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F 3434 (Pages : 4) Reg. No. ME Dept

Name..............................

B.TECH. DEGREE EXAMINATION, NOVEMBER 2010

Third Semester

Branch—Civil, Mechanical, Electrical and Electronics, Polymer Electronics and Communication, Electronics and Instrumentation, Automobile Engineering and Aeronautical Engineering

ENGINEERING MATHEMATICS—II (CMEPLANSU)

(Regular/Improvement/Supplementary)

Time : Three Hours Maximum : 100 Marks

Answer **one** *full question from each module.*
Each full question carries 20 *marks.*

Module 1

1. (a) Define a scalar point function, its gradient and directional derivative if $\phi = r^m$ where $r = \left|\vec{r}\right|$, and $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k} + z\vec{k}$, find $\nabla\phi$.

(6 marks)

(b) Show that $\nabla \times \left(\phi\vec{A}\right) = \left(\nabla\phi\right) \times \vec{A} + \phi\left(\nabla \times \vec{A}\right)$. (6 marks)

(c) Expand $\nabla \cdot \left(\phi\vec{A}\right)$. Hence evaluate $\nabla \cdot \left(r^3\vec{r}\right)$, where $r = \left|\vec{r}\right|$, and $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$.

(8 marks)

Or

(d) If $\vec{r}$ is the position vector of the point $p(x, y, z)$, then prove :

(i) $\text{div}\ \vec{r} = 3$. (ii) $\text{curl}\ \vec{r} = \vec{0}$.

(iii) $\nabla r^n = nr^{n-2}\ \vec{r}$, where $r = \left|\vec{r}\right|$.

(3 × 5 = 15 marks)

Turn over

(e) For every vector point function $\vec{F}$, prove that div curl $\vec{F} = 0$. (5 marks)

Module 2

2. (a) Using Green's theorem, evaluate $\int_c \left(xy^2\, dy - x^2 y\, dx\right)$ where C is the Cardioid $r = a(1 - \cos\theta)$.

(5 marks)

(b) Find the flux of the vector find $\vec{A} = (x - 2z)\hat{i} + (x + 3y + z)\hat{j} + (5x + y)\hat{k}$ through the upper side of the triangle ABC with vertices at points A (1, 0, 0), B (0, 1, 0), C (0, 0, 1).

(7 marks)

(c) Using divergence theorem, evaluate $\int_s \vec{f} \cdot \hat{n}\, ds$, where $\vec{f} = 4x\hat{i} - 2y^2\hat{j} + z^2\hat{k}$ and S is the surface enclosing the region for which $x^2 + y^2 \leq 4$ and $0 \leq z \leq 3$.

(8 marks)

Or

(d) Verify Stoke's theorem for $\vec{f} = y\hat{i} + z\hat{j} + x\hat{k}$ for the upper part of the sphere $x^2 + y^2 + z^2 = 1$.

(9 marks)

(e) Show that the vector $\left(\frac{\vec{r}}{r^3}\right)$ is both solenoidal and irrotation. (6 marks)

(f) Show that $\int_c \vec{F} \cdot d\vec{r} = 3\pi$, given $\vec{F} = 2\vec{i} + x\vec{j} + \vec{k}$ and C is the arc of the curve :

$$\vec{V} = \cos t\ \vec{i} + \sin t\ \vec{j} + t\vec{k}$$

from $t = 0$, $t = 2\pi$.

(5 marks)

Module 3

3. (a) Define an analytic function. Show that the function $f(z) = xy + iy$ is not analytic. (5 marks)

(b) Show that $u = x^2 - y^2 + \frac{x}{(x^2 + y^2)}$ is harmonic. Find its harmonic conjugate and the analytic function $f(z)$ whose real part is u. (8 marks)

(c) If $f(z) = u + iv$ is analytic function, prove that $\left[\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right] |f(z)|^2 = 4\,|f'(z)|^2$. (7 marks)

Or

(d) Derive the Cauchy-Riemann equations satisfied by an analytic function, in polar form. (6 marks)

(e) Show that $u = x^3 - 3xy^2 + 3x^2 - 3y^2 + 1$ is a harmonic function. Find v such that $u + iv$ is analytic. (7 marks)

