Hall Ticket Number :										

R-15

Code: 5GC31

II B.Tech. I Semester Regular Examinations November 2016

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 rank of the matrix $\begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$ by reducing it into Row-Echelon form. 8M

b) Test for consistency and solve the system of equations:
$2x + 6y + 11 = 0, \quad 6x + 20y - 6z + 3 = 0, \quad 6y - 18z + 1 = 0$ 6M

OR

2. a) Verify Cayley-Hamilton theorem for $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ and express the matrix polynomial $A^5 - 4A^4 - 7A^3 + 11A^2 - A - 10I$ as linear polynomial in A. 7M

b) Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$. 7M

UNIT–II

3. a) Using Regula-falsi method, find the root of the equation $x e^x = 2$ correct to three decimal places. 7M

b) Apply Lagrange's interpolation scheme to estimate the value of x when $y = 15$ for the following data.

x	5	6	9	11
y	12	13	14	16

7M

OR

4. Evaluate $\int_0^{\frac{\pi}{2}} \sin x \, dx$ using i) Trapezoidal rule ii) simpson's 3/8 rule.

(Divide the range into 10 equal parts) 14M

UNIT–III

5. Use Modified Euler's method to find an approximate value of y when $x = 1$, given that $\frac{dy}{dx} = x + y,\ y(0) = 0$ (choose step length $h = 0.2$). 14M

OR

6. Apply 4th order Runge-Kutta method to find $y(0.2)$ for the equation $\frac{dy}{dx} = \frac{y - x}{y + x}\ y(0) = 1$ insteps of 0.1 14M

UNIT–IV

7. Obtain Fourier cosine series and sine series of a function $f(x) = x,\ 0 \le x \le ®$. Hence deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + - - - - = \frac{®^2}{8}$. 14M

OR

8. a) Form the partial differential equation by eliminating arbitrary function F from $F(xy + z^2,\ x + y + z) = 0$. 7M

   b) Solve $\frac{\partial^3 z}{\partial x^2 \partial y} - \cos(2x + 3y) = 0$ by the method of separation of variables. 7M

UNIT–V

9. a) If $f(z)$ is an analytic function of z, show that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)|f(z)|^2 = 4|f'(z)|^2$. 9M

   b) Determine the analytic function whose real part is $y + e^x \cos y$. 5M

OR

10. Evaluate $\oint_c \frac{e^{-3®z}}{2z + i} dz$, where c the boundary of the square with the vertices $\pm 1 and \pm i$. 14M

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Hall Ticket Number :										

R-15

Code: 5G534

II B.Tech. I Semester Regular Examinations November 2016

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 allowances are provided for patterns of green sand moulding. 7M
   b) Explain functions of various gating system elements. 7M

OR

2. a) Compare hot chamber die casting &cold chamber die casting. 7M
   b) Describe shell moulding .and state its suitability, applications. 7M

UNIT-II

3. a) Explain various flames used in oxy-acetylene gas welding 7M
   b) Explain Thermit welding process state its advantages. 7M

OR

4. a) Compare Soldering, Brazing ,and Welding. 7M
   b) Compare TIG&MIG welding. 7M

UNIT-III

5. a) Compare hot working &cold working. State few products made for each of the processes. 7M
   b) Explain hot and cold spinning. 7M

OR

6. a) Describe two high, four high roll mills. 7M
   b) Describe bending & forming operation. 7M

UNIT-IV

7. a) Explain extrusion process and discuss forward, backward, impact extrusion processes 7M
   b) Explain rotary forging and state its applications and advantages. 7M

OR

8. a) Describe coining and embossing process of forming. 7M
   b) Describe few defects of rolled products and state their remedies. 7M

UNIT-V

9. a) Compare thermo plastics and thermo setting plastics. 7M
   b) Explain Injection moulding process and applications. 7M

OR

10. a) Explain blow moulding process and applications 7M
    b) Explain compression moulding process and applications 7M

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Hall Ticket Number :										

