Code No: R22033 **R10** SET - 1

II B. Tech II Semester, Regular Examinations, April/May – 2013
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) Illustrate the constructional details of an I.C engines? Explain briefly about the important Components and its materials?
   b) Discuss briefly the loss due to gas exchange process?

2. a) How are S.I and C.I engine fuels rated?
   b) With a neat sketch explain the magneto ignition system?

3. a) What is the need of air movement in S.I. Engine combustion chamber? Explain.
   b) What is the difference between physical delay and chemical delay? Explain its importance
   c) Explain the working principle of pre-combustion chamber with the suitable diagram.

4. a) Explain abnormal combustion and what is delay period?
   b) Explain open type and divide type combustion chamber with neat sketch.

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5. In a test of a four-cylinder, four-stroke petrol engine of 75 mm bore and 100 mm stroke, the following results were obtained at full throttle at a constant speed and with a fixed setting of the fuel supply of 0.082 kg/min.

   bp with all cylinders 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 these conditions. If the calorific value of the fuel is 44 MJ/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 work required for a single stage reciprocating air compressor.
   b) A single stage double acting reciprocating air compressor is driven by a 39 kW electric motor with a transmission efficiency of 95%. Air is drawn in at 0.98 bar and 288 K and compressed according to the law $pv^{1.2} = c$ to 5.8 bar. The compressor runs at 100 rpm with a piston speed of 151.5 m/s.

7. a) Explain the working principle of Roots blower with suitable diagrams.
   b) A centrifugal compressor delivers 54 kg of air per minute at pressure of 200 kPa, when compressing air from 100 kPa and 15^0C. If the temperature of air delivered is 97^0C, and no heat is added to the air from the external sources during compression, determine the efficiency of the compressor relative to ideal adiabatic compression and power absorbed.

8. a) Define the degree of reaction and derive its equation for the symmetrical blades of an axial flow air compressor.
   b) Show that the degree of reaction is 50% for the symmetrical blade axial flow air compressor.

Code No: R22033 **R10** SET - 2

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THERMAL ENGINEERING-I
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Time: 3 hours Max. Marks: 75

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1. a) What are the major differences between S.I. Engine and C.I. Engine? Explain them with suitable examples.
   b) Briefly discuss pumping and rubbing friction losses.

2. a) What is meant by crankcase ventilation? Explain.
   b) Describe the essential parts of a modern carburetor.

3. a) What is ignition delay in combustion of S.I. Engine? What are different parameters influencing the ignition delay?
   b) Explain the working of fuel injector with a neat sketch

4. a) Explain detail what is diesel knock
   b) Explain combustion process in C.I Engine?

5. In a test on two stroke oil engine, the following results were obtained: speed = 350 rev/min; Net brake load = 600 N; Mean effective pressure = 2.66 bar; Fuel consumption = 3.2 kg/h; cooling water used = 495 kg/h; Temperatures of jacket water at inlet and outlet = 30^0C and 50^0C; Exhaust gases per kg of fuel = 32 kg; Temperature of exhaust gases = 432^0C; specific heat of exhaust gases = 1.005 kJ/kg K; Inlet air temperature = 32^0C. Draw up a heat balance for the engine if its cylinder diameter = 205 mm and stroke = 275 mm; brake drum diameter = 1.0 m; calorific value of fuel = 40870 kJ/kg.
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Code No: R22033 **R10** SET - 2

6. a) Define the volumetric efficiency and derive its expression for the single stage reciprocating air compressor with clearance volume.
   b) A single stage single acting reciprocating air compressor with 0.3 m bore and 0.4 m stroke runs at 400 rpm. The suction pressure is 1 bar at 300 K and the delivery pressure is 5 bar. Find the power required to run it, if the compression is isothermal, adiabatic and compression follow $pv^{1.3} = C$. Also find the isothermal efficiency.

7. a) Draw the velocity triangles for the centrifugal compressor and derive the equation for the estimation of power required to compress the air.
   b) Define the term slip factor and power input factor with respect to the centrifugal compressor. Explain them.

8. a) With a suitable sketch and velocity diagrams, explain the working principle of simple axial flow air compressor.
   b) What is meant by a stage of axial flow air compressor? and explain in detail about the stage velocity triangles.