(f) Find the bilinear transformation which maps $z_1 = 1, z_2 = i, z_3 = -1$ onto $w_1 = 2, w_2 = i, w_3 = -2$. (7 marks)

Module 4

4. (a) Determine $f(x)$ of the following data using Newton's divided difference :

x :	−4	−1	0	2	5
$f(x)$:	1235	36	5	9	1325

(10 marks)

(b) Find $f(x)$ using Stirling's formula :

x :	20	30	40	50	60
$f(x)$:	512	438	356	243	140

(10 marks)

Or

(c) Find the missing value using backward difference formula :

x :	0	1	2	3	4
y :	1	3	9	?	81

Explain why the result differs from $3^3 = 27$. (10 marks)

(d) Use Lagrange interpolation to fit a polynomial to the data :

x :	−1	0	2	3
y :	−8	3	1	2

(10 marks)

Module 5

5. (a) A solid of revolution is formed by rotating about x-axis the area between x-axis, the lines $x = 0$, and $x = 1$ and the curve through following points. Find the volume of the above by Simpson's rule :

x :	0	0.25	0.5	0.75	1.0
y :	1	0.9897	0.9588	0.9088	0.8415

(10 marks)

(b) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ using trapezoidal rule taking 12 equal parts and compare with the exact value of $\tan^{-1} 6$.

(10 marks)

Or

(c) Evaluate $\int_0^1 \frac{dx}{1+x}$ with $h = 0.25$ and $h = 0.5$ using tarapozoidal and Simpson's $\frac{1}{3}$ rule and compare.

(12 marks)

(d) Find the first and second derivatives of $f(x)$ at $x = 1.5$ if :

x :	1.5	2	2.5	3	3.5	4
$f(x)$:	3.375	7	13.65	24	38.5	59

(8 marks)

[5 × 20 = 100 marks]

F 3445 (Pages : 2) Reg. No...............................

Name...................................

B.TECH. DEGREE EXAMINATION, NOVEMBER 2010

Third Semester

Branch : Mechanical Engineering

FLUID MECHANICS – I(M)

(Regular/Improvement/Supplementary)

Time : Three Hours **Maximum : 100 Marks**

Answer **all** *questions.*

Part A

1. Differentiate between Newtonian and non-Newtonian fluid.
2. What is the significance of metacentric height of a floating body?
3. What are the properties of velocity potential function?
4. What is a vortex flow? Differntiate between free and forced vortex flows.
5. Explain momentum correlation factor.
6. Using Bernouli's theorem, discuss the pressure distribution at different points in a venturimeter.
7. Describe the features of an aerofoil.
8. What is boundary layer separation?
9. Discuss the application of Mody's chart.
10. What is water hammer?

(10 × 4 = 40 marks)

Part B

11. (a) The space between two square flat parallel plates is filled with oil. Each side of the plate is 60 cm. The thickness of the oil film is 12 mm. The upper plate, which moves at 3 m/s requirea a force of 100 N to maintain the speed. Determine dynamic and kinematic viscosity of the oil, if it has specific gravity of 0.90.

(b) What are the classifications of manometers?

(7 + 5 = 12 marks)

Or

Turn over

12. A circular plate of diameter 0.75 m is immersed in a liquid of relative density 0.80 with its plane making an angle of 30° with the horizontal. The centre of the plate is at a depth of 1.50 m below the free surface. Calculate the total on one side of the plane and locate the centre of pressure.

(12 marks)

13. Differntiate between (i) stream line and streak line (ii) source and sink (iii) rotational flow and irrotational flow (iv) laminar flow and turbulent flow. (12 marks)

Or

14. (a) Explain doublet and define the strength of a doublet.

(b) Explain (i) magnus effect and (ii) Joukowski theorem. (6 + 6 = 12 marks)

15. Gasoline at 20°C is pumped through a 12 cm diameter pipe 10 km long at a flow rate of 75 m^3/hour. The inlet is fed by a pump at an absolute pressure of 24 atm. The exit is at standard atmospheric pressure and is 150 metres higher. Estimate the frictional head loss h_f. Take density of gasoline at 20°C to be 680 kg/m^3.

