Code No: RR220303 **Set No. 1**

**II B.Tech II Semester Supplementary Examinations,**
**November/December 2005**
**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) What are the differences between S.I. Engine over C.I. Engine?
   (b) What are the parts that require lubrication in an IC Engine? [16]

2. (a) What is ignition lag in S.I engines and how does it affect performance.
   (b) How does engine speed influence flame velocity and explain it with proper reasoning.
   (c) What two rates combinedly advance the normal flame front? Explain their roles. [5+5+6]

3. (a) Explain how induction swirl is created in C.I. Engine combustion chambers.
   (b) Discuss the advantages and disadvantages of induction swirl. [8+8]

4. (a) What is the significance of conducting the MORSE test? Explain the same in detail.
   (b) During the trail of a four stroke diesel engine the following observations were recorded:
   Area of the indicator diagram = 475 $mm^2$
   Length of indicator diagram = 62 mm
   Spring number = 1.1 bar / mm
   Diameter of piston = 100 mm
   Length of the stroke = 150 mm
   Engine RPM = 375
   Determine
      i. indicated mean effective pressure
      ii. indicated power in kW. [16]

5. (a) What is the principle of operation of the reciprocating compressor valves?
   (b) An air compressor has a piston displacement of 2200 cm with a clearance of 5% . It receives air at 110kPa. There is a pressure drop of 3.5kPa through the suction valves. The discharge valves also leaks and a drop of 5% occurs in delivery pressure. Using n=1.35, calculate and plot the volumetric efficiency for the discharge pressures of 350, 700 ,1000, 1500,2000 and 2500kPa. [4+12]

6. (a) Explain the terms slip factor and power input factor in centrifugal compressors.

(b) A centrifugal compressor operating at a pressure ratio of 4:1 has inlet temperature of 15$^o$C. Calculate the overall diameter of impeller given that speed of operation 15000 rpm.
Slip factor 0.9
Power input factor 1.03
Isentropic efficiency 0.85 [16]

7. In an open type air refrigeration 550 kg of air is circulated per hour. The air is drawn from the cold chamber at $3^0$C at atmospheric pressure and compressed isentropically to 5 bar absolute. It is then cooled to $20^0$C at the same pressure. Air is then led to expander where it is expanded isentropically down to atmospheric pressure and is discharged to cold chamber. Calculate

   (a) heat extracted from cold chamber,

   (b) Heat rejected to cooling water per hr and

   (c) COP of the system. [16]

8. (a) Discuss the essential properties of an ideal refrigerant?

   (b) Name various psychrometric processes and show each of them on psychrometric chart? Which of these properties is most suitable in summer? [8+8]

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Code No: RR220303 **Set No. 2**

**II B.Tech II Semester Supplementary Examinations,**
**November/December 2005**
**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) Explain thermosyphon system of cooling with a neat sketch.
   (b) What are the requirements of ignition system in i.c. engines?
   (c) Where do you employ air cooling? [16]

2. (a) Describe with suitable sketches the combustion phenomenon in S.I engines and explain the two phases of combustion.
   (b) What are the basic parameters that influence the flame speed? Discuss the influence of engine variables of the flame speed. [10+6]

3. (a) Define cetane number and briefly explain the method of evaluating cetane number for a given fuel.
   (b) What are the reference fuels used for rating of C.I. Engine fuels? Discuss. [10+6]

4. (a) Explain the significance of the following tests
      i. Motoring test
      ii. Morse test
      iii. Retardation test.
   (b) A single cylinder internal combustion engine working on four stroke cycle principle develops 45 kw BP under the following working conditions:
   Mean effective pressure = 7.5 bar
   Number of explosions per min = 90
   Ratio of stroke length to the piston diameter = 2.1
   Mechanical efficiency = 85%
   Determine the dimensions of the engine cylinder and piston speed. [16]

5. (a) What is the principle of operation of the reciprocating compressor valves?
   (b) An air compressor has a piston displacement of 2200 cm with a clearance of 5% . It receives air at 110kPa. There is a pressure drop of 3.5kPa through the suction valves. The discharge valves also leaks and a drop of 5% occurs in delivery pressure. Using n=1.35, calculate and plot the volumetric efficiency for the discharge pressures of 350, 700 ,1000, 1500,2000 and 2500kPa. [4+12]

6. (a) List the various types of rotary compressors? [5+5]
   (b) Explain with a neat sketch, the working of a roots blower. [6]

