Hall Ticket Number :										

R-15

Code: 5G533

II B.Tech. I Semester Regular & Supplementary Examinations Nov/Dec 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) Explain clearly the difference between a non-flow and a steady flow process. 5M

   b) A mass of 2.4 kg of air at 150 kPa and 12°C is contained in a gas-tight, frictionless piston–cylinder device. The air is now compressed to a final pressure of 600 kPa. During the process, heat is transferred from the air such that the temperature inside the cylinder remains constant. Calculate the work input during this process. 9M

OR

2. a) What is the mechanical equivalent of heat? Write down its value when heat is expressed in kJ and work is expressed in N-m. 5M

   b) A house has an electric heating system that consists of a 300-W fan and an electric resistance heating element placed in a duct. Air flows steadily through the duct at a rate of 0.6 kg/s and experiences a temperature rise of 7°C. The rate of heat loss from the air in the duct is estimated to be 300 W. Determine the power rating of the electric resistance heating element. 9M

UNIT–II

3. a) A heat pump that is used to heat a house has a COP of 2.5. That is, the heat pump delivers 2.5 kWh of energy to the house for each 1 kWh of electricity it consumes. Is this a violation of the first law of thermodynamics? Explain. 5M

   b) A well-insulated rigid tank contains 2 kg of a saturated liquid–vapor mixture of water at 100 kPa. Initially, three-quarters of the mass is in the liquid phase. An electric resistance heater placed in the tank is now turned on and kept on until all the liquid in the tank is vaporized. Determine the entropy change of the steam during this process. 9M

OR

4. a) Derive Clausius – Clapeyron equation. What approximations are involved in the Clapeyron-Clausius equation? 6M

   b) A 200-m^3 rigid tank contains compressed air at 1 MPa and 300 K. Determine how much work can be obtained from this air if the environment conditions are 100 kPa and 300 K. 8M

UNIT–III

5. a) Describe the process of formation of steam and give its graphical representation also. 5M

   b) A spherical vessel of 0.9 m^3 capacity contains steam at 8 bar and 0.9 dryness fraction. Steam is blown off until the pressure drops to 4 bar. The valve is then closed and the steam is allowed to cool until the pressure falls to 3 bar. Assuming that the enthalpy of steam in the vessel remains constant during blowing off periods, determine :

   (i) The mass of steam blown off ;

   (ii) The dryness fraction of steam in the vessel after cooling ;

   (iii) The heat lost by steam per kg during cooling. 9M

OR

6. a) Draw a neat sketch of throttling calorimeter and explain how dryness fraction of steam is determined; clearly explain its limitations. 7M

   b) The following observations were taken with a separating and a throttling calorimeter arranged in series :

   Water separated = 2 kg, Steam discharged from the throttling calorimeter = 20.5 kg,

   Temperature of steam after throttling = 110°C, Initial pressure = 12 bar abs.,

   Barometer = 760 mm of Hg, Final pressure = 5 mm of Hg.

   Estimate the quality of steam supplied. 7M

UNIT–IV

7. a) Determine the value of compressibility factor at critical point (Z_{cp}) for the Van der Waals' gas. 6M

   b) A vessel of capacity $3m^3$ contains 1 kg mole of N_2 at 90°C.

      i. Calculate pressure and the specific volume of the gas.
      ii. If the ratio of specific heats is 1.4, evaluate the values of c_p and c_v.
      iii. Subsequently, the gas cools to the atmospheric temperature of 20°C; evaluate the final pressure of gas.
      iv. Evaluate the increase in specific internal energy, the increase in specific enthalpy, increase in specific entropy and magnitude and sign of heat transfer. 8M

OR

8. a) Calculate the increase in entropy when 3 kg of O_2 at 50°C are mixed with 9 kg of N_2 at the same temperature. The initial pressure of each constituent is 11 bar and is the same as that of the mixture. 7M

   b) The following is the volumetric analysis of a producer gas:

   CO = 28%, H_2 =13%, CH_4 = 4%, CO_2 = 4%, N_2 = 51%.