Or

16. Derive an expression for the discharge through an orifice meter having coefficient of discharge C_d. (12 marks)

17. Oil having viscosity of 0.15 Ns/m^2 and specific gravity 0.9 is flowing through a circular pipe of diameter 60 mm and length 400 m. The discharge through the pipe is 4 litres/seconds. Find the pressure drop in a length of 400 m and the shear stress at the pipe wall.

Or

18. A cylinder rotates at 200 r.p.m. with its axis perpendicular in an air stream which is having uniform velocity of 30 m/s. The cylinder is 10 m long and 1.5 m in diameter. Assuming ideal fluid theory find (i) the circulation (ii) the lift force (iii) position of the stagnation points. Take density of air as 1.25 kg/m^3. (12 marks)

19. Find the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer given by $\frac{U}{V} = \left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$, where 'U' is the velocity at the distance 'y' from the plate and U = V at y = δ and 'δ' is the boundary layer thickness.

Or

20. (a) Derive an expression for the power transmission through a pipe of length L metre under a head of H metre. Also find the expression for efficiency of transmission.

(b) What do you mean by an equivalent pipe?

(8 + 4 = 12 marks)

[5 ×12 = 60 marks]

F 3453 (Pages : 2) Reg. No..............................

Name..................................

B.TECH. DEGREE EXAMINATION, NOVEMBER 2010

Third Semester

Branch : Mechanical Engineering/Automobile Engineering

METALLURGY AND MATERIAL SCIENCE (M, U)

(Regular/Improvement/Supplementary)

Time : Three Hours **Maximum : 100 Marks**

Answer* all *questions.

Part A

1. What is the relation of the packing of the crystals with coordination number?
2. Differentiate between edge and screw dislocation.
3. What is the difference between cold working and hot working of metals?
4. Explain phase rule.
5. Briefly explain the normalizing process of metals.
6. What do you mean by dispersion hardening?
7. Differentiate cast iron, wrought and steel.
8. Explain why the cutting alloys are superior to high speed steels.
9. What are the features of ductile and brittle fractures?
10. Define fatigue strength and endurance limit.

(10 × 4 = 40 marks)

Part B

11. (a) Explain how miller indices are used to designate directions within a crystal lattice.

(b) What do you mean by surface imperfections of a crystalline structure.

(7 + 5 = 12 marks)

Or

12. (a) Explain the effect of grain size on mechanical and optical properties of a crystallite solid.

(b) Distinguish between the homogeneous and heterogeneous nuclei formation.

(7 + 5 = 12 marks)

13. (a) Explain the process of recovery, recrystallisation and grain growth in a strain hardened metal. (12 marks)

Or

Turn over

14. (a) Describe the special features of martensite transformation compared to other transformations in steel.

(b) Explain the features of a peritectic system.

(6 + 6 = 12 marks)

15. (a) Describe the process of martempering and austempering.

(b) What is metal cladding?

(8 + 4 = 12 marks)

Or

16. Explain the following processes (i) carburizing (ii) nitriding (iii) flame hardening.

(12 marks)

17. Explain how the properties of steel depend upon its alloying elements. List out the various alloy steels giving their uses. (12 mark)

Or

18. Describe the composition, properties, and uses of (i) Duralumin (ii) Babbit metal (iiii) Bronze (iv) Gun metal. (12 marks)

19. How are fractures classified? Describe the features of each type of fracture. (12 marks)

Or

20. Discuss (i) Cleavage (ii) Effect of stress concentration of fatigue (iii) Structural changes during creep. (12 marks)

(5 ×12 = 60 marks)

F 3460 (Pages : 2) Reg. No...............................

Name...............................

B.TECH. DEGREE EXAMINATION, NOVEMBER 2010

Third Semester

Branch : Mechanical Engineering and Automobile Engineering

THERMODYNAMICS (MU)

(Regular/Improvement/Supplementary)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

1. What are the different types of thermodynamic systems?
2. State law of corresponding states.
3. Write the steady flow energy equation and explain the terms with units.
4. Explain temperature scale? It is based on which law of thermodynamics?
5. Write a note on irreversibility. What are its causes?
6. Explain carnot cycle with the help of p-v diagram.
7. Write down Maxwell's equations and explain each term.
8. What is Clausius - Clapeyron equation?
9. What is Dew point temperature?
10. Distinguish between DBT and WBT. What are their significance in psychrometrics?