7. (a) Explain the vapour compression refrigeration system on T-s and p-h diagrams.
   (b) What are the advantages and disadvantages of air as working fluid against a vapour in refrigeration. [8+8]

8. (a) Define wet bulb and dry bulb temperature and illustrate its application with respect to air conditioning applications?
   (b) How the refrigerants are named according their composition? Discuss the important properties of refrigerants? [8+8]

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Code No: RR220303 **Set No. 3**

**II B.Tech II Semester Supplementary Examinations,**
**November/December 2005**
**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) Explain thermosyphon cooling system with a neat diagram?
   (b) Compare and contrast the differences between SI engine with CI engine. [16]

2. Discuss the effects of the following operating variables on detonation
   (a) compression ratio.
   (b) Inlet temperature of mixture.
   (c) Spark timing.
   (d) Engine speed.
   (e) Size of bore. [16]

3. (a) what causes the knock in a CI engine? In which part of the combustion process (beginning or the end) does it occur?
   (b) Explain and discuss the phenomenon of diesel knock in C.I engines and compare the same with detonation in S.I engines.
   (c) How do the injection timing and the fuel quality affect the engine knock? [4+8+4]

4. (a) Explain the measurement of air supply to an internal combustion engine with a neat sketch.
   (b) An engine is required to develop 100 kW, the mechanical efficiency of the engine is 86% and the engine uses 55 kg/h of fuel. Due to improvement in the design and operating conditions there is reduction in engine friction to the extent of 4.8 kw. If indicated thermal efficiency remains the same, determine the saving in fuel in kg/h. [16]

5. (a) State the uses of compressed air in engineering
   (b) Working from first principles, derive an expression for work done on air in a reciprocating compressor in terms of the pressure ratio. [6+10]

6. (a) List the various types of rotary compressors? [5+5]
   (b) Explain with a neat sketch, the working of a roots blower. [6]

7. (a) Draw the flow diagram of vapour compression refrigeration system and analyse the thermodynamic cycle applied for it?

(b) Explain the difference between the Bell Coleman and Joule cycle of refrigeration. [8+8]

8. (a) Define wet bulb and dry bulb temperature and illustrate its application with respect to air conditioning applications?

(b) How the refrigerants are named according their composition? Discuss the important properties of refrigerants? [8+8]

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Code No: RR220303 **Set No. 4**

**II B.Tech II Semester Supplementary Examinations,**
**November/December 2005**
**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) Explain the working of a four stroke c.i. engine with a neat sketch.
   (b) Explain the mechanism for load control in c.i. engines. [16]

2. Discuss the various types of combustion chambers used on S.I. Engines, with showing line diagram for each type, indicating the spank plug locatin. [16]

3. (a) How does the mixture of air and fuel in the combustion chamber of C.I engine differ from that of S.I engines? What are the reason for operating a C.I engines at considerably higher A:F ratio compared to the chemically correct mixture?
   (b) What is the range of overall A/F ratios m a C.I engine combustion chamber?
   (c) Does the flame front exist in a C.I engines? Why [16]

4. A gas engine having compression ratio of 6 develops an indicated power of 16.7 kW. The gas consumption is 15.3 $m^3$/h measured at 25$^o$C and at a pressure of 12.7 cm of water above the atmospheric pressure 73.75 cm of mercury. The calorific value of gas at 1bar and 0$^o$C was 18700 kJ/$m^3$. Find the ratio of the actual and the ideal thermal efficiencies. Take $\gamma$ =1.4.

5. (a) Derive an expression for the isothermal efficiency of a compressor in terms of the pressure ratio.
   (b) A double acting compressor takes in air at 100kPa and delivers it to the receiver at 1000kPa. The speed is 200rpm, diameter is 150mm and stroke length is 220mm. Calculate the capacity of the motor required. [8+8]

6. (a) List the various types of rotary compressors? [5+5]
   (b) Explain with a neat sketch, the working of a roots blower. [6]

7. (a) Write the differences between refrigerator and heat pump? Derive the COP for both of them?
   (b) b) Calculate the power required to run a refrigerator producing 500 kg/hr of ice at -5$^0$C when the water is supplied at 15$^0$C. Take $C_p$ = 2.0 kJ/kg K for the ice and latent heat of freezing as 315 kJ/kg. [8+8]

8. (a) Discuss the essential properties of an ideal refrigerant?
   (b) Name various psychrometric processes and show each of them on psychrometric chart? Which of these properties is most suitable in summer? [8+8]

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