Code No: 07A52403 **R07** **Set No. 2**

III B.Tech I Semester Examinations,December 2011
THERMAL ENGINEERING
Automobile Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What do you mean by natural draught? What are the limitations of natural draught?
   (b) What are the factors to be considered while designing chimney. Explain. [8+8]

2. Inlet diffuser, nozzle, thrust. An aircraft powered by a turbojet engine, is working in ambient conditions : 22 kN/m^2, 220 k, is flying with a speed of 130 m/s. the total head temperature rise in the compressor is 222 k. the total head conditions at turbine inlet :195 kN/m^2 995 k; the total head efficiency of the turbine, 0.84. Find specific thrust of the engine in flight. Take nozzle isentropic efficiency, 0.91. [16]

	k	Cp kj/kg k
Air	1.4	1.0
Gases	1.3	1.15

3. The air in a gas turbine plant is taken in L.P compressor at 293 K and 1.05 bar and after compression it is passed through intercooler where its temperature is reduced to 300 K. The cooled air is further compressed in H.P. and then passed in the combustion chamber where its temperature is increased to 750^0C by burning the fuel. The combustion products expand in H.P. turbine which runs the compressors and further expansion is continued in L.P. turbine which runs the alternator. The gases coming out from L.P. turbine are used for heating the incoming air from H.P. compressor and then expanded to atmosphere. Pressure ratio of each compressor = 2, Isentropic efficiency of each compressor stage = 82% , isentropic efficiency of each turbine stage =82%, effectiveness of heat exchanger = 0.72, air flow = 16 kg/s, calorific value of the fuel = 42000 kJ/kg , C_v(for gas)=1.0 kJ/kg K, C_p(for gas)= 1.15 kJ/kg K, γ (for air) = 1.4, γ (for gas) = 1.33. Neglecting the mechanical, pressure and heat losses of the system and fuel mass also determine the following:
   (a) The power output
   (b) Thermal efficiency
   (c) Specific fuel consumption. [16]

4. (a) How are the maximum temperature and maximum pressure in the Rankine cycle fixed? Explain, with the help of 'T-s' diagram(s).
   (b) A steam turbine plant operates on the Rankine cycle. Steam is supplied at a pressure of 1 MN/m^2 and with a dryness fraction of 0.97. The steam exhausts into a condenser at a pressure of 15 kN/m^2. Determine the Rankine efficiency. [8+8]

5. (a) What are the advantages and limitations of velocity compounding?

   (b) An impulse turbine stage having a row of nozzles and a single ring of blades. The nozzle angle is 20^0 and the blade exit angle is 30^0 with reference to the plane of rotation. The mean blade speed is 130 m/s and the velocity of steam leaving the nozzles is 330 m/s. Taking the blade friction factor as 0.8 and a nozzle efficiency of 85%, determine the work done in the stage per kg of steam, and the stage efficiency. [6+10]

6. The following data refer to a particular stage of a Parson's reaction turbine
   Speed of the turbine = 1500 rpm
   Mean diameter of the rotor = 1 metre
   Stage efficiency = 80%
   Speed ratio = 0.7
   Blade outlet angle = 20^0
   Determine the available isentropic enthalpy drop in the stage. [16]

7. (a) What are the effects of super saturated flow on the performance of nozzle?

   (b) Derive the expressions for maximum velocity and discharge through a convergent-divergent nozzle in terms of initial pressure, specific volume and ploytropic index. [6+10]

8. (a) Draw the schematic diagram of counter flow jet condenser and explain its working.

   (b) The surface condenser is designed to handle 16000kg of steam per hour. The steam enters the condenser at 0.09 bar abs. and 0.88 dryness fraction and condensate leaves the condenser at the corresponding saturation temperature. Determine the rise in cooling water temperature if the cooling water flow rate is 8.96 x 10^5 kg/hour. Assume that the pressure is constant throughout the condenser. [8+8]

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Code No: 07A52403 **R07** **Set No. 4**

III B.Tech I Semester Examinations,December 2011
THERMAL ENGINEERING
Automobile 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 advantages and limitations of velocity compounding?
   (b) An impulse turbine stage having a row of nozzles and a single ring of blades. The nozzle angle is 20^0 and the blade exit angle is 30^0 with reference to the plane of rotation. The mean blade speed is 130 m/s and the velocity of steam leaving the nozzles is 330 m/s. Taking the blade friction factor as 0.8 and a nozzle efficiency of 85%, determine the work done in the stage per kg of steam, and the stage efficiency. [6+10]