   The values of c_p for the constituents CO, H_2, CH_4, CO_2 and N_2 are 29.27 kJ/mole-K, 28.89 kJ/mole-K, 35.8 kJ/mole-K, 37.22 kJ/mole-K, and 29.14 kJ/mole-K respectively. Calculate the values of c_p, c_v, c_p and c_v for the mixture. 7M

UNIT–V

9. a) How is the rpm (revolutions per minute) of an actual four-stroke gasoline engine related to the number of thermodynamic cycles? What would your answer be for a two-stroke engine? 5M

   b) The compression ratio of an air-standard Otto cycle is 9.5. Prior to the isentropic compression process, the air is at 100 kPa, 35°C, and 600 cm^3. The temperature at the end of the isentropic expansion process is 800 K. Using specific heat values at room temperature, determine:

   (*i*) the highest temperature and pressure in the cycle;

   (*ii*) the amount of heat transferred in, in kJ;

   (*iii*) the thermal efficiency; and

   (*iv*) the mean effective pressure. 9M

OR

10. Consider a Carnot cycle executed in a closed system with air as the working fluid. The maximum pressure in the cycle is 800 kPa while the maximum temperature is 750 K. If the entropy increase during the isothermal heat rejection process is 0.25 kJ/kg - K and the net work output is 100 kJ/kg, determine:

    i. the minimum pressure in the cycle,
    ii. the heat rejection from the cycle, and
    iii. the thermal efficiency of the cycle.
    iv. If an actual heat engine cycle operates between the same temperature limits and produces 5200 kW of power for an air flow rate of 90 kg/s, determine the second law efficiency of this cycle. 14M

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Hall Ticket Number :										

R-15

Code: 5GC31

II B.Tech. I Semester Regular & Supplementary Examinations Nov/Dec 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 = 70 Marks)

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UNIT–I

1. a) Find the rank of the matrix by reducing it to the normal form $\begin{bmatrix} 4 & 3 & 2 & 1 \\ 5 & 1 & -1 & 2 \\ 0 & 1 & 2 & 3 \\ 1 & -1 & 3 & -2 \end{bmatrix}$ 7M

b) Find the values of 'a' and 'b' for which the equations

$x+y+z=3;\ x+2y+2z=6;\ x+ay+3z=b$

have (**i**) No Solution (**ii**) a Unique Solution (**iii**) Infinite number of Solutions. 7M

OR

2. Find a Matrix P which transforms the matrix $A=\begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$ to Diagonal form.

Hence Calculate A^4. Find the Eigen Values and Eigen Vectors of A. 14M

UNIT–II

3. a) Derive a formula to find the cube root of N using Newton- Raphson Method hence find the cube root of 15. 10M

b) Find the parabola passing through points $(0,1)\ (1,3)$ and $(3,55)$ using Newton Raphson Method Lagrange's interpolation formula. 4M

OR

4. Evaluate $\int_0^1 \sqrt{1+x^3}\,dx$ taking h = 0.1 using

i) Simpson's 1/3rd rule (**ii**) Simpson's 3/8th rule (**iii**) Trapezoidal rule. 14M

UNIT–III

5. Find $y(0.1), y(0.2)$ and $z(0.1), z(0.2)$ given that $y'=x+z$, $z'=x-y^2$ and $y(0)=2, z(0)=1$ by using Taylor's series method. 14M

OR

6. Apply the fourth order Runge-Kutta method, to find an approximate values of y when x= 1.2, in steps of 0.1, given that $y'=x^2+y^2$, y(1) = 1.5 14M

UNIT–IV

7. Find the Fourier series to represent the function $f(x) = x \sin x$, $-® < x < ®$.

Hence deduce that $\frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5.7} - \frac{1}{7.9} + ... = \frac{1}{4}(® - 2)$ 14M

OR

8. a) Form the Partial differential equation by eliminating the arbitrary function from

$¤\left[\frac{y}{x},\ x^2 + y^2 + z^2\right] = 0$ 7M

b) Solve by the method of separation of variables $2xz_x - 3yz_y = 0.$ 7M

UNIT–V

9. a) If f(z) is a regular function of z, prove that

$$\left[\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right]\left|f(z)\right|^2 = 4\left|f'(z)\right|^2$$ 7M

b) Find k such that $f(x, y) = x^3 + 3kxy^2$ may be harmonic and find its conjugate. 7M

OR

10. Using Cauchy's integral formula, evaluate $\int_C \frac{z^4}{(z+1)(z-i)^2}\,dz$ where C is the ellipse $9x^2 + 4y^2 = 36.$ 14M

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Hall Ticket Number :										

R-15

Code: 5G532

II B.Tech. I Semester Regular & Supplementary Examinations Nov/Dec 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. Explain about different Bonds in Solids.

