Hall Ticket Number :										

R-15

Code: 5G533

II B.Tech. I Semester Supplementary Examinations May 2017

Basic Thermodynamics

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)

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UNIT–I

1. a) The working fluid, in a steady flow process flows at a rate of 220 kg/min. The fluid rejects 100 kJ/s passing through the system. The conditions of the fluid at inlet and outlet are given as C_1 = 320 m/s, P_1 = 6 bar, U_1 = 2000 kJ/kg, v_1 = 0.36 m^3/kg and C_2 = 140 m/s, P_2 = 1.2 bar, U_2 = 1400 kJ/kg, v_2 = 1.3 m^3/kg. Determine the power capacity of the system in MW. The change in potential energy may be neglected.

   b) A 15 cm diameter vertical cylinder, closed by a piston contains a combustible mixture at a temperature of 30°C. The piston is free to move and its weight is such that the mixture pressure is 3 bar. Upper surface of the piston is exposed to the atmosphere. The mixture is ignited. As the reaction proceeds, the piston moves slowly upwards and heat transfer to the surroundings takes place. When the reaction is complete and the contents have been reduced to the initial temperature of 30°C, it is found that the piston has moved upwards a distance of 8.5 cm and the magnitude of heat transfer is kJ. Evaluate **i**) the work and **ii**) decrease in internal energy of the system

OR

2. a) In a piston-cylinder device, 300 g of saturated water vapour, maintained at 200 kPa, is heated by a resistance heater installed within the cylinder for 10 min by passing a current of 0.35 ampere from a 220 V source. The heat loss from the system during the heating process is 2.2 kJ. Calculate the work done and the final temperature of the steam.

   b) Write short notes on the following.
      i. Zeroth law and its application
      ii. Thermodynamic temperature scale
      iii. Law of corresponding states

UNIT–II

3. a) A gas mixture of 2.2 kg mass, which consists of 75 % nitrogen, 22 % oxygen and 3 % carbon dioxide by mass, is contained in a piston-cylinder device. The mixture is initially at 101 kPa and 310 K. It is then compressed to 500 kPa in a reversible polytrophic process with an index of 1.3. Determine the work done, heat transfer, and change in entropy associated with the compression process. Take γ for N_2, O_2 and CO_2 as 1.4, 1.4 and 1.3 respectively.

   b) Calculate the entropy change of the universe as a result of the following processes:
      i. A copper block of 750 g mass and with Cp of 150 J/kg K at 100°C is placed in a lake at 9°C.
      ii. The same block at 9°C is dropped from a height of 100 m into the lake.

      Two such blocks at 100 and 0°C are joined together

OR

4. a) A heat pump working on a reversed Carnot cycle takes in energy from a reservoir at 3°C and delivers it to another reservoir at 77°C. The heat pump gets power from a reversible engine taking heat from the reservoir at 1077°C and rejecting to the reservoir at 77°C. For 100 kJ/s of energy supplied to the reservoir at 77°C, estimate the energy taken from the reservoir at 1077°C

   b) Derive the expression for maximum work obtainable by using one finite body at temperature T and a thermal reservoir at temperature T_o, $T > T_o$.

UNIT–III

5. a) Water is boiled in a pan covered with a poorly fitting lid at a specified location. Heat is supplied to the pan by a 2-kW resistance heater. The amount of water in the pan is observed to decrease by 1.19 kg in 30 minutes. If it is estimated that 75 percent of electricity consumed by the heater is transferred to the water as heat, determine the local atmospheric pressure in that location.

   b) Determine the specific volume, internal energy, and enthalpy of compressed liquid water at 100°C and 15 MPa using the saturated liquid approximation. Compare these values to the ones obtained from the compressed liquid tables.

OR

6. a) A piston–cylinder device initially contains 50 L of liquid water at 40°C and 200 kPa. Heat is transferred to the water at constant pressure until the entire liquid is vaporized.
   i. What is the mass of the water?
   ii. What is the final temperature?
   iii. Determine the total enthalpy change.
   iv. Show the process on a *T-v* diagram with respect to saturation lines.

   b) A 0.3-m3 rigid vessel initially contains saturated liquid– vapor mixture of water at 150°C. The water is now heated until it reaches the critical state. Determine the mass of the liquid water and the volume occupied by the liquid at the initial state.

