Hall Ticket Number :										

R-14

Code: 4G533

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 :										

Code: 4G236

R-14

II B.Tech. I Semester Supplementary Examinations May 2017

Electrical Engineering and Electronics Engineering

(Common to ME, CSE & IT)

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) Derive the relation between phase and line values of 3 phase balanced star connected system. 7M

   b) A current of 10 A flows in a circuit with a 30 degree angle of lag when the applied voltage is 100 V. Find the impedance, reactance and resistance of the circuit. 7M

OR

2. a) State and explain Kirchoff's laws with the help of neat diagram 7M

   b) Two resistances of 1.5 Ω and 3.5 Ω are connected in parallel and their combination is connected is series with a resistance of 1.95 Ω. Find the equivalent resistance of the circuit. What current will it draw if connected to a 30V supply? 7M

UNIT–II

3. The resistance of the field circuit of a shunt wound dc generator is 200 ohms. When the output of the generator is 100 kW, the terminal voltage is 500 V and the generated emf is 525 V. Calculate: (a) the armature resistance, and (b) the value of the generated emf when the output is 60 kW, with a terminal voltage of 520 V. 14M

OR

4. a) A 240V,dc shunt motor takes 32 A of line current of the armature and field resistances are 1.2Ω and 240Ω respectively of the load torque remains constant, find the resistance inserted in series with the armature to have the speed. 7M

   b) Explain Swinburne's test for the determination of efficiency of a dc machine 7M

UNIT–III

5. a) Explain the principle of operation of 3 phase induction motor 7M

   b) Discuss the synchronous impedance method of calculating voltage regulation of an alternator 7M

OR

6. a) List out different types of losses present in transformer 6M

   b) A 1- transformer has 500 primary and 100 secondary terms. The net cross-sectional area of the core is 50 cm^2. if the primary winding is connected to a 50 H_2 supply at 400V. Calculate (i) Peak value of the flux density in the core (ii) The voltage induced in the secondary winding. 8M

UNIT–IV

7. Explain the working of P-N-P transistor and mention its input-output characteristics 14M

OR

8. a) Explain in detail about frequency response of CE amplifier. 7M

   b) With a neat circuit explain the operation of half wave rectifier circuit 7M

UNIT–V

9. a) Derive the expression for the electrostatic deflection of CRO 7M

   b) Explain the principle of dielectric heating 7M

OR

10. Explain the concept of induction heating and also discuss about various industrial applications of induction heating 14M

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Hall Ticket Number :										

R-14

Code: 4GC31

II B.Tech. I Semester Supplementary Examinations May 2017

Mathematics –II

(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-14

Code: 4G534

II B.Tech. I Semester Supplementary Examinations May 2017

Machine Drawing

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

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Section-I

Answer any two of the following **2x4=8M**

1. a) Sketch the following types of lines: (i) centre line, and (ii) cutting plane line 2M
   b) Sketch the conventional representation of the following materials: (i) concrete and (ii) wood 2M

2. a) With a suitable drawing, explain the terms half section. 2M
   b) List out various principles to be followed while dimensioning a drawing. 2M

3. a) Explain the term ‘‘Machine drawing’’. 2M
   b) Define the term ‘‘Production drawing’’. 2M

Section-II

Answer any two of the following **2x10=20M**

4. Sketch any two types of machine screws of 10 mm diameter. 10M

5. Draw (*a*) sectional view from the front and (*b*) view from above, of single riveted lap joint to join plates of thickness 10 mm 10M

6 Draw the sectional view from the front of a knuckle joint used to connect two rods of 50 mm diameter each. 10M

Section-III
Answer the following 1x42=42M

7. The details of a crosshead of a steam engine are shown in Figure1. Assemble the parts and draw, (*i*) half sectional view from the front, showing top half in section and (*ii*) the view from the left. 42M