2. The air in a gas turbine plant is taken in L.P compressor at 293 K and 1.05 bar and after compression it is passed through intercooler where its temperature is reduced to 300 K. The cooled air is further compressed in H.P. and then passed in the combustion chamber where its temperature is increased to 750^0C by burning the fuel. The combustion products expand in H.P. turbine which runs the compressors and further expansion is continued in L.P. turbine which runs the alternator. The gases coming out from L.P. turbine are used for heating the incoming air from H.P. compressor and then expanded to atmosphere. Pressure ratio of each compressor = 2, Isentropic efficiency of each compressor stage = 82% , isentropic efficiency of each turbine stage =82%, effectiveness of heat exchanger = 0.72, air flow = 16 kg/s, calorific value of the fuel = 42000 kJ/kg , C_v(for gas)=1.0 kJ/kg K, C_p(for gas)= 1.15 kJ/kg K, γ (for air) = 1.4, γ (for gas) = 1.33. Neglecting the mechanical, pressure and heat losses of the system and fuel mass also determine the following:
   (a) The power output
   (b) Thermal efficiency
   (c) Specific fuel consumption. [16]

3. (a) Draw the schematic diagram of counter flow jet condenser and explain its working.
   (b) The surface condenser is designed to handle 16000kg of steam per hour. The steam enters the condenser at 0.09 bar abs. and 0.88 dryness fraction and condensate leaves the condenser at the corresponding saturation temperature. Determine the rise in cooling water temperature if the cooling water flow rate is 8.96 x 10^5 kg/hour. Assume that the pressure is constant throughout the condenser. [8+8]

4. (a) What do you mean by natural draught? What are the limitations of natural draught?

(b) What are the factors to be considered while designing chimney. Explain. [8+8]

5. (a) What are the effects of super saturated flow on the performance of nozzle?

   (b) Derive the expressions for maximum velocity and discharge through a convergent-divergent nozzle in terms of initial pressure, specific volume and ploytropic index. [6+10]

6. (a) How are the maximum temperature and maximum pressure in the Rankine cycle fixed? Explain, with the help of 'T-s' diagram(s).

   (b) A steam turbine plant operates on the Rankine cycle. Steam is supplied at a pressure of 1 MN/m^2 and with a dryness fraction of 0.97. The steam exhausts into a condenser at a pressure of 15 kN/m^2. Determine the Rankine efficiency. [8+8]

7. Inlet diffuser, nozzle, thrust. An aircraft powered by a turbojet engine, is working in ambient conditions : 22 kN/m^2, 220 k, is flying with a speed of 130 m/s. the total head temperature rise in the compressor is 222 k. the total head conditions at turbine inlet :195 kN/m^2 995 k; the total head efficiency of the turbine, 0.84. Find specific thrust of the engine in flight. Take nozzle isentropic efficiency, 0.91. [16]

	k	Cp kj/kg k
Air	1.4	1.0
Gases	1.3	1.15

8. The following data refer to a particular stage of a Parson's reaction turbine
   Speed of the turbine = 1500 rpm
   Mean diameter of the rotor = 1 metre
   Stage efficiency = 80%
   Speed ratio = 0.7
   Blade outlet angle = 20^0
   Determine the available isentropic enthalpy drop in the stage. [16]

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Code No: 07A52403 **R07** **Set No. 1**

III B.Tech I Semester Examinations,December 2011
THERMAL ENGINEERING
Automobile Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) How are the maximum temperature and maximum pressure in the Rankine cycle fixed? Explain, with the help of 'T-s' diagram(s).
   (b) A steam turbine plant operates on the Rankine cycle. Steam is supplied at a pressure of 1 MN/m^2 and with a dryness fraction of 0.97. The steam exhausts into a condenser at a pressure of 15 kN/m^2. Determine the Rankine efficiency. [8+8]

2. (a) What do you mean by natural draught? What are the limitations of natural draught?
   (b) What are the factors to be considered while designing chimney. Explain. [8+8]

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4. The following data refer to a particular stage of a Parson's reaction turbine
   Speed of the turbine = 1500 rpm
   Mean diameter of the rotor = 1 metre
   Stage efficiency = 80%
   Speed ratio = 0.7
   Blade outlet angle = 20^0
   Determine the available isentropic enthalpy drop in the stage. [16]

5. The air in a gas turbine plant is taken in L.P compressor at 293 K and 1.05 bar and after compression it is passed through intercooler where its temperature is reduced to 300 K. The cooled air is further compressed in H.P. and then passed in the combustion chamber where its temperature is increased to 750^0C by burning the fuel. The combustion products expand in H.P. turbine which runs the compressors and further expansion is continued in L.P. turbine which runs the alternator. The gases coming out from L.P. turbine are used for heating the incoming air from H.P. compressor and then expanded to atmosphere. Pressure ratio of each compressor

= 2, Isentropic efficiency of each compressor stage = 82% , isentropic efficiency of each turbine stage =82%, effectiveness of heat exchanger = 0.72, air flow = 16 kg/s, calorific value of the fuel = 42000 kJ/kg , C_v(for gas)=1.0 kJ/kg K, C_p(for gas)= 1.15 kJ/kg K, γ (for air) = 1.4, γ (for gas) = 1.33. Neglecting the mechanical, pressure and heat losses of the system and fuel mass also determine the following:

(a) The power output

(b) Thermal efficiency

(c) Specific fuel consumption. [16]

6. (a) What are the effects of super saturated flow on the performance of nozzle?