OR

2. What is the necessity of alloying and explain its advantages.

UNIT–II

3 Explain about Experimental methods of construction of equilibrium diagrams.

OR

4. Explain about Lever rule and phase rule.

UNIT–III

5. Explain the structure and properties of White cast iron.

OR

6. Explain the structure and properties of copper and its alloys.

UNIT–IV

7. Explain about TTT diagram.

OR

8. What is the effect of alloying elements on Iron-Iron carbon system?

UNIT–V

9. What is composite material and explain different methods of production of composites.

OR

10. Explain about Electric Furnace process with neat sketch.

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Hall Ticket Number :										

R-15

Code: 5G535

II B.Tech. I Semester Regular & Supplementary Examinations November 2017

Machine Drawing

(Mechanical Engineering)

Max. Marks: 70 Time: 4 Hours

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PART-A

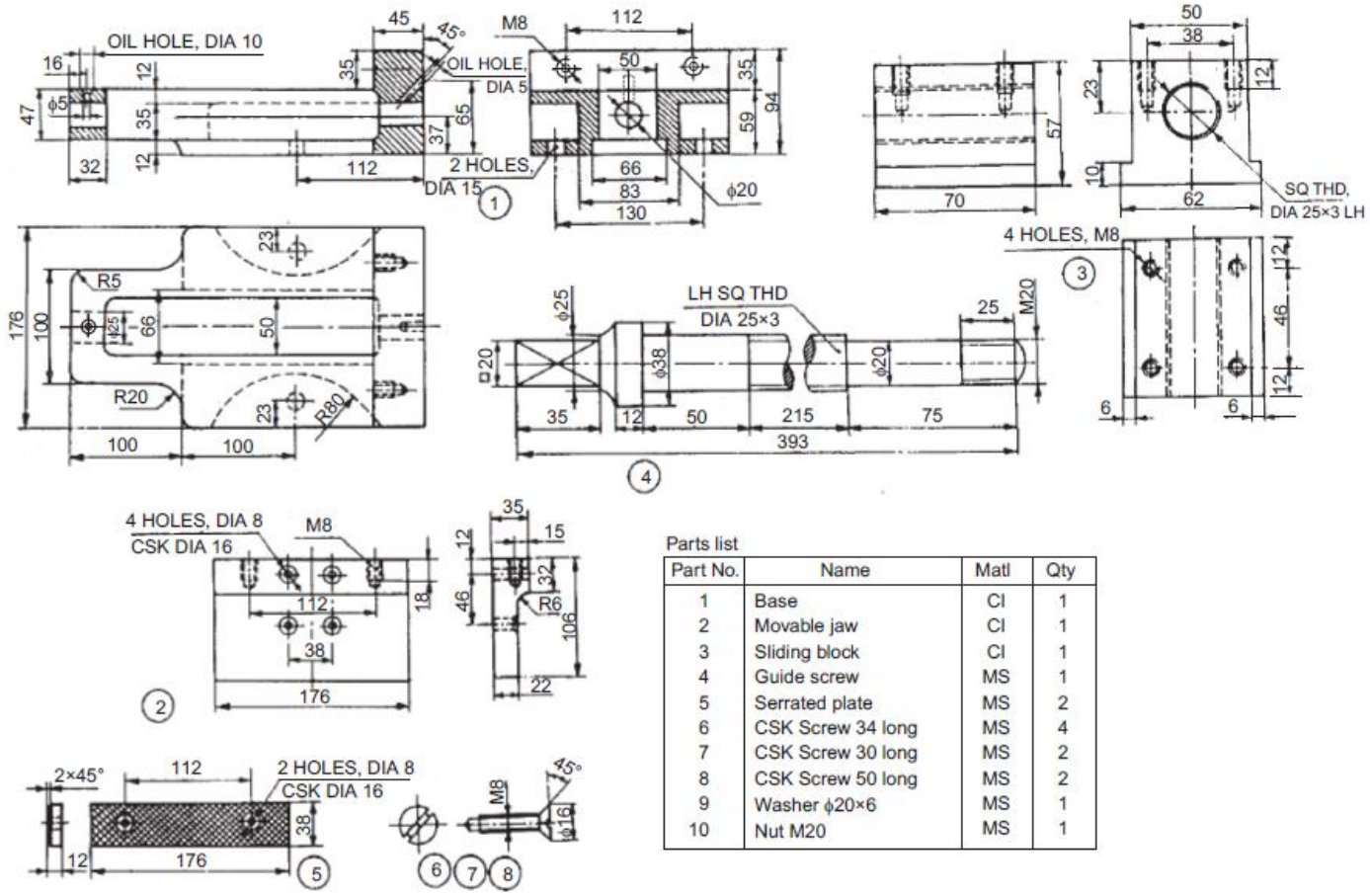
Answer any two from the following (2 x 10 = 20Marks)