R-15

Code: 5G531

II B.Tech. I Semester Regular Examinations November 2016

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 tensile test was conducted on a specimen. The following data was obtained from the test: Diameter =22mm; Gauge length of extensor meter = 200 mm; Least count of extensor meter = 0.001 mm; at a load of 22 kN, extensor meter reading = 60; at a load of 36 kN, extensor meter reading = 94; Yield load = 95 kN; Maximum load=157kN; Diameter at neck=15mm; Final length over 100 mm original length=132 mm. Find Young's Modulus, yield stress, ultimate stress, percentage elongation and percentage reduction in area. 10M

   b) Draw the stress-strain diagram of mild steel specimen subjected to tensile test and mark the salient points. 4M

OR

2. a) What are the three types of stresses? Give the relationship between them. 4M

   b) The composite bar shown in Fig.1 is subjected to a tensile force of 30 kN. The extension observed is 0.372 mm. Find the Young's modulus of brass of 20 mm diameter. If Young's modulus of steel of 30 mm diameter is $2X10^5$ N/mm^2.

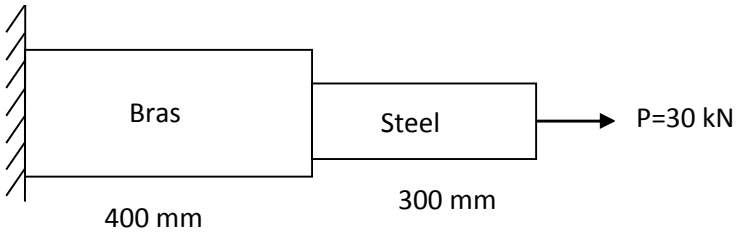

Fig.1

10M

UNIT–II

3. Draw the shear force and bending moment diagrams and find the maximum bending moment for the beam shown in Fig.2.

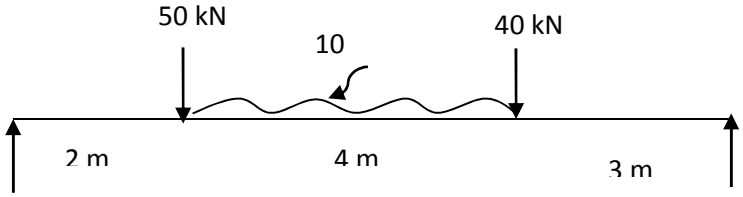

Fig.2

14M

OR

4. Draw the shear force and bending moment diagram for the beam and locate the point of contraflexure if any for the beam shown in Fig.3.

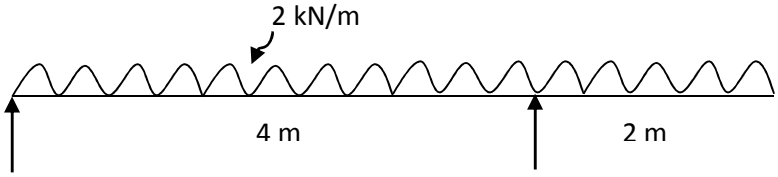

Fig.3

14M

UNIT–III

5. a) Derive an expression for $M/I = Q/Y = E/R$ 7M

   b) A rectangular beam 300 mm deep is simply supported over the span of 4 m. Determine the uniformly distributed load per meter which the beam may carry, if the bending stress should not exceed 120 N.mm^2. Take I=8x10^6 mm^4. 7M

OR

6. a) What is shear center? Mention its practical significance. 4M

   b) An I section beam 350 X 150 mm has a web thickness of 10mm and a flange thickness of 20 mm. If the shear force acting on a section is 40 kN, find the maximum shear stress developed in the I section. 10M

UNIT–IV

7. A simply supported beam of length 7m is supported at its ends. It is carrying two point loads of 5 kN at a distance of 1m and 2m respectively from the left end of the beam. Determine the slope at the support points, the deflection under the applied loads and the position and magnitude of maximum deflection. Take E as 90 GPa and I as 18x10^{-6} m^4. 14M

OR

8. a) Write the assumptions made in torsion equation. 4M

   b) Find the angle of twist per metre length of a hollow shaft of 100 mm external diameter and 60 mm internal diameter, if the shear stress is not to exceed 35 MPa. Take modulus of rigidity G = 85 GPa. 10M

UNIT–V

9. A closed cylindrical vessel made of steel plates 4 mm thick, carries fluid under pressure of 3.5 N/mm^2. The diameter of the cylinder is 27 cm and length is 77 cm. Calculate the longitudinal and hoop stresses in the cylinder wall and determine the change in diameter, length and volume of the cylinder. Take E=2.1 x 10^5 N/mm^2 and Poisson's ratio = 0.3. 14M

