meant by abnormal combustion ? Explain the phenomenon of Knock in SI engines?

(b) What is ignition lag in SI engine and how does it affect performance.

4. (a) what are the different methods used in CI engines to Create turbulence in the mixture ? Explain its effect on power output and thermal efficiency of the engine.

(b) Discuss the advantages and disadvantages of the two type of Combustion chambers of CI engines.

5. A Test on a single cylinder, four stroke CI engine have a bore of 150 mm and stroke 300mm gave the following results: speed 300rpm; brake torque 200 Nm; indicated mean effective pressure 8bar; fuel consumption 2.4 kg/h; cooling water flow 5kg /min; cooling water temperature rise 35^0C; air fuel ratio 21;exhaust gas temperature 415^0C; barometer pressure 1 bar; room temperature 20^0C.The fuel has a calorific value of 42 MJj/kg and contains 15% by weight of hydrogen. Take latent heat of vaporization as 2250 KJ/kg. Determine ,

i) The indicated thermal efficiency.

ii) The volumetric efficiency based on atmospheric conditions.

Draw up a heat balance in terms of KJ/min. take c_p for dry exhaust gas 1 KJ/kg K, and for super heated steam C_p= 2.1 KJ/Kg-K, R= 0.287 KJ/Kg K .

6. (a) What do you mean by multistage compression? State its advantages.

(b) A single acting two stage compressor with complete inter cooling delivers 10.5 kg/ min of air at 16 bar. The suction occurs at 1 bar and 25^0c. The compression and expansion processes are reversible, polytrophic index, n=1.3. Determine,

i) The power required to drive the compressor.

ii) Isothermal efficiency.

iii) Volumetric efficiencies of both the compressors.

If the clearance ratios for LP and HP cylinders are 0.04 and 0.06 respectively.

7. (a) What is slip factor and pressure coefficient?

(b) A centrifugal compressor handles 150 kg/min. of air. The suction pressure and temperature are 1 bar and 20^0 c. The suction velocity is 80m/s. After compression in impeller the conditions are 1.5 bar and 70^0c and 220m/s. Determine

i) Isentropic efficiency.

ii) Power required to drive the compressor

8. An axial flow compressor with isentropic efficiency 85% draws air at 20^0c and compresses it in the pressure ratio of 4:1. The mean blade speed and flow velocity are constant through out the compressor. Assuring 50% reduction blading and blade velocity as 180 m/s and work input factor as 0.8, find i) flow velocity ii) No of stages. If blade angles are 42^0 and $12^{0.}$

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THERMAL ENGINEERING-I
(Mechanical Engineering)

Time: 3 Hours **Max. Marks 80**

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1. (a) Distinguish among air standard cycle, fuel air cycle and ideal cycle.
   (b) What is the need and requirement of cooling in IC engines?

2. (a) Briefly discuss the air fuel ratio requirement of a petrol engine from no load to full load.
   (b) Compare wet sump and dry sump lubrication systems.

3. (a) Explain the various factor that influence the flame speed.
   (b) Explain the effect of various engine variables on SI engine Knock.

4. (a) Explain the phenomenon of knock in CI engines and compare it with SI engine knock.
   (b) What is delay period and what are the factors that affect the delay period ?

5. (a) Explain the effect of the following factors on the performance of an SI engine:
   i) compression ratio ii) air-fuel ratio iii) spark timing iv) Engine speed.
   (b) Ina test of four cylinder , 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 4cut off =10.45 KW
   Estimate the indicated power of the engine under this condition. If the calorific Value of the is 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. prove that the work done in two stage compressor per kg of air delivered with perfect inter cooling is give by

$$W/\,kg = 2n/(n-1)\ R\ T_1 \left[\left(\frac{p_d}{p_s}\right)^{\frac{n-1}{2n}} - 1\right]$$

7. (a) Describe with a neat sketch vane type compressor.
   (b) A centrifugal compressor delivers 16 kg/s of air with a total head pressure ratio of

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4;1. The speed of the compressor is 15000 rpm. Inter total head temperature is 20^0 C, slip factor 0.9 , power input factor 1.04 and 80% is entropic efficiency.

Determine; i) over all diameter of the impeller ii) power input

8. (a) What is degree of reaction? Draw the velocity diagrams of an axial flow Compressor when the degree of reaction is 0.5.
(b) An axial flow Compressor , with compression ratio as 5, draws air at 20^0C and delivers at 50^0C. Assuming 50% degree of reaction, find velocity of flow if the blade Velocity is 120 m/s .Also find the no. of stages.
Take work factor =l, $\alpha=10^0$; $\beta=40^0$ & C_p =1KJ/kg k