1. Draw the sectional view from the front and view from the side of a cotter joint with sleeve used to connect two rods of 50mm diameter each.
2. Draw sectional front view and top view for double riveted double strap zig-zag butt joint to join plates of thickness 10mm.
3. Sketch the following thread profiles for a nominal diameter of 25mm and pitch 3mm.
   (a) Worm thread (b) Buttress thread (c) ACME thread (d) Whitworth thread

PART-B

Answer any one from the following (1 x 25 = 25 Marks)

4. The following Fig. shows the details of a machine vice. Assemble the parts and draw (*i*) sectional view from the front (*ii*) view from above.

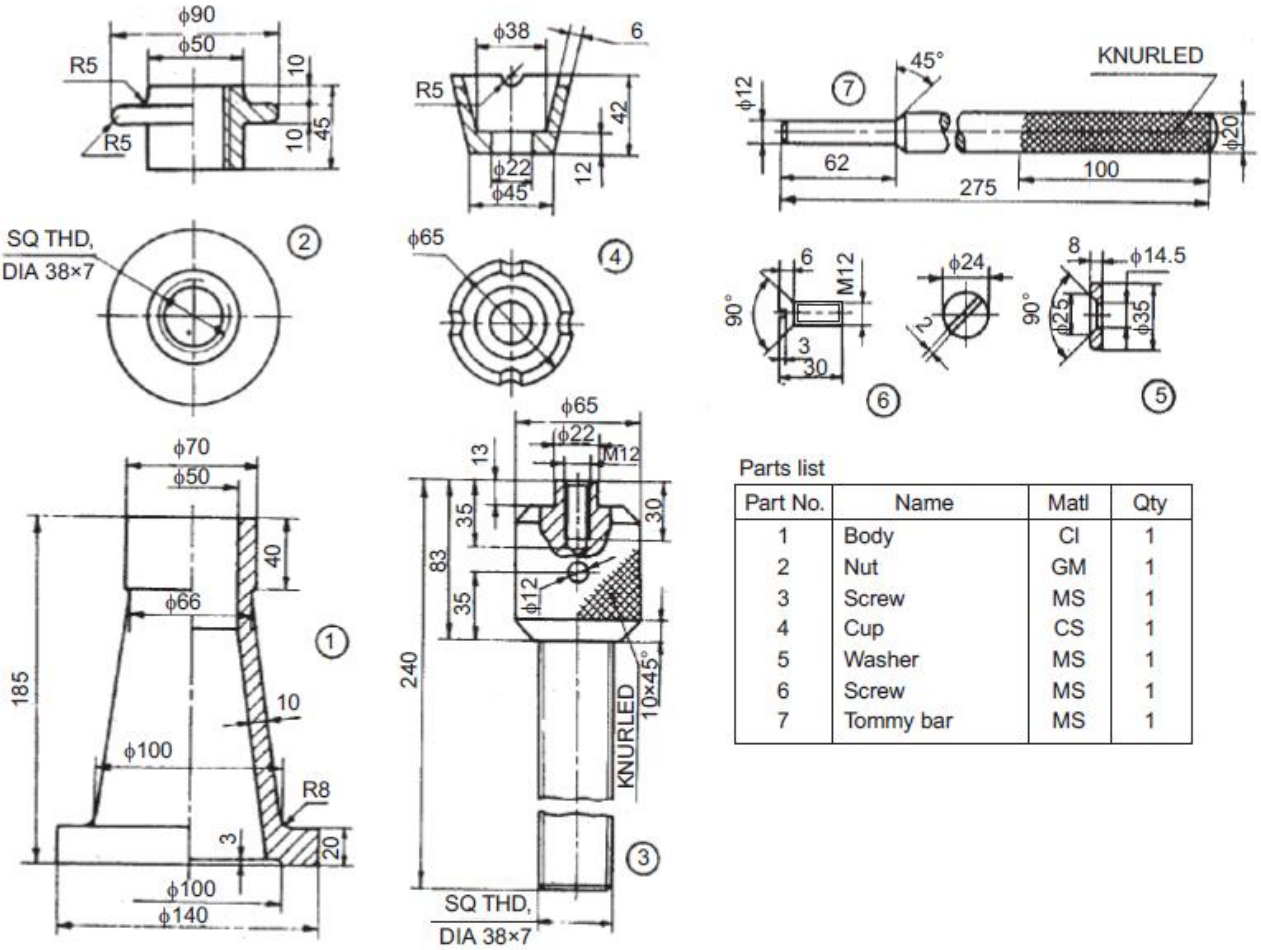


Parts list

Part No.	Name	Matl	Qty
1	Base	CI	1
2	Movable jaw	CI	1
3	Sliding block	CI	1
4	Guide screw	MS	1
5	Serrated plate	MS	2
6	CSK Screw 34 long	MS	4
7	CSK Screw 30 long	MS	2
8	CSK Screw 50 long	MS	2
9	Washer ϕ20×6	MS	1
10	Nut M20	MS	1

OR

5. Assemble all parts of the screw jack as shown in Fig. and draw the following views:
(*i*) Half sectional view from the front (*ii*) View from above.



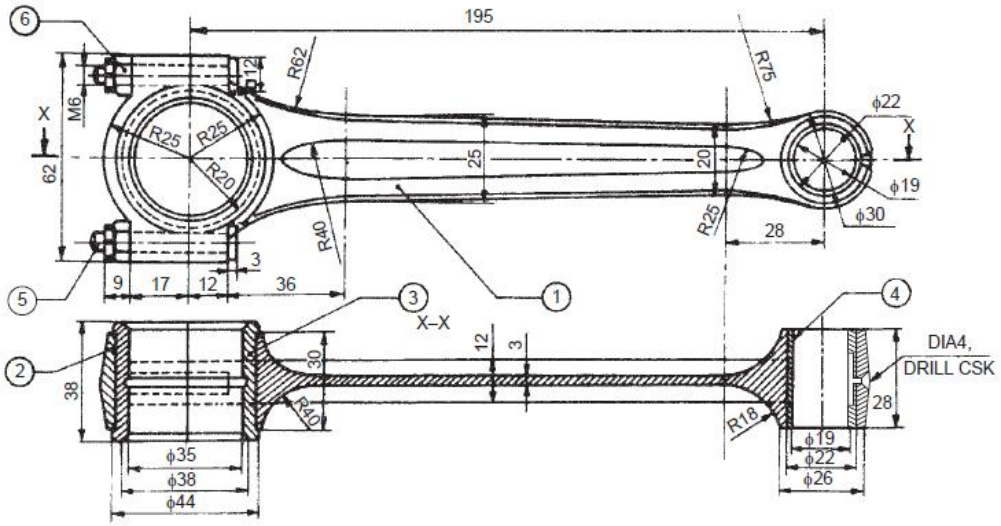
Parts list

Part No.	Name	Matl	Qty
1	Body	CI	1
2	Nut	GM	1
3	Screw	MS	1
4	Cup	CS	1
5	Washer	MS	1
6	Screw	MS	1
7	Tommy bar	MS	1

