

Code No: R05220304

**R05****Set No. 2****II B.Tech II Semester Examinations, December 2010****THERMAL ENGINEERING-I****Common to Mechanical Engineering, Automobile Engineering****Time: 3 hours****Max Marks: 80****Answer any FIVE Questions****All Questions carry equal marks**

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1. (a) List the parameters by which performance of an engine is evaluated.  
 (b) Find the bore of the single-cylinder diesel engine working on the four-stroke cycle and delivers 40 kW at 200 rpm from the following data:  
 Compression ratio : 14:1  
 Fuel cut-off : 5% of stroke  
 Index of compression curve : 1.4  
 Index for expansion curve : 1.3  
 Pressure at beginning of compression : 1 atm  
 Ratio of stroke to bore : 1.5 to 1. [8+8]
2. (a) How is the vapour compression refrigeration cycle different from the reversed Carnot cycle? Explain what you understand by the terms  
 i. COP and  
 ii. a tonne of Refrigeration.  
 (b) A dense air refrigeration machine operating on Bell-Coleman cycle operates between 3.4 bar and 17 bar. The temperature of air after the cooler is 15°C and after the refrigerator is 6°C. For a refrigeration capacity of 6 tonnes, find  
 i. Temperature after compression and expansion;  
 ii. Air circulation required in the cycle per minute;  
 iii. Work of compressor and expander ;  
 iv. Theoretical COP;  
 v. Rate of water circulation required in the cooler in kg/min, if the rise in temperature is limited to 30°C. [16]
3. Determine the absolute Mach number of the flow at the exit of the radial vaned impeller of a centrifugal compressor when the radial component of the velocity at impeller exit is 28 m/s and the slip factor is 0.9. The impeller tip speed is 350 m/s. If the impeller exit area is 0.08 m<sup>2</sup> and the total head isentropic efficiency of the impeller is 90%, determine the mass flow rate. Take  $\gamma = 1.4$ ,  $C_p = 1.005 \text{ KJ / Kg K}$ ,  $R = 0.287 \text{ KJ / Kg K}$  and  $T_{01} = 288^\circ \text{ K}$ . [16]
4. (a) What is effective temperature?  
 (b) In a heating application, moist air enters a steam heating coil at 10°C, 50% RH and leaves at 30°C. Determine the sensible heat transfer if mass flow rate of air is 100 kg of dry air /s. Also determine the steam mass flow rate if steam enters saturated at 100°C and condensate leaves at 80°C. [16]

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5. (a) Draw the neat sketch of an injection pump in a C.I Engine and explain its working?  
(b) Draw the ideal and actual indicator diagrams for 4 Stroke C.I engine and explain salient features? [8+8]
6. (a) What is ignition delay in combustion of C.I. Engine? What are different parameters influencing the ignition delay?  
(b) Differentiate between direct injection type and indirect injection type combustion chambers used in C.I. Engines. [8+8]
7. A small single-acting compressor has a bore and stroke both of 10 cm and is driven at 350 r.p.m. The clearance volume is  $75 \text{ cm}^3$  and the index of compression and expansion is 1.23. The suction pressure is 0.95 bar and the delivery is 7 bar. Calculate  
(a) the volume of free air at 1 bar and  $20^\circ\text{C}$  dealt with per minute, if the temperature at the start of compression is  $30^\circ\text{C}$ , and  
(b) the mean effective pressure of the indicator diagram, assuming constant suction and delivery pressure. [16]
8. (a) What are the common problems faced with C.I.Engines during starting in winter and explain various methods of starting.  
(b) Explain the working of air cell combustion chamber with suitable diagram. [8+8]

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**R05****Set No. 4****II B.Tech II Semester Examinations, December 2010****THERMAL ENGINEERING-I****Common to Mechanical Engineering, Automobile Engineering****Time: 3 hours****Max Marks: 80****Answer any FIVE Questions****All Questions carry equal marks**