UNIT–IV

7. a) An insulated rigid tank is divided into two compartments by a partition. One compartment contains 7 kg of oxygen gas at 40°C and 100 kPa, and the other compartment contains 4 kg of nitrogen gas at 20°C and 150 kPa. Now the partition is removed, and the two gases are allowed to mix. Determine (***i***) the mixture temperature and (***ii***) the mixture pressure after equilibrium has been established

   b) 0.03 m^3 of nitrogen contained in a cylinder behind a piston is initially at 1.05 bar and 15°C. The gas is compressed isothermally and reversibly until the pressure is 4.2 bar. Calculate the change of entropy, the heat flow, and the work done, and sketch the process on a *p-v* and *T-s* diagrams. Assume nitrogen to act as a perfect gas. Molecular weight of nitrogen = 28.

OR

8. a) A rigid vessel of volume 0.4 m^3 contains 10 kg of air at 303 K. Using (**i**) the perfect gas equation, (**ii**) the Vander Walls' equation of state and (**iii**) generalized compressibility chart, determine the pressure which would be exerted by the air on the vessel.

   b) A gas mixture of 2.2 kg mass, which consists of 75 % nitrogen, 22 % oxygen and 3 % carbon dioxide by mass, is contained in a piston-cylinder device. The mixture is initially at 101 kPa and 310 K. It is then compressed to 500 kPa in a reversible polytrophic process with an index of 1.3. Determine the work done, heat transfer, and change in entropy associated with the compression process. Take γ for N_2, O_2 and CO_2 as 1.4, 1.4 and 1.3 respectively

UNIT–V

9. a) The minimum pressure and temperature in an Otto cycle are 100 kPa and 27°C. The amount of heat added to the air per cycle is 1500 kJ/kg.
   i. Determine the pressures and temperatures at all points of the air standard Otto cycle.
   ii. Also calculate the specific work and thermal efficiency of the cycle for a compression ratio of 8 : 1.

   b) The efficiency of an Otto cycle is 60% and γ = 1.5. What is the compression ratio?

OR

10. a) An engine working on Otto cycle has a volume of 0.45 m3, pressure 1 bar and temperature 30°C at the beginning of compression stroke. At the end of compression stroke, the pressure is 11 bar. 210 kJ of heat is added at constant volume. Determine :
   i. Pressures, temperatures and volumes at salient points in the cycle.
   ii. Percentage clearance.
   iii. Efficiency.
   iv. Net work per cycle.
   v. Mean effective pressure.
   vi. Ideal power developed by the engine if the number of working cycles per minute is 210. Assume the cycle is reversible.

   b) The mean effective pressure of a Diesel cycle is 7.5 bar and compression ratio is 12.5. Find the percentage cut-off of the cycle if its initial pressure is 1 bar.

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Hall Ticket Number :										

R-15

Code: 5GC31

II B.Tech. I Semester Supplementary Examinations May 2017

Engineering Mathematics –III

(Common to CE & ME)

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 14 = 70Marks)

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UNIT–I

1. a) Find the values of a and b for which the equations $x+ay+z=3,\ x+2y+2z=b,\ x+5y+3z=9$ are consistent. When will these equations have a unique solution? 8M

   b) Find the rank of the matrix $\begin{bmatrix} 5 & 5 & 5 & 5 \\ 1 & 4 & 0 & 7 \\ 0 & -2 & 1 & 3 \end{bmatrix}$ by reducing it into Row-Echelon form. 6M

OR

2. a) Prove that the sum of the eigen values of a matrix is the sum of the elements of the principal diagonal. 6M

   b) Verify Cayley-Hamilton theorem for A= $\begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$ and hence find A^{-1} and A^3. 8M

UNIT–II

3. a) Find a recurrence formula to calculate $\sqrt{N}$ using Newton-Raphson method and hence evaluate $\sqrt{17}$. 7M

   b) Estimate the values of $f(1.2)$ and $f(2)$ from the date given.

x	1	1.4	1.8	2.2
$f(x)$	3.49	4.82	5.96	6.5

7M

OR

4. The following table gives the velocity v of a particle at time t :

t (sec)	0	2	4	6	8	10	12
v (m/s)	4	6	16	34	60	94	136

Find the distance moved by the particle in 12 seconds and also the acceleration at t = 6 seconds. 14M