PART-C

Answer any one from the following (1 x 25 = 25 Marks)

6. Prepare the part drawings of the petrol engine connecting rod

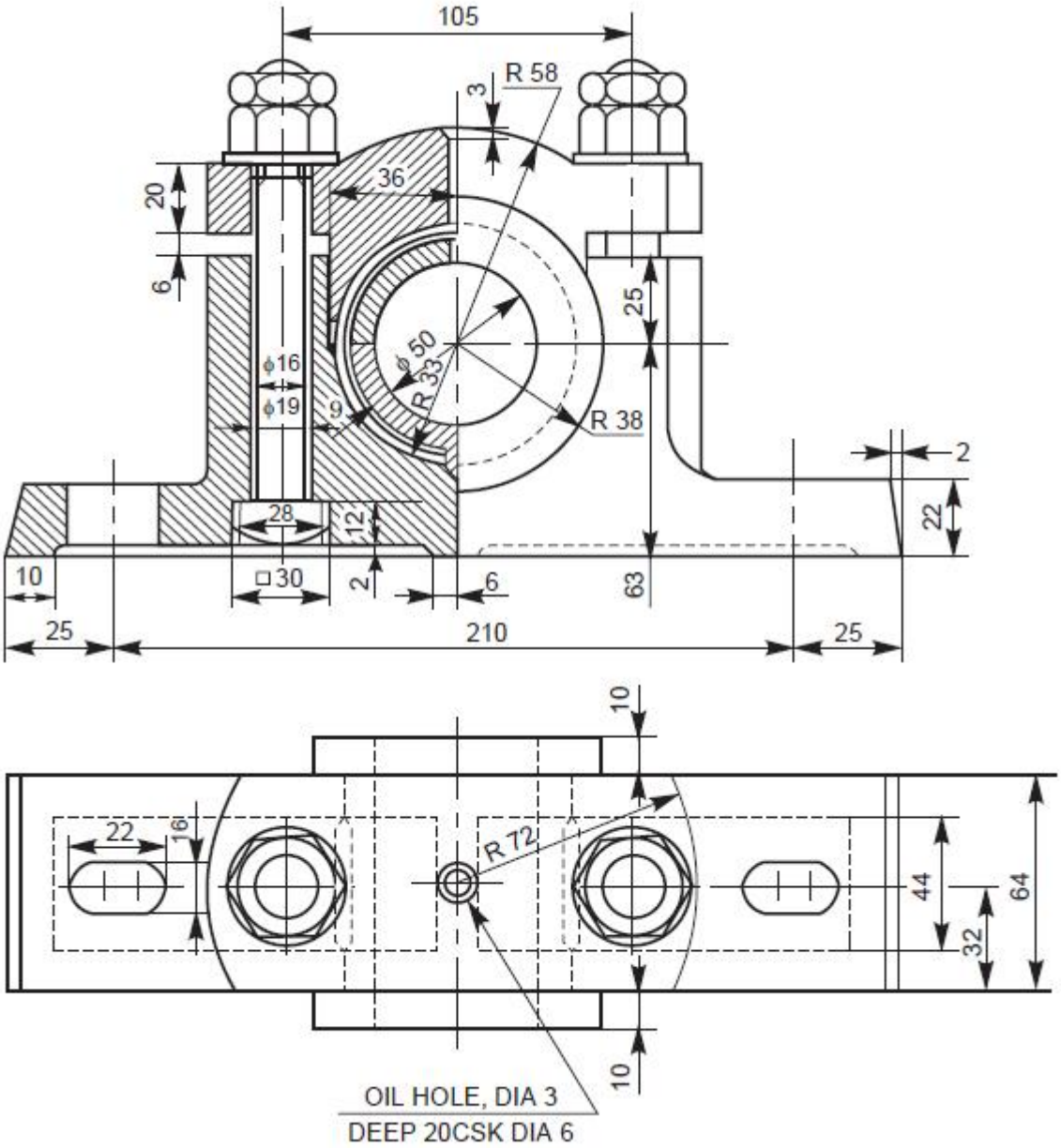


Parts list

Part No.	Name	Matl.	Qty.
1	Rod	FS	1
2	Cap	FS	1
3	Bearing brass	GM	2
4	Bearing bush	P Bronze	1
5	Bolt	MCS	2
6	Nut	MCS	2