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2. (a) Draw the neat sketch of an injection pump in a C.I Engine and explain its working?  
(b) Draw the ideal and actual indicator diagrams for 4 Stroke C.I engine and explain salient features? [8+8]
3. (a) How is the vapour compression refrigeration cycle different from the reversed Carnot cycle? Explain what you understand by the terms
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 (b) A dense air refrigeration machine operating on Bell-Coleman cycle operates between 3.4 bar and 17 bar. The temperature of air after the cooler is  $15^{\circ}\text{C}$  and after the the refrigerator is  $6^{\circ}\text{C}$ . For a refrigeration capacity of 6 tonnes, find
  - i. Temperature after compression and expansion;
  - ii. Air circulation required in the cycle per minute;
  - iii. Work of compressor and expander ;
  - iv. Theoretical COP;
  - v. Rate of water circulation required in the cooler in kg/min, if the rise in temperature is limited to  $30^{\circ}\text{C}$ . [16]
4. Determine the absolute Mach number of the flow at the exit of the radial vaned impeller of a centrifugal compressor when the radial component of the velocity at impeller exit is 28 m/s and the slip factor is 0.9. The impeller tip speed is 350 m/s. If the impeller exit area is  $0.08 \text{ m}^2$  and the total head isentropic efficiency of the impeller is 90%, determine the mass flow rate. Take  $\gamma = 1.4$ ,  $C_p = 1.005 \text{ KJ / Kg K}$ ,  $R = 0.287 \text{ KJ / Kg K}$  and  $T_{01} = 288^{\circ}\text{K}$ . [16]
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(b) Explain the working of air cell combustion chamber with suitable diagram. [8+8]

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6. A small single-acting compressor has a bore and stroke both of 10 cm and is driven at 350 r.p.m. The clearance volume is  $75 \text{ cm}^3$  and the index of compression and expansion is 1.23. The suction pressure is 0.95 bar and the delivery is 7 bar. Calculate
- (a) the volume of free air at 1 bar and  $20^\circ\text{C}$  dealt with per minute, if the temperature at the start of compression is  $30^\circ\text{C}$ , and
  - (b) the mean effective pressure of the indicator diagram, assuming constant suction and delivery pressure. [16]
7. (a) What is effective temperature?
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8. (a) List the parameters by which performance of an engine is evaluated.
- (b) Find the bore of the single-cylinder diesel engine working on the four-stroke cycle and delivers 40 kW at 200 rpm from the following data:
- Compression ratio : 14:1
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  - Pressure at beginning of compression : 1 atm
  - Ratio of stroke to bore : 1.5 to 1.
- [8+8]

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**R05****Set No. 1**

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**THERMAL ENGINEERING-I**

Common to Mechanical Engineering, Automobile Engineering

Time: 3 hours

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Ratio of stroke to bore : 1.5 to 1. [8+8]
3. A small single-acting compressor has a bore and stroke both of 10 cm and is driven at 350 r.p.m. The clearance volume is 75 cm<sup>3</sup> and the index of compression and expansion is 1.23. The suction pressure is 0.95 bar and the delivery is 7 bar. Calculate  
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- (b) A dense air refrigeration machine operating on Bell-Coleman cycle operates between 3.4 bar and 17 bar. The temperature of air after the cooler is  $15^{\circ}\text{C}$  and after the the refrigerator is  $6^{\circ}\text{C}$ . For a refrigeration capacity of 6 tonnes, find
- Temperature after compression and expansion;
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**R05****Set No. 3**

II B.Tech II Semester Examinations, December 2010

**THERMAL ENGINEERING-I**

Common to Mechanical Engineering, Automobile Engineering

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6. (a) List the parameters by which performance of an engine is evaluated.  
(b) Find the bore of the single-cylinder diesel engine working on the four-stroke cycle and delivers 40 kW at 200 rpm from the following data:  
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