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*

1. (a) Explain compressibility factor.

   (b) The properties of a closed system change following the relation between pressure and volume as pV = 3 where p is in bar, V is in m^3. Calculate the work done when the pressure increases from 1.5 bar to 7.5 bar.

(5 + 7 = 12 marks)

Or

2. (a) Explain the significance of Zeroth law of Thermodynamics.

   (b) A fluid at a pressure of 3 bar, and with specific volume of 0.18 m^3/kg, contained in a cylinder behind a piston expands reversibly to a pressure of 0.6 bar according to a law, $p=C/v^2$ where C is a constant. Calculate the work done by the fluid on the piston.

(5 + 7 = 12 marks)

Turn over

3. A fluid is confined in a cylinder by a spring -loaded, frictionless piston so that the pressure in the fluid is a linear function of the volume (p = a + bV). The internal energy of the fluid is given by the following equation U = 34 + 3.15 pV where U is in kJ, p in kPa, and V in cubic metre. If the fluid changes from an initial state of 170 kPa, 0.03 m^3 to a final state of 400 kPa, 0.06 m^3, with no work other than that done on the piston, find the direction and magnitude of work and heat transfer.

(12 marks)

Or

4. Derive steady flow energy equation. Apply this equation to get the energy equation for a Turbine.

(12 marks)

5. (a) Explain third law of thermodynamics.

(b) A house requires 2×10^5 kJ/hr for heating in winter. Heat pump is used to absorb heat from cold air outside in winter and send heat to the house. Work required to operate the heat pump is 3×10^4 kJ/hr. Determine (i) heat extracted from outside (ii) coefficient of performance.

(5 + 7 = 12 marks)

Or

6. (a) Explain Clausius inequality.

(b) Explain available energy and unavailable energy

(6 + 6 = 12 marks)

7. (a) Show that the internal energy of an ideal gas is a function of temperature alone.

(b) What is the significance of Maxwell's equation.

(8 + 4 = 12 marks)

Or

8. (a) Show that enthalpy of an ideal gas is a function of temperature alone.

(b) Derive the TdS equations.

(6 + 6 = 12 marks)

9. (a) Show the following processes on a psychrometric chart : (i) sensible heating (ii) sensible cooling and (iii) adiabatic humidification.

(b) Distinguish between DBT and WBT. What are their significance in airconditioning?

(7 + 5 = 12 marks)

Or

10. What is a pure substance? Explain with the help of p-v, p-T and T-s diagrams. (12 marks)

[5 ×12 = 60 marks]

F 3467 (Pages : 2) Reg. No.................................

Name.................................

B.TECH. DEGREE EXAMINATION, NOVEMBER 2010

Third Semester

Branch : Mechanical, Polymer Engineering and Automobile Engineering

STRENGTH OF MATERIALS AND STRUCTURAL ENGINEERING (MPU)

(Regular/Improvement/Supplementary)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Assume missing data if any suitably.

Part A

1. Establish the relationship between Young's modulus and Bulk modulus.
2. Derive the expression for the stresses on an oblique plane of rectangular body, when the body is subjected to simple shear stress.
3. A horizontal cantilever 4 m long carries a point load of 1 kN at free end and a U.D.L. of 0.5 kN/m over a length of 2 m from the free end. Draw the S.F. and B.M. diagrams.
4. Derive the expression for maximum shear stress in a circular section of radius R, where F = shear force.
5. Discuss Macaulay's method. Determine the maximum slope and deflection of a beam carrying an eccentric point load.
6. Explain moment area method of finding the deflection of a beam.
7. Derive the equation $T/J = \tau/R$ for a circular shaft subjected to torque.
8. Calculate the thickness of metal necessary for a cylindrical shell of internal diameter 150 mm to withstand an internal pressure of 25 MN/m^2, if maximum permissible tensile stress is 125 MN/m^2.
9. Derive the expression for crippling load by Euler's formula for a column hinged at both ends.
10. Derive the expression for safe load for a long column under eccentric loading by Rankine's formula.