OR

10. Find the Euler's crippling load for a hollow cylindrical steel column of 38 mm external diameter and 2.5 mm thick. Take length of the column as 2.3 m and hinged at its both ends. Take E= 205 kN/ mm^2. Also determine the crippling load by Rankine's formula using f_c= 335 N/mm^2 and a= 1/7500. 14M

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Hall Ticket Number :										

R-15

Code: 5G532

II B.Tech. I Semester Regular Examinations November 2016

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. What are the three basic methods of grain size measurement recommended by ASTM? Explain the procedure in each method briefly. Why is the estimate of grain size by any of the above methods not a precise one? 14M

OR

2. What are solid solutions? What is their classification? Explain the Hume Rothery rules that decide the solid solubility? 14M

UNIT–II

3. Sketch the Iron carbide diagram to scale and label the details. What are the important structures observed and their characteristics? Write down the invariant reactions observed in the diagram. 14M

OR

4. a) Explain the solidification of a eutectic system taking three typical compositions. 7M

   b) Outline the properties and applications of Eutectic alloys. 7M

UNIT–III

5. What are nodular cast Irons? How are they produced? Compare Nodular Cast iron with Grey Cast Iron as regards properties and applications. 14M

OR

6. What are bronzes? What are its types? Write important notes on tin bronzes. Why is lead added to tin bronzes? 14M

UNIT–IV

7. a) What are ferritic and austenitic stabilizers? What is their effect on eutectoid temperature and composition? 7M

   b) Explain case hardening of steels. 7M

OR

8. Write notes on
   i) Cryogenic treatment
   ii) Age hardening
   iii) Normalizing. 14M

UNIT–V

9. Write about the acid Bessemer process of steel making. Include in tour answer, the selection of Pig iron and the chemical reactions that are observed. 14M

OR

10. a) What the benefits realized by use of composites? 7M

    b) Explain any two methods of manufacture of composite components. 7M

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Hall Ticket Number :										

R-15

Code: 5G533

II B.Tech. I Semester Regular Examinations November 2016

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) A fluid flows through a steady-flow open system at the rate of 3 kg/s. At the system inlet, the pressure, velocity, internal energy and specific volume are 5 atm, 150 m/s, 2000 kJ/kg and 0.4 m^3/kg respectively. The fluid leaves the system with 1.2 atm, 80 m/s, internal energy of 1300 kJ/kg and specific volume of 1.1 m^3/kg. The fluid loses 25 kJ/kg through heat transfer during the process. Determine the power output of the system, neglecting the change in potential energy

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

OR

2. a) A turbine operates under steady flow conditions, receiving steam at the following state: pressure 1.2 MPa, temperature 188°C, enthalpy 2785 kJ/kg, velocity 33.3 m/s and elevation 3m. The steam leaves the turbine at the following state: pressure 20kPa, enthalpy 2512 kJ/kg, velocity 100m/s, and elevation of 0 m. Heat is lost to the surroundings at the rate of 0.29kJ/s. If the rate of flow through the turbine is 0.42 kg/s, what is the power output of the turbine in kW.

   b) 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.

UNIT–II

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

   b) A Carnot heat engine receives heat from a reservoir at 900°C at a rate of 800 kJ/min and rejects the waste heat to the ambient air at 30°C. The entire work output of the heat engine is used to drive a refrigerator that removes heat from the refrigerated space at -5°C and transfers it to the same ambient air at 30°C. Determine (***i***) the maximum rate of heat removal from the refrigerated space and (***ii***) the total rate of heat rejection to the ambient air

OR

4. a) 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.
      iii. Two such blocks at 100 and 0°C are joined together

   b) Air is compressed from 1 bar at 15°C to 6 bar at 110°C, in a steady-flow device, (a) Determine the entropy change for the air. (b) If there is heat transfer between the air and environment at 15°C, and the actual shaft work input is 200 kJ/kg, determine the entropy change for the overall process

UNIT–III

5. 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) 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) 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) 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) 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) 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

OR

8. 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 (*a*) the mixture temperature and (*b*) 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.