   (b) Derive the expressions for maximum velocity and discharge through a convergent-divergent nozzle in terms of initial pressure, specific volume and ploytropic index. [6+10]

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   (b) An impulse turbine stage having a row of nozzles and a single ring of blades. The nozzle angle is 20^0 and the blade exit angle is 30^0 with reference to the plane of rotation. The mean blade speed is 130 m/s and the velocity of steam leaving the nozzles is 330 m/s. Taking the blade friction factor as 0.8 and a nozzle efficiency of 85%, determine the work done in the stage per kg of steam, and the stage efficiency. [6+10]

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   (b) The surface condenser is designed to handle 16000kg of steam per hour. The steam enters the condenser at 0.09 bar abs. and 0.88 dryness fraction and condensate leaves the condenser at the corresponding saturation temperature. Determine the rise in cooling water temperature if the cooling water flow rate is 8.96 x 10^5 kg/hour. Assume that the pressure is constant throughout the condenser. [8+8]

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Code No: 07A52403 **R07** **Set No. 3**

III B.Tech I Semester Examinations,December 2011
THERMAL ENGINEERING
Automobile Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. The following data refer to a particular stage of a Parson's reaction turbine
   Speed of the turbine = 1500 rpm
   Mean diameter of the rotor = 1 metre
   Stage efficiency = 80%
   Speed ratio = 0.7
   Blade outlet angle = 20^0
   Determine the available isentropic enthalpy drop in the stage. [16]

2. (a) What are the effects of super saturated flow on the performance of nozzle?
   (b) Derive the expressions for maximum velocity and discharge through a convergent-divergent nozzle in terms of initial pressure, specific volume and ploytropic index. [6+10]

3. (a) Draw the schematic diagram of counter flow jet condenser and explain its working.
   (b) The surface condenser is designed to handle 16000kg of steam per hour. The steam enters the condenser at 0.09 bar abs. and 0.88 dryness fraction and condensate leaves the condenser at the corresponding saturation temperature. Determine the rise in cooling water temperature if the cooling water flow rate is 8.96 x 10^5 kg/hour. Assume that the pressure is constant throughout the condenser. [8+8]

4. Inlet diffuser, nozzle, thrust. An aircraft powered by a turbojet engine, is working in ambient conditions : 22 kN/m^2, 220 k, is flying with a speed of 130 m/s. the total head temperature rise in the compressor is 222 k. the total head conditions at turbine inlet :195 kN/m^2 995 k; the total head efficiency of the turbine, 0.84. Find specific thrust of the engine in flight. Take nozzle isentropic efficiency, 0.91. [16]

	k	Cp kj/kg k
Air	1.4	1.0
Gases	1.3	1.15

5. (a) What are the advantages and limitations of velocity compounding?
   (b) An impulse turbine stage having a row of nozzles and a single ring of blades. The nozzle angle is 20^0 and the blade exit angle is 30^0 with reference to the plane of rotation. The mean blade speed is 130 m/s and the velocity of steam leaving the nozzles is 330 m/s. Taking the blade friction factor as 0.8 and a

nozzle efficiency of 85%, determine the work done in the stage per kg of steam, and the stage efficiency. [6+10]

6. The air in a gas turbine plant is taken in L.P compressor at 293 K and 1.05 bar and after compression it is passed through intercooler where its temperature is reduced to 300 K. The cooled air is further compressed in H.P. and then passed in the combustion chamber where its temperature is increased to 750^0C by burning the fuel. The combustion products expand in H.P. turbine which runs the compressors and further expansion is continued in L.P. turbine which runs the alternator. The gases coming out from L.P. turbine are used for heating the incoming air from H.P. compressor and then expanded to atmosphere. Pressure ratio of each compressor = 2, Isentropic efficiency of each compressor stage = 82% , isentropic efficiency of each turbine stage =82%, effectiveness of heat exchanger = 0.72, air flow = 16 kg/s, calorific value of the fuel = 42000 kJ/kg , C_v(for gas)=1.0 kJ/kg K, C_p(for gas)= 1.15 kJ/kg K, γ (for air) = 1.4, γ (for gas) = 1.33. Neglecting the mechanical, pressure and heat losses of the system and fuel mass also determine the following:

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   (b) Thermal efficiency
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7. (a) What do you mean by natural draught? What are the limitations of natural draught?
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