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*

Each question carries 12 *marks.*

11. (a) A copper rod of 25 mm in diameter is surrounded by a steel tube of 35 mm external diameter and 30 mm internal diameter. The rod and the tube are of same length and their ends are rigidly fixed. If the tube and rod are at 20° C, calculate the stress in each material, when the temperature is raised to 20°C.

Take $E_s = 200\ GN/m^2$ $E_b = 100\ GN/m^2$

$\alpha_S = 11.6 \times 10^{-6}/°C$ $\alpha_b = 18.7 \times 10^{-6}/°C$

Or

Turn over

(b) At a point in an elastic material under strain, there are normal stresses of 60 MN/m^2 (tensile) and 35 MN/m^2 (compressive) respectively at right angles to each other with a shearing stress of 25 MN/m2. Find the principal stresses and position of principal planes. Find also the maximum shear stress and its plane.

12. (a) A beam ABCD, 12m long, is freely supported at A and C, 10 m apart, with an overhang CD of 2 m. It carries a uniformly distributed load of 25 kN/m over the whole length and a couple of 100 kNm at B, 3 m from A. State the position and amount of maximum B. M in BC and sketch the S.F.D. and B.M.D.

Or

(b) At a given section of an I-beam, the value of vertical shear force is 40 kN and the sectional dimensions are

Flange width	220 mm	Flange thickness	35 mm
Web thickness	50 mm	Total depth	350 mm

Draw the shear distribution diagram for the given section. Also find in what proportion the total shearing force is carried by the web.

13. (a) A horizontal beam of uniform section and 9 m long is simply supported at its ends. Two vertical loads of 52 kN and 45 kN act at 2.5 and 5.5 m respectively from the left hand support. Determine (i) the deflection and slope under the loads and (ii) position and magnitude of maximum deflection.

Or

(b) A cantilever of 5m span carries a u.d.l. of intensity 10 kN/m over the entire span together with a point load of 20 kN at 1 m from the free end. Find the maximum slope and deflection. Take EI = 6×10^{12} N/mm^2.

14. (a) A hollow shaft is of 140 mm external diameter and diameter ratio 0.6. If the maximum shear stress in the shaft is limited to 110 MPa and allowable twist 1° per meter length, find the maximum power that can be transmitted to the shaft, if it is to rotate at 100 r.p.m. Take C = 8×10^4 MPa.

Or

(b) A thick cylindrical pipe of outside diameter 350 mm and internal diameter of 250 mm is subjected to an internal fluid pressure of 25 N/mm^2 and external fluid pressure of 8 N/mm^2. Determine the maximum hoop stress developed and plot the curves showing the variation of hoop stress across the thickness.

15. (a) Find the Euler's critical load for a hollow cylindrical cast iron column of 250 mm external diameter and 30 mm thickness. It is 5m long and hinged at both ends. Value of E = 8.0×10^4 N/mm^2. For what length the critical load by Euler's and Rankine's formula be equal. Take constant of 1/1600 and f_c = 600 N/mm^2.

Or

(b) (i) Briefly explain the principles of R.C.C.

(ii) Prepare the detailed sketch of a RCC slab simply supported at all edged.

(5 ×12 = 60 marks)

F 3437 (Pages : 3) Reg. No................................

Name....................................

B.TECH. DEGREE EXAMINATION, NOVEMBER 2010

Third Semester

Branch : Mechanical Engineering and Automobile Engineering

MACHINE DRAWING – I (M,U)

Regular/Improvement/Supplementary

Time : Three Hours Maximum : 100 Marks

Missing dimensions, if any may be assumed.

Answer **all** *questions.*

Drawing sheet will be supplied.

1. Answer any *two* of the following:

   (a) Sketch a split end foundation bolt and show all dimensions.

   (b) Draw the two view of a nut with a locking nut arrangement.

   (c) Draw the cross sectional view of a single bevel butt weld for joining.

   10 mm plates and represent it as per BIS standards.