UNIT–V

9. a) An ideal Otto cycle has a compression ratio of 8. At the beginning of the compression process, air is at 100 kPa and 17°C, and 800 kJ/kg of heat is transferred to air during the constant-volume heat-addition process. Accounting for the variation of specific heats of air with temperature, determine (***i***) the maximum temperature and pressure that occur during the cycle, (***ii***) the net work output, (***iii***) the thermal efficiency, and (***iv***) the mean effective pressure for the cycle.

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

OR

10. a) A Diesel engine working on a dual combustion cycle has a stroke volume of 0.0085 m3 and a compression ratio 15 : 1. The fuel has a calorific value of 43890 kJ/kg. At the end of suction, the air is at 1 bar and 100°C. The maximum pressure in the cycle is 65 bar and air fuel ratio is 21 : 1. Find for ideal cycle the thermal efficiency. Assume cp = 1.0 and cv = 0.71

   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: 5G535

II B.Tech. I Semester Regular Examinations November 2016

Machine Drawing

(Mechanical Engineering)

Max. Marks: 70 Time: 4 Hours

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PART-A **2 X 10 = 20M**

Answer the following two questions each carries 10 marks

1. Draw three view of a hexagonal bolt of nominal diameter 30 mm and length 110 mm.

OR

2. Draw
   a) Half sectional front view, top half in section and
   b) Side view of a rigid Flange Coupling to connect two shafts, each of diameter 25 mm.

3. Draw sectional front view and top view of the double riveted butt joint with double strap with diameter of rivet as 20mm.

OR

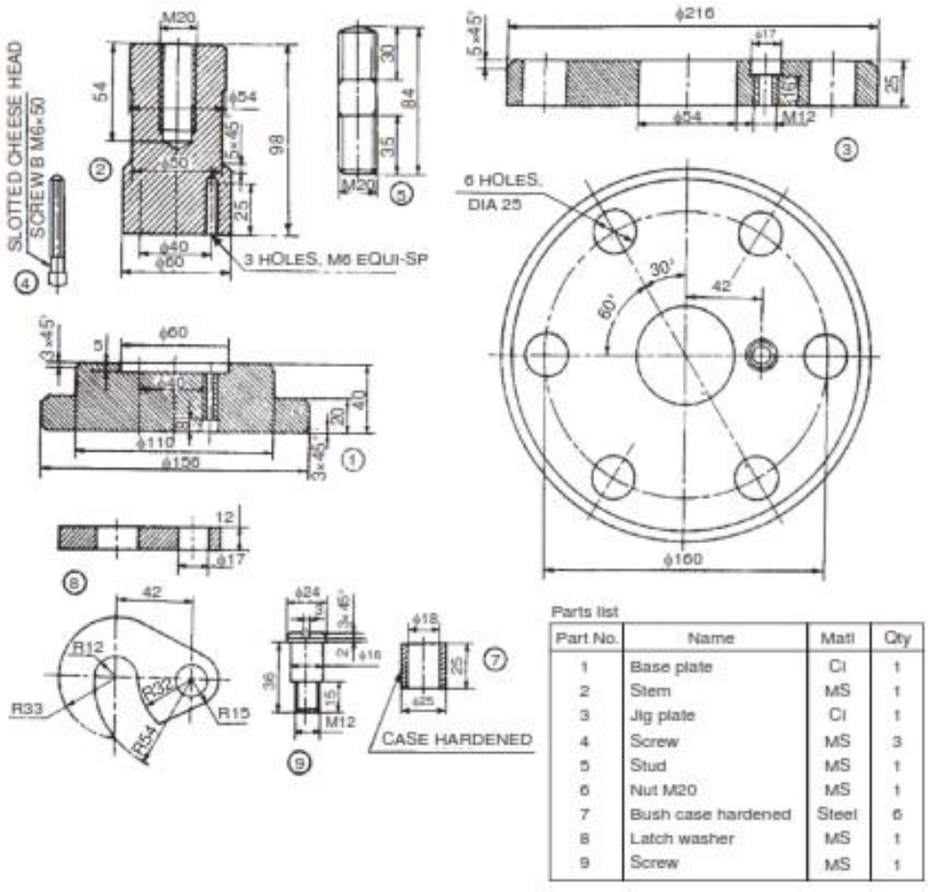
4. Draw the half sectional view from the front, with top half in section and the view from the side of a cotter joint with socket and spigot ends, to connect two rods of 50 mm diameter each.

