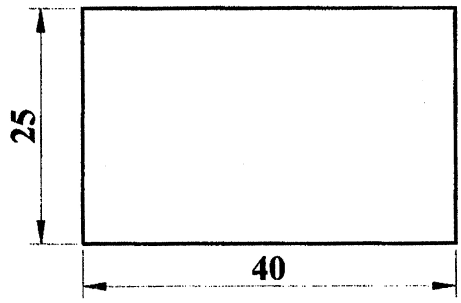
TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2081 Ashwin

Exam.	Regular (New Course-2080 Batch)		
Level	BE	Full Marks	30
Programme	BCE	Pass Marks	12
Year / Part	I / II	Time	3 hrs.

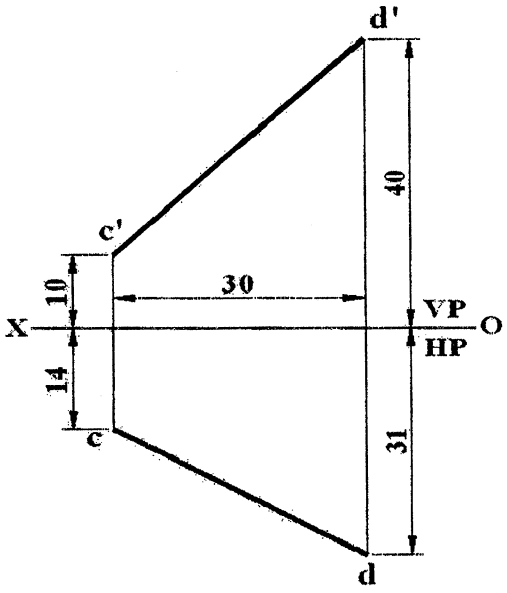
Subject: - Engineering Drawing (*ME 158*)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Draw the involute of the rectangle shown in figure below. [3]

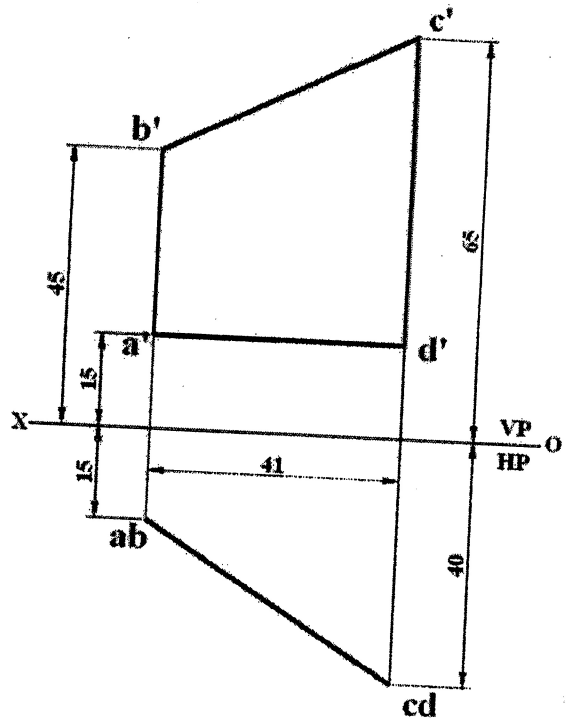


2. Orthographic views of a line CD is shown in figure below. Find the true length of the line CD and its inclination with the VP and HP. [3]



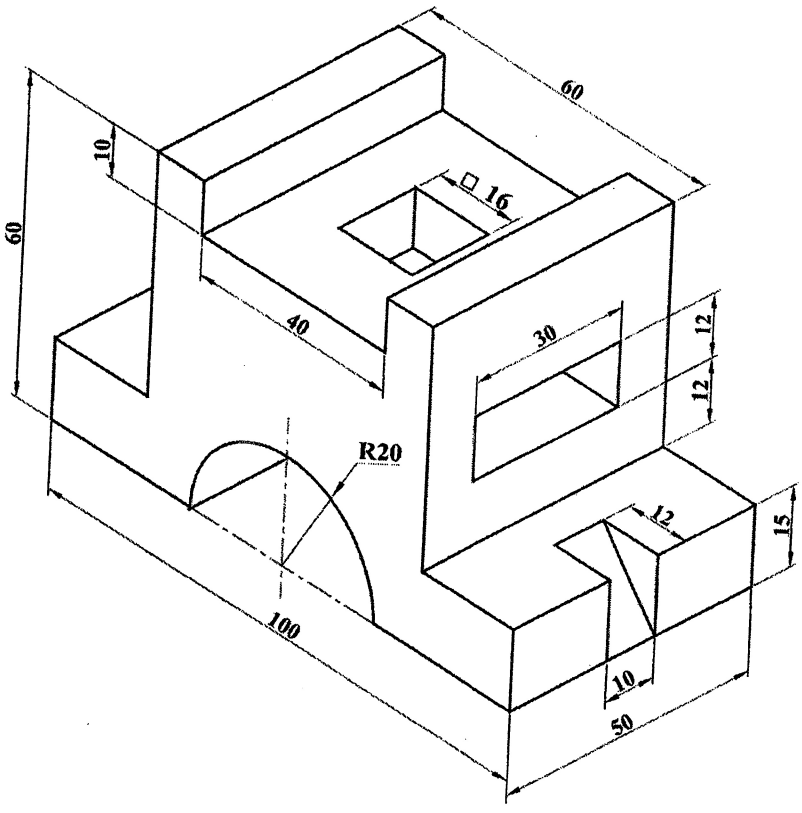
OR

Determine the true shape of the quadrilateral shown in figure below. Also determine the angle of inclination of the plane with the VP.

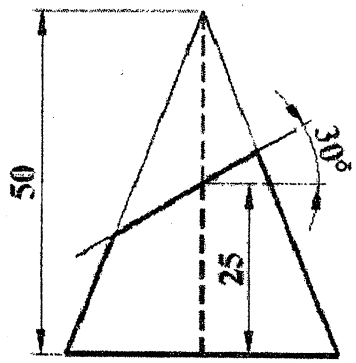


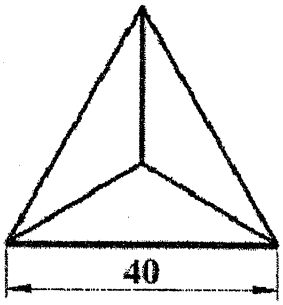
3. Pictorial view of an object is shown in figure below. Draw (with dimensions) its (a) full sectional front view and (b) top view