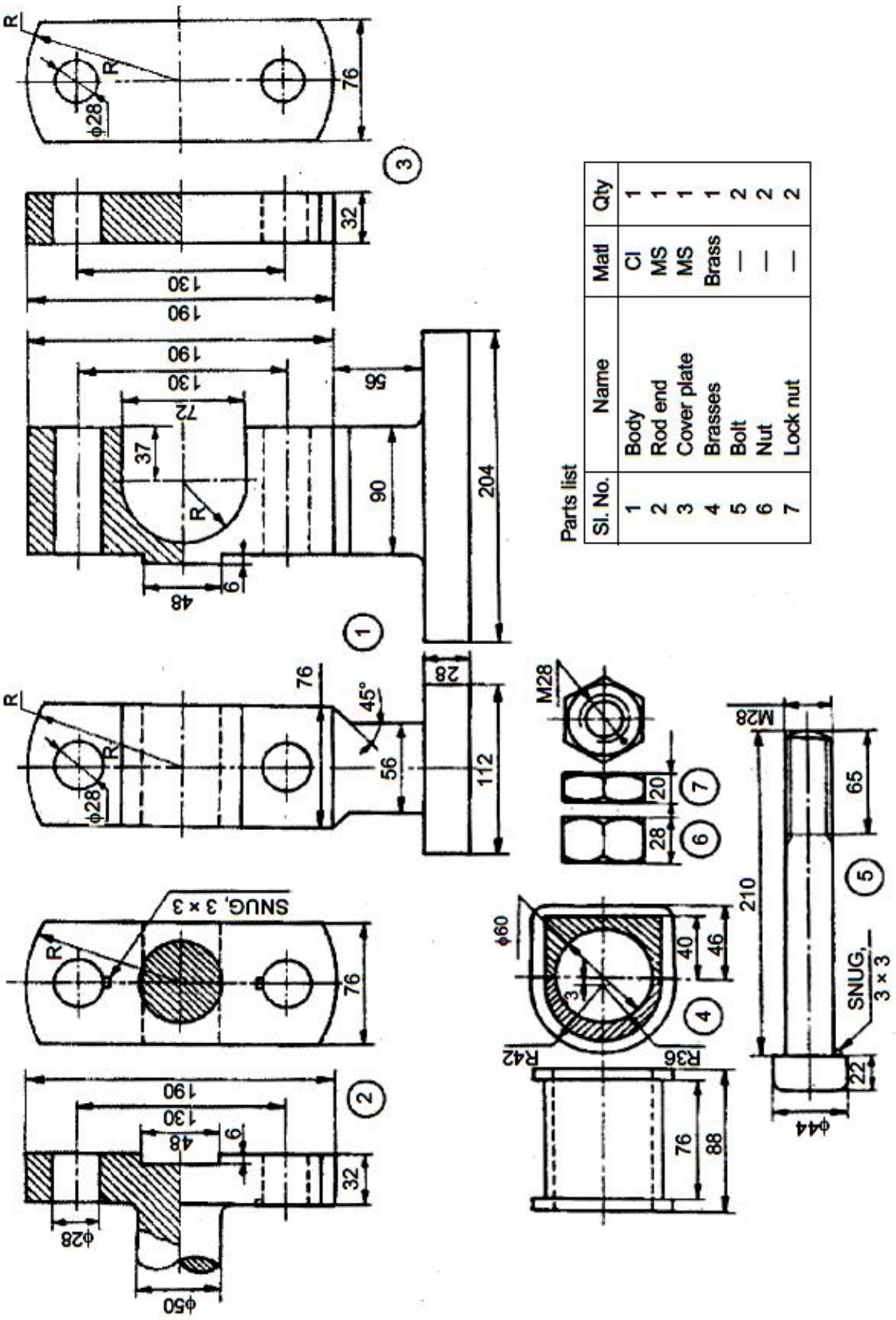

Figure 1 Cross Head

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Hall Ticket Number :										

R-14

Code: 4G532

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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