Part-B

1 X 25 = 25M

Answer any one of the following carries 25 marks

5. Assemble all the parts of the Drill jig, shown in below figure and draw the following views:
   a) Half sectional view from the front
   b) View from above.

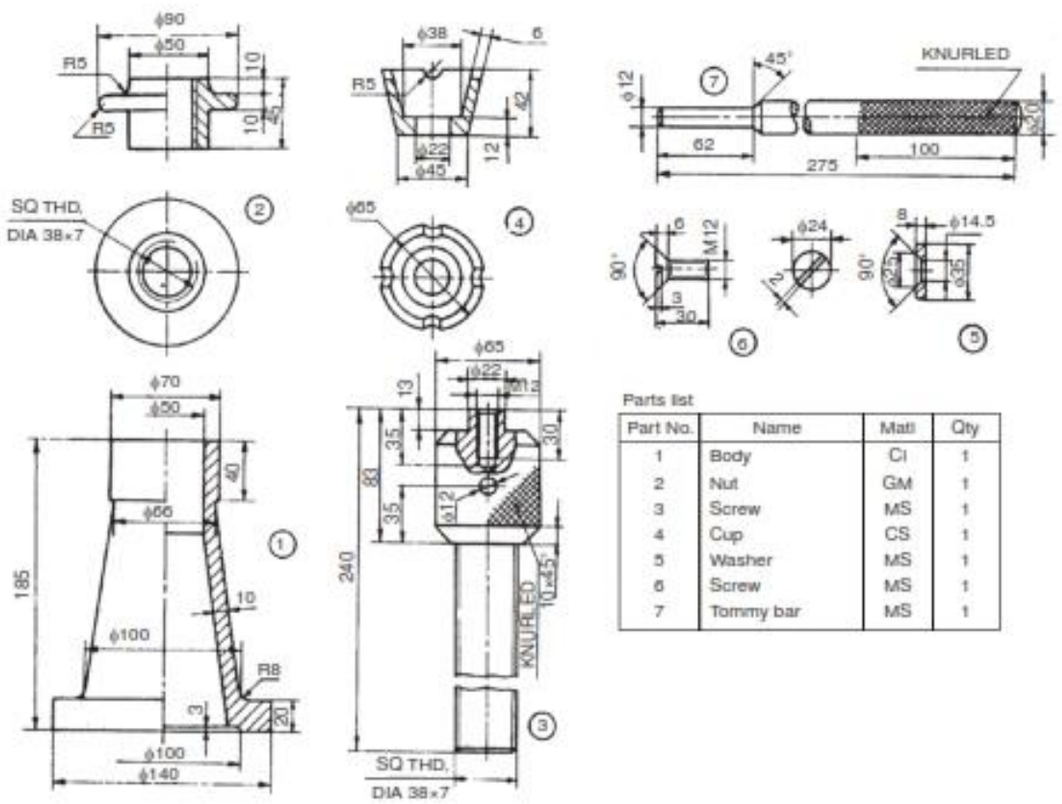


Parts list

Part No.	Name	Matl	Qty
1	Base plate	CI	1
2	Stem	MS	1
3	Jig plate	CI	1
4	Screw	MS	3
5	Stud	MS	1
6	Nut M20	MS	1
7	Bush case hardened	Steel	6
8	Latch washer	MS	1
9	Screw	MS	1

OR

6. Assemble all the parts of the screw jack, shown in below figure and draw the following views:
   a) Half sectional view from the front
   b) View from above.