Code No: R22033 **R10** SET - 3

II B. Tech II Semester, Regular Examinations, April/May – 2013
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) Explain the working principle of four stroke I C Engines along with the valve timing diagram.
   b) Briefly explain (i) Time loss factor (ii) Heat loss factor

2. a) Describe the multi-point fuel injection system with neat sketch.
   b) Explain the principle of Wankle Engine.

3. a) Differentiate between uncontrolled combustion and controlled combustion in S.I. Engine.
   b) Describe the phenomenon of knocking in C.I. Engine and how it is different from S.I. engine detonation.

4. a) Explain detail what is detonation
   b) Explain flame front propagation with suitable sketch

5. A four stroke petrol engine with a compression ratio of 6.5 to 1 and total piston displacement of 5.2×10^{-3} m^3 develops 100 kW brake power and consumes 33 kg of petrol per hour of calorific value 44300 kJ/kg at 3000 rpm. Find:
   i) Brake mean effective pressure
   ii) Brake thermal efficiency
   iii) Air standard efficiency ($\gamma = 1.4$); and
   iv) Air-fuel ratio by mass.
   Assume a volumetric efficiency of 80 %. One kg of petrol vapor occupies 0.26 m^3 at 1.013 bar and 15^0C. Take R for air 287 J/kg K.
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Code No: R22033 **R10** SET - 3

6. a) Derive an expression for the optimums inter cooler pressure for two stage reciprocating air compressors with perfect inter cooling.

   b) A single stage single acting reciprocating air compressor with 0.3 m bore and 0.4 m stroke runs at 400 rpm. The suction pressure is 1 bar at 300 K and the delivery pressure is 5 bar. Find the power required to run it, if the compression is isothermal, adiabatic and compression follow $pv^{1.3} = c$. Also find the isothermal efficiency.

7. a) Derive an expression for the efficiency of roots blower in terms of pressure ratio and ratio of specific heats based on p-v and T-s diagrams.

   b) A rotary air compressor receives air at a pressure of 1 bar and 17^{o}C and delivers at a pressure of 6 bar. Determine work done by the compressor per kg of air delivered, if the process is i) isothermal ii) adiabatic and iii) polytrophic with the index as 1.3.

8. a) Draw the schematic diagram of axial flow air compressor and explain its working along with velocity triangles.

   b) Derive the work input requirement for an axial flow air compressor and explain the salient points.

Code No: R22033 **R10** SET - 4

II B. Tech II Semester, Regular Examinations, April/May – 2013
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Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
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1. a) Differentiate between Magneto ignition system with battery coil ignition system.
   b) Why lubrication is necessary in I.C. Engine components? Explain different methods of lubrication system.

2. a) Explain the fuel supply system in S.I Engine.
   b) Explain the working of Zenith carburetor with neat sketch.

3. a) What are different stages of combustion in S.I. Engine? Explain with p-θ diagram.
   b) Explain the influence of different operating parameters on ignition delay during combustion process in S.I. Engine.

4. a) Explain need of air movement combustion induced turbulence in a C.I engine with a neat sketch.
   b) Explain, what are the reasons for abnormal combustion in C.I engine.

5. A nine-cylinder petrol engine of bore 150 mm and stroke 200 mm has a compression ratio 6:1 and develops 360 kW at 2000 rpm when running on a mixture of 20% rich. The fuel used has a calorific value of 43 MJ/kg and contains 85.3% carbon and 14.7% hydrogen. Assuming volumetric efficiency of 70% at 17^0C and mechanical efficiency of 90%, find the indicated thermal efficiency of the engine.
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Code No: R22033 **R10** SET - 4

6. a) Derive the expressions for the reversible work of compression if the compression processes are i) adiabatic, ii) polytrophic and iii) isothermal.
   b) Differentiate between positive displacement compressors and dynamic compressors.

7. a) Explain the working principle of Vane sealed compressor.
   b)What are different parameters that influence the performance of the centrifugal compressors? Explain.

8. a) Define the degree of reaction and derive its equation for the symmetrical blades of an axial flow air compressor.
   b) What is meant by low degree of reaction and high degree of reaction? How you differentiate these two?