OR

7. Prepare the part drawings of the plummer block



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Hall Ticket Number :										

Code: 5G534

R-15

II B.Tech. I Semester Regular & Supplementary Examinations Nov/Dec 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 = 70 Marks)

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UNIT–I

1. a) Define 'pattern allowance'? Explain various allowances usually considered on patterns and core boxes 7M
   b) Sketch and explain 'Die casting method' in detail. 7M

OR

2. a) Explain the factors to be considered in the selection of pattern materials 7M
   b) Classify special casting processes and explain 'Investment casting' process 7M

UNIT–II

3. a) Classify 'welding processes' and explain different types of 'weld joints'. 7M
   b) Briefly describe the 'Oxy-Acetylene welding' technique with a neat sketch 7M

OR

4. a) Sketch and explain 'plasma arc welding process'. Give its advantages and applications in detail 7M
   b) Describe the possible causes for 'weld defects'. 7M

UNIT–III

5. a) Briefly explain the 'metal working processes' in detail. Give their applications 7M
   b) Explain the process of 'coining' in detail with the help of a sketch. 7M

OR

6. a) Sketch and explain 'wire drawing' and 'Tube drawing' processes in detail. Give their applications and advantages 7M
   b) Explain in brief the defects in 'rolled products'. 7M

UNIT–IV

7. a) Classify 'extrusion processes'? With a neat sketch explain 'Hydrostatic extrusion' process 7M
   b) Differentiate between 'Forward extrusion' and 'Backward extrusion' 7M

OR

8. a) List and describe various types of 'dies' 7M
   b) Explain with neat sketches the process of 'smith forging' and 'drop forging' 7M

UNIT–V

9. a) Give a broad classification of 'plastic materials'. State their properties and applications. 7M
   b) Explain in brief the method of preparing 'plastic materials'. 7M

OR

10. a) Describe the process of 'Injection moulding' with a neat sketch. 7M
    b) Explain in brief about 'Compression moulding'. 7M

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Hall Ticket Number :										

R-15

Code: 5G531

II B.Tech. I Semester Regular & Supplementary Examinations Nov/Dec 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) Prove that the maximum stress induced in a body due to suddenly applied load is twice the stress induced when the same load is applied gradually. 7M

   b) A steel bar is placed between two copper bars, each having the same area and length as steel bar at 20^0C.At this stage, they are rigidly connected together at both the ends. When the temperature is raised to 320^0C, the length of the bars increased by 1.5 mm. Determine the original length and final stresses in the bars. Take E_S=220GN/m^2;E_C=110 GN/m^2;α_S=0.000012 per^{0}C;α_C=0.0000175 per^{0}C. 7M

OR

2. a) Find an expression for the total elongation of a bar due to its own weight, when the bar is fixed at its upper end and hanging freely at its lower end. 7M

   b) An axial pull of 40000N is acting on a bar consisting of three sections of length 30cm,25 cm and 25 cm and diameters 2 cm,4 cm and 5 cm respectively. If the Young's modulus=2×10^5 N/mm^2, determine:

   (i) Stress in each section (ii) total extension in the bar. 7M

UNIT–II

3. a) What do you mean by point of contra flexure? Is the point of contra flexure and point of inflexion different? 7M

   b) A cantilever 2 m long is loaded with a uniformly distributed load of 2 kN/m run over a length of 1 m from the free end. It also carries a point load of 4 KN at a distance of 0.5 m from the free end. Draw the shear force and M.M. diagrams. 7M