UNIT–III

5. Find $y(0.1)$ and $y(0.5)$ by Taylor's series method from $\frac{dy}{dx}=xy+1,\ y(0)=1.$ Compare the numeric solution with its exact solution. 14M

OR

6. Apply Milne's method to find a solution of $\frac{dy}{dx}=x-y^2,\ y(0)=0$ in the range $0\le x\le 1.$ 14M

UNIT–IV

7. Obtain Fourier series of a function $f(x) = |x|$, $-® < x < ®$ and hence deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \text{----} = \frac{®^2}{8}$. 14M

OR

8. a) Form the partial differential equation by eliminating arbitrary constants a, b, c from $(x-a)^2 + (y-b)^2 + z^2 = c^2$. 8M

b) Solve $\frac{\partial^2 z}{\partial x \partial y} - \frac{x}{y} = 100$ by the method of separation of variables. 6M

UNIT–V

9. Find the analytic function $f(z) = u + iv$, if $2u + v = e^x(\cos y - \sin y)$. 14M

OR

10. a) Evaluate $\oint_c \frac{e^z \cos z}{\left(z - \frac{®}{2}\right)^2} dz$, where c is $|z| = 2$. 10M

b) Evaluate $\oint_c z^2 \cot z \, dz$, where c is the unit circle. 4M

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Hall Ticket Number :										

R-15

Code: 5G532

II B.Tech. I Semester Supplementary Examinations May 2017

Metallurgy & Material Science

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)

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UNIT–I

1. a) Differentiate between a crystal, dendrite and a grain. 7M

   b) What are the three methods of obtaining fine grain size? Explain about each in brief. 7M

OR

2. Write down the benefits obtained by alloying with examples. Give the classification of alloys and explain about each in brief. 14M

UNIT–II

3. List out the methods of constructing phase diagrams. Discuss about construction of a phase diagram for a binary system where the two constituents are completely soluble in each other in both liquid and solid states. Apply lever rule and obtain chemical composition as well as amounts of different phases for a typical composition. 14M

OR

4. a) Metal A melts at 650^0C and metal B melts at 450^0C. When alloyed together, A and B does not form any compound or intermediate phase. Solid solubility of metal A in B and B in A is negligible. The metal pair forms a eutectic at 300^0C with 40 % A and 60% B. Assume that the liquidus lines are straight. Draw the phase diagram for the alloy series and find:
   (i) temperature at which 70% of A and 30% of B starts and completes solidification
   (ii) for the same alloy, find the amount of solid phase and liquid phase at 400^0C 10M

   b) What is coring? How is it handled? 4M

UNIT–III

5. a) Write a note on mechanical properties and applications of Grey Cast Iron. 7M

   b) Elaborate the purposes for which alloying of steels is performed. 7M

OR

6. a) Write down the alloy designation system for aluminium alloys. Explain about each in brief. 9M

   b) Explain seasonal cracking of brass. How can this be handled? 5M

UNIT–IV

7. a) What is hardenability of Steel? Explain the end quench test to obtain hardenability. 9M

   b) What is austempering? What are its benefits? 5M

OR

8. What are the limitations of Iron – Iron carbide equilibrium diagram? Explain in detail the procedure followed in construction of TTT diagram. 14M

UNIT–V

9. Discuss about steel making using an electric furnace. What are the advantages? 14M

OR

10. Write notes on
    i) Cermets
    ii) FRP
    iii) MMC 14M

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Hall Ticket Number :										

R-15

Code: 5G531

II B.Tech. I Semester Supplementary Examinations May 2017

Mechanics of Solids

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)

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UNIT–I

1. a) A rod of 250 cm long and diameter 3.0 cm is subjected to an axial pull of 30 kN. If the modulus of elasticity of the material of the rod is 2 x 10^5 N/mm^2. Determine stress, strain, the elongation of the rod and Poisson's ratio. 7M

   b) Derive a relation for change in length of a bar hanging freely under its own weight. 7M

