Code No: 07A32302　　　　| R07 |　　　　| Set No. 2 |

II B.Tech I Semester Examinations,November 2010
THERMODYNAMICS FOR BIOTECHNOLOGISTS
Bio-Technology

Time: 3 hours　　　　　　　　　　　　　　　　　　　　Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Define Helmholtz free energy and Gibbs free energy.

   (b) Discuss various thermodynamic diagrams and tables used for estimation of thermodynamic properties.　　　　　　　　　　　　　　　[6+10]

2. What is Azeotrope and explain high boiling and low boiling Azeotropes with neat diagrams?　　　　　　　　　　　　　　　　　　　　　　　[16]

3. A particular power plant operates with a heat source reservoir at 623.15 ^{o}K and a heat sink reservoir at 303.15^{o}k. It has a thermal efficiency equal to 55% of the Carnot engine.To what temperature must the heat source reservoir be raised to increase the thermal efficiency to 55% of the Carnot engine value?　　　[16]

4. Prove that $\mu_i^{ig} = \overline{G_i}^{ig} + RT \ln y_i$.　　　　　　　　　　　　　　　[16]

5. The hydrogenation of acetylene to ethylene can be represented by the addition of formation reactions
   Viz., C_2H_2 - - - - - - - - ->2C+H$_2$- (I)
   2C+2H$_2$- - - - - - ->C$_2$H$_4$- (II)
   The reaction is carried out at 1120^{0}C and 1bar.The equilibrium constants for the reactions are given as K$_I$ = 4.0*10^5 and K$_{II}$ = 2.5*10^6
   If the feed is an equimolar mixture of acetylene ad hydrogen what is the composition of the product stream at equilibrium?　　　　　　　　　　　　[16]

6. Discuss in detail the EMP Pathway related to TCA with respect to energy utilization.　　　　　　　　　　　　　　　　　　　　　　　　　　[16]

7. (a) Develop mathematical expression for first law of thermodynamics for flow process.

   (b) Dry saturated steam at 5 bar enters a adiabatic nozzle at a velocity of 2 m/sec and leaves as dry saturated steam at 2 bar. Calculate the exit velocity of the stream.
5 bar	2 bar
H = 2748 kJ/kg	H = 2706 kJ/kg
V$_1$ = 2 m/sec	
   　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　[8+8]

8. Develop unsteady state energy balance equation for biological system, explaining about different parameters involved.　　　　　　　　　　　　　[16]

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1

| R07 | Set No. 4

II B.Tech I Semester Examinations,November 2010
THERMODYNAMICS FOR BIOTECHNOLOGISTS
Bio-Technology

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Develop mathematical expression for first law of thermodynamics for flow process.

   (b) Dry saturated steam at 5 bar enters a adiabatic nozzle at a velocity of 2 m/sec and leaves as dry saturated steam at 2 bar. Calculate the exit velocity of the stream.
   5 bar   2 bar
   H = 2748 kJ/kg   H = 2706 kJ/kg
   V_1 = 2 m/sec   [8+8]

2. A particular power plant operates with a heat source reservoir at 623.15 ^{o}K and a heat sink reservoir at 303.15^{o}k. It has a thermal efficiency equal to 55% of the Carnot engine.To what temperature must the heat source reservoir be raised to increase the thermal efficiency to 55% of the Carnot engine value?   [16]

3. (a) Define Helmholtz free energy and Gibbs free energy.

   (b) Discuss various thermodynamic diagrams and tables used for estimation of thermodynamic properties.   [6+10]

4. What is Azeotrope and explain high boiling and low boiling Azeotropes with neat diagrams?   [16]

5. Discuss in detail the EMP Pathway related to TCA with respect to energy utilization.   [16]

6. Develop unsteady state energy balance equation for biological system, explaining about different parameters involved.   [16]

7. The hydrogenation of acetylene to ethylene can be represented by the addition of formation reactions
   Viz., C_2H_2 - - - - - - - - - ->2C+H$_2$- (I)
   2C+2H$_2$- - - - - ->C$_2$H$_4$- (II)
   The reaction is carried out at 1120^0C and 1bar.The equilibrium constants for the reactions are given as K$_I$ = 4.0*10^5 and K$_{II}$ = 2.5*10^6
   If the feed is an equimolar mixture of acetylene ad hydrogen what is the composition of the product stream at equilibrium?   [16]