   (2 × 7½ = 15 marks)

2. Fig. 1 (on page 2) shows the details of a project type flanged coupling. Draw the following assembled views.

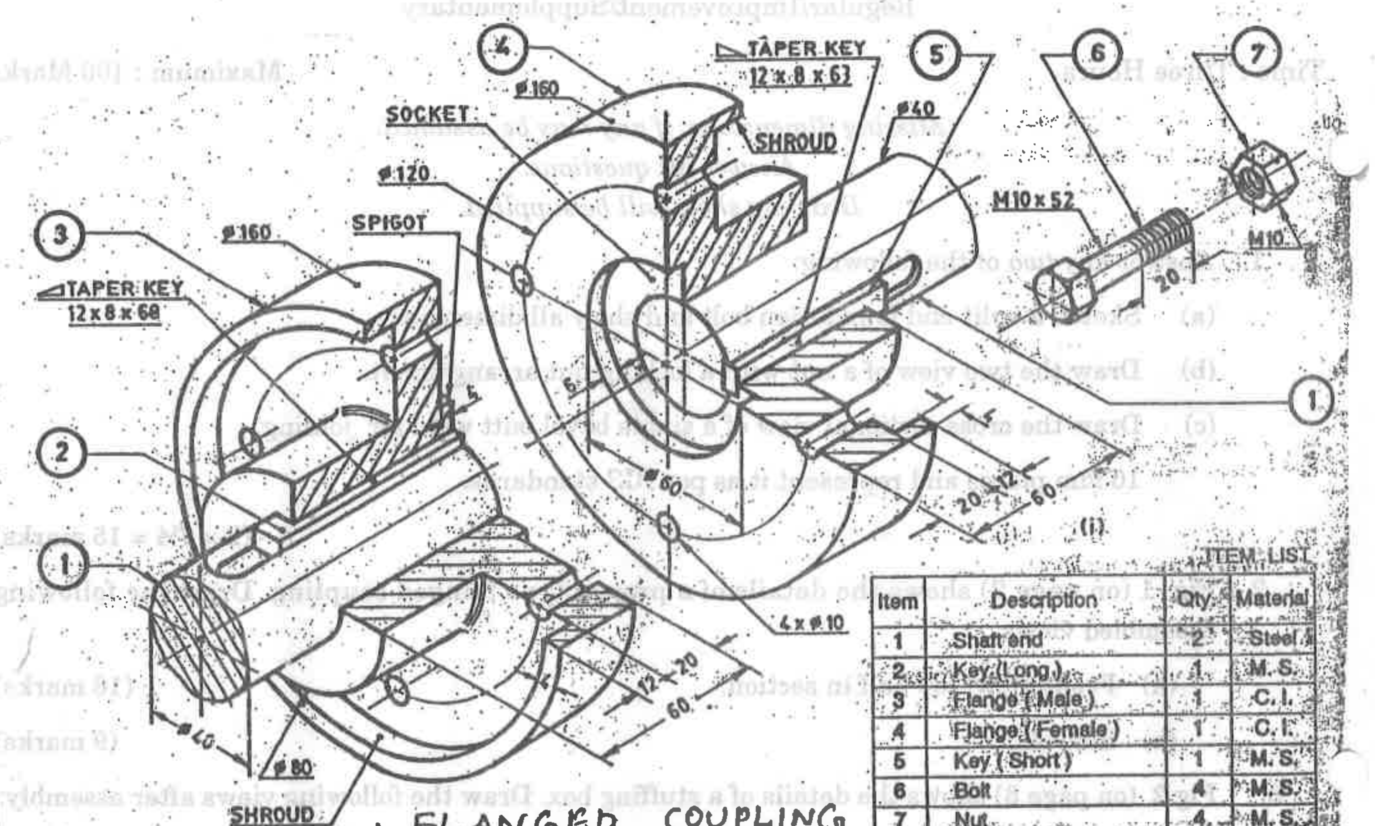
   (a) Front view, top half in section. (16 marks)

   (b) Side show. (9 marks)

3. Fig.2 (on page 3) shows the details of a stuffing box. Draw the following views after assembly:

   (a) Front view, left half in section. (30 marks)