Parts list

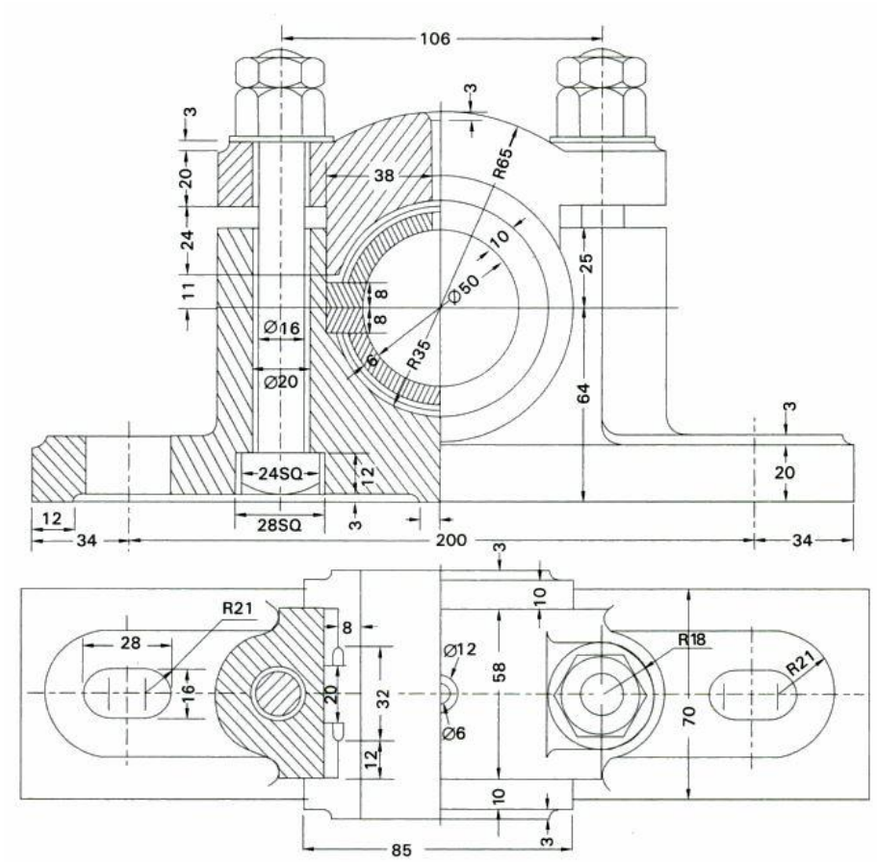
Part No.	Name	Matl	Qty
1	Body	CI	1
2	Nut	GM	1
3	Screw	MS	1
4	Cup	CS	1
5	Washer	MS	1
6	Screw	MS	1
7	Tommy bar	MS	1

Part-C

1 X 25 = 25M

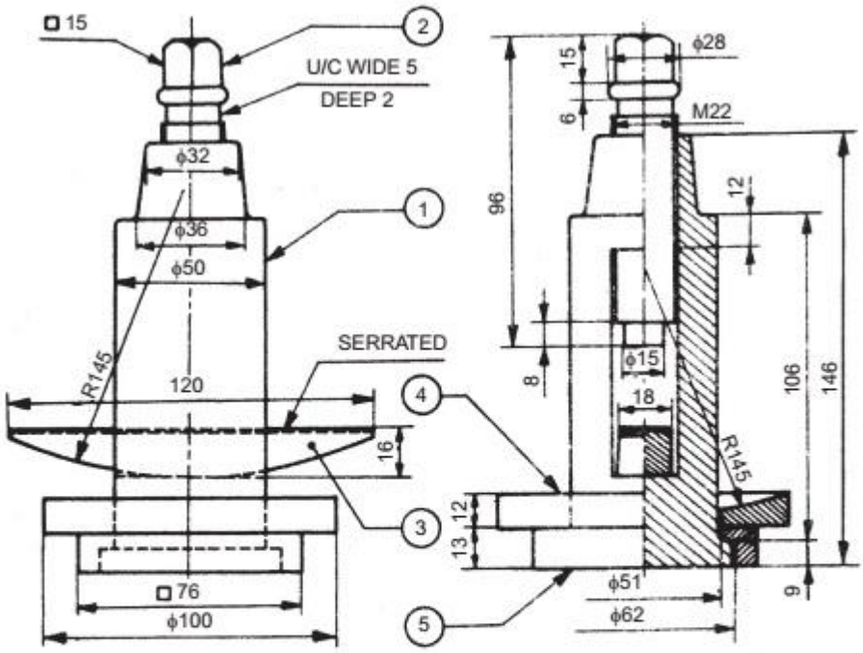
Answer any one of the following carries 25 marks

7. Prepare the part drawings of the plumber block



OR

8. Prepare the part drawings of the Tool Post



Parts list

Part No.	Name	Matl.	Qty.
1	Body	MS	1
2	Clamp screw	MCS	1
3	Wedge	CI	1
4	Ring	MS	1
5	Square block	MS	1