8. Prove that $\mu_i^{ig} = \overline{G_i}^{ig} + RT \ln y_i$.   [16]

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Code No: 07A32302 | R07 | Set No. 1

II B.Tech I Semester Examinations,November 2010
THERMODYNAMICS FOR BIOTECHNOLOGISTS
Bio-Technology

Time: 3 hours   Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. A particular power plant operates with a heat source reservoir at 623.15 ^{o}K and a heat sink reservoir at 303.15^{o}k. It has a thermal efficiency equal to 55% of the Carnot engine.To what temperature must the heat source reservoir be raised to increase the thermal efficiency to 55% of the Carnot engine value?   [16]

2. (a) Develop mathematical expression for first law of thermodynamics for flow process.

   (b) Dry saturated steam at 5 bar enters a adiabatic nozzle at a velocity of 2 m/sec and leaves as dry saturated steam at 2 bar. Calculate the exit velocity of the stream.

   5 bar   2 bar
   H = 2748 kJ/kg   H = 2706 kJ/kg
   V_1 = 2 m/sec   [8+8]

3. The hydrogenation of acetylene to ethylene can be represented by the addition of formation reactions
   Viz., C_2H_2 - - - - - - - - - ->2C+H_2- (I)
   2C+2H_2- - - - - - ->C_2H_4- (II)
   The reaction is carried out at 1120^0C and 1bar.The equilibrium constants for the reactions are given as K_I = 4.0*10^5 and K_{II} = 2.5*10^6
   If the feed is an equimolar mixture of acetylene ad hydrogen what is the composition of the product stream at equilibrium?   [16]

4. Discuss in detail the EMP Pathway related to TCA with respect to energy utilization.   [16]

5. Develop unsteady state energy balance equation for biological system, explaining about different parameters involved.   [16]

6. What is Azeotrope and explain high boiling and low boiling Azeotropes with neat diagrams?   [16]

7. (a) Define Helmholtz free energy and Gibbs free energy.

   (b) Discuss various thermodynamic diagrams and tables used for estimation of thermodynamic properties.   [6+10]

8. Prove that $\mu_i^{ig} = \overline{G_i}^{ig} + RT \ln y_i$.   [16]

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3

Code No: 07A32302 | **R07** | **Set No. 3**

II B.Tech I Semester Examinations,November 2010
THERMODYNAMICS FOR BIOTECHNOLOGISTS
Bio-Technology

Time: 3 hours   Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
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1. A particular power plant operates with a heat source reservoir at 623.15 ^{o}K and a heat sink reservoir at 303.15^{o}k. It has a thermal efficiency equal to 55% of the Carnot engine.To what temperature must the heat source reservoir be raised to increase the thermal efficiency to 55% of the Carnot engine value? [16]

2. What is Azeotrope and explain high boiling and low boiling Azeotropes with neat diagrams? [16]

3. (a) Develop mathematical expression for first law of thermodynamics for flow process.

   (b) Dry saturated steam at 5 bar enters a adiabatic nozzle at a velocity of 2 m/sec and leaves as dry saturated steam at 2 bar. Calculate the exit velocity of the stream.
   5 bar   2 bar
   H = 2748 kJ/kg   H = 2706 kJ/kg
   V_1 = 2 m/sec   [8+8]

4. The hydrogenation of acetylene to ethylene can be represented by the addition of formation reactions
   Viz., C_2H_2- - - - - - - ->2C+H$_2$- (I)
   2C+2H$_2$- - - - - ->C$_2$H$_4$- (II)
   The reaction is carried out at 1120^{0}C and 1bar.The equilibrium constants for the reactions are given as K$_I$ = 4.0*10^5 and K$_{II}$ = 2.5*10^6
   If the feed is an equimolar mixture of acetylene ad hydrogen what is the composition of the product stream at equilibrium? [16]

5. Develop unsteady state energy balance equation for biological system, explaining about different parameters involved. [16]

6. Prove that $\mu_i^{ig} = \overline{G_i}^{ig} + RT \ln y_i$. [16]

7. Discuss in detail the EMP Pathway related to TCA with respect to energy utilization. [16]

8. (a) Define Helmholtz free energy and Gibbs free energy.

   (b) Discuss various thermodynamic diagrams and tables used for estimation of thermodynamic properties. [6+10]

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