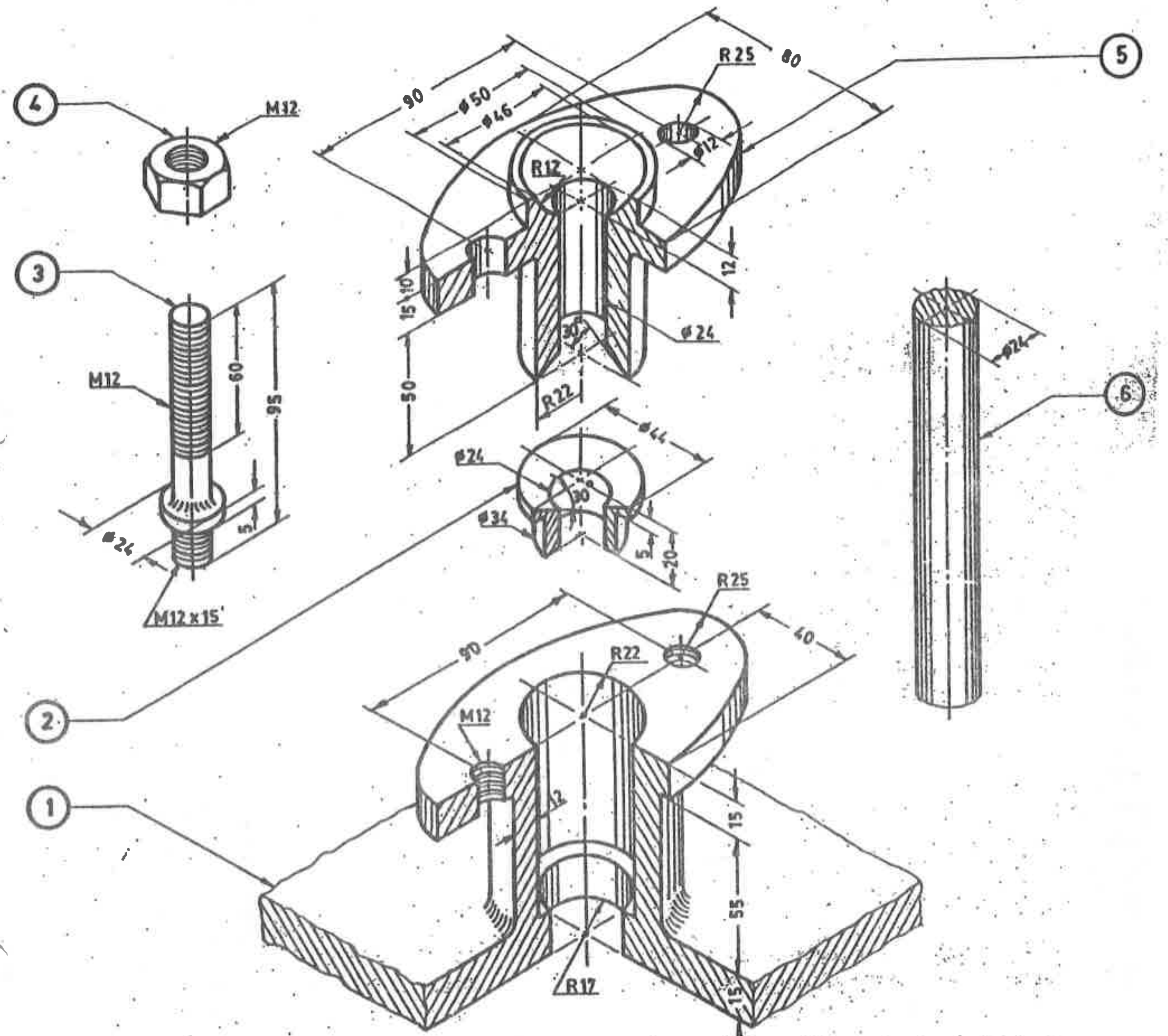
   (b) Left side view, right half in section. (30 marks)



ITEM LIST

Item	Description	Qty.	Material
1	Shaft end	2	Steel
2	Key (Long)	1	M. S.
3	Flange (Male)	1	C. I.
4	Flange (Female)	1	C. I.
5	Key (Short)	1	M. S.
6	Bolt	4	M. S.
7	Nut	4	M. S.

Fig 1. FLANGED COUPLING



ITEM LIST

Item	Description	Qty.	Material
1	Body	1	C. I.
2	Gland bush	1	Brass
3	Stud	2	M. S.
4	Nut	2	M. S.
5	Gland	1	C. I.
6	Piston rod	1	Steel

Fig-2

[redacted] STUFFING BOX
(TYPE - 1)