OR

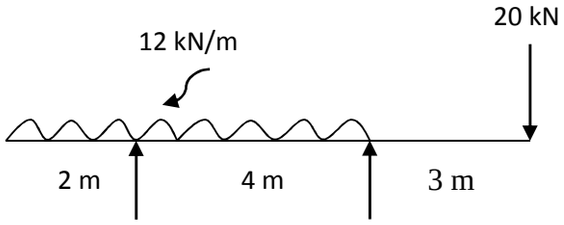
2. a) Derive the relationship between bulk modulus and young's modulus. 7M

   b) A solid circular bar of diameter 20mm when subjected to an axial tensile load of 40 kN, the reduction in diameter of the rod was observed as 6.4 x 10 -3 mm. The bulk modulus of the material of the bar is 67 GPa. Determine the following: Young's Modulus, Poissson's ratio, Modulus of rigidity, change in length per meter and Change in volume of the bar per meter length. 7M

UNIT–II

3. a) Derive the relationship between bending moment and shear force. 4M

   b) Draw the shear force and bending moment diagrams for the beam given in Fig.1.



10M

Fig.1

OR

4. A simply supported beam of length 6 m carries a UDL of 20 kN/m, throughout its length and a point load of 30 kN at 2 m from the right support. Draw shear force and bending moment diagram. Also find the position and magnitude of maximum bending moment. 14M

UNIT–III

5. a) State the assumptions made in the theory of simple bending and derive the simple bending equation. 7M

   b) A rectangular beam 120 mm wide and 270 mm deep is subjected to a maximum shear force 60 kN. Determine the average shear stress, maximum shear stress and shear stress at a distance 20 mm above the neutral axis. 7M

OR

6. The cross section of a T-beam is as follows: flange thickness=10mm; width of flange = 100 mm; thickness of web = 10mm; depth of web=120 mm. If shear force of 2kN is acting at particular section of the beam. Draw the shear stress distribution across the cross section. 14M

UNIT–IV

7. A beam 6m long, simply supported at its ends and carrying a point load of 55 kN at its centre. The moment of inertia of the beam is given as equal to 78 x 10^6 mm^4. If E for the material of the beam = 2.1 x 10^5 N/mm^2, Calculate: (i) deflection at the centre of the beam and (ii) slope at the supports. 14M

OR

8. A solid steel shaft is subjected to a torque of 50 kNm. If the angle of twist is 0.5 degree per meter length of the shaft and the shear stress is not to be allowed to exceed 95 MN/m^2, find (i) suitable diameter for the shaft (ii) Final maximum shear stress, and (iii) Maximum shear strain in the shaft. Take C = 80 GN/m^2. 14M

UNIT–V

9. A thin cylindrical shell 3.5 m long has 1.2 m internal diameter and 15 mm metal thickness. Calculate the circumferential and longitudinal stresses induced and also the change in the dimensions of the shell, if it is subjected to an internal pressure of 1.5 N/mm^2. Take E= 2 x 10^5 N/mm^2 and poison's ratio = 0.3. Also calculate change in volume. 14M

OR

10. a) What are the assumptions made in Euler's column theory? Differentiate between a strut and column. 7M

    b) Derive the crippling load for a column with one end fixed and the other end free. 7M

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Hall Ticket Number :										

R-15

Code: 5G534

II B.Tech. I Semester Supplementary Examinations May 2017

Manufacturing Technology

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 14 = 70Marks)

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UNIT–I

1. a) What is pattern? Explain various allowances to be given for patterns. 7M
   b) Describe centrifugal casting process and its advantages. 7M

OR

2. a) Describe Pressurized and non-pressurized gating systems 7M
   b) Describe at least six casting defects, state their remedies. 7M

UNIT–II

3. a) Describe Resistance welding process .state few applications. 7M
   b) Describe Friction welding and state its advantages. 7M

OR

4. a) What arc blow in arc welding? how this can be eliminated,. 7M
   b) Compare TIG&MIG welding processes. 7M

UNIT–III

5. a) Compare hot and cold rolling, state few applications. 7M
   b) Describe Rolling process. And describe some Rolling stands. 7M

OR

6. a) Describe Embossing, and Coining process, and differentiate them. 7M
   b) Describe wire drawing and cup drawing processes. 7M

UNIT–IV

7. a) Describe drop forging process and roll forging process. 7M
   b) What is Rotary forging and state its advantages 7M

OR

8. What is Extrusion? Discuss various types of extrusion process, stating applications, merits& demerits. 14M

UNIT–V

9. a) Classify plastics. And state their applications. 7M
   b) Describe compression moulding process and state its applications. 7M

OR

10. a) Describe injection moulding process and state its applications. 7M
    b) Describe blow moulding process and state its applications. 7M

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