OR

4. A simply supported beam of length 5 m, carries a uniformly distributed load of 100 N/m extending from the left end to a point 2 m away. There is also a clock wise couple of 1500 Nm applied at the centre of the beam. Draw the SF and B.M. diagrams for the beam and find the maximum bending moment. 14M

UNIT–III

5. a) What do you mean by section modulus? Find an expression for section modulus for rectangular, circular and hollow circular sections. 7M

   b) A steel pipe of width 60 mm and of thickness 10 mm is bent into a circular arc of radius 10 m. Determine the maximum stress induced and the bending moment which will produce the maximum stress. Take E=2×10^5 N/mm^2. 7M

OR

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

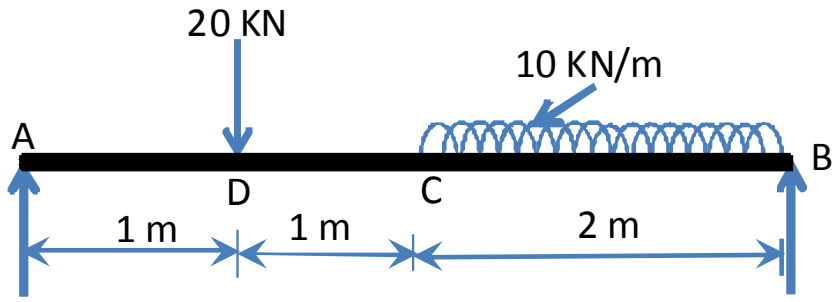
   b) A circular beam of 105 mm diameter is subjected to a shear force of 5 KN. Calculate average shear stress. maximum shear stress. Also sketch the variation of shear stress along the depth of beam. 7M

UNIT–IV

7. a) Derive an expression for the slope and deflection of a cantilever of length L, carrying a point load W at the free end by double integration method. 7M

b) A beam AB of 4 meters span is simply supported at the ends and is loaded as shown in the figure. Determine:

(i) Deflection at C
(ii) Maximum deflection
(iii) Slope at the end A
(iv) E=200×10^6 kN/m^2 and I=20×10^{-6} m^4. Use Macaulay's method



7M

OR

8. a) Prove that the strain energy stored in a body due to shear stress is given by

$U=\frac{\tau^2}{2C} \times V$

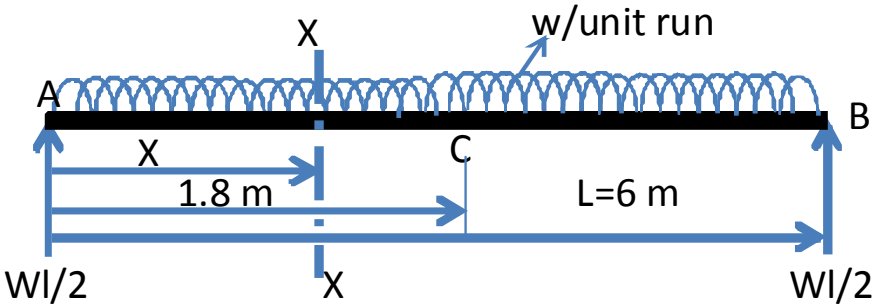
Where τ= shear stress

C=Modulus of rigidity

V= volume of the body 7M

b) A steel girder of 6 m length acting as a beam carries a uniformly distributed load w N/m run throughout its length. If I=30×10^{-6} m^4 and depth 270 mm, calculate:

(i) The magnitude of w so that the maximum stress developed in the beam section does no exceed 72 MN/m^2
(ii) The slope and deflection (under this load) in the beam at a distance of 1.8 m from one end.



7M

UNIT–V

9. a) Define slenderness ratio. State the limitations of Euler's formula. 7M

b) Determine the crippling load for a T- section of dimensions 10cm×10cm×2cm and of length 5m when t is used as strut with both of its ends hinged. Take Young's modulus E=2.0×10^5 N/mm^2. 7M

OR

10. a) What do you mean by Lame's equation? How will you derive these equations? 7M

b) Determine the ratio of buckling strengths of two columns one hollow and the other solid. Both are made of the same material and have the same length, cross sectional area and end conditions. The internal diameter of hollow column is 2/3rd of its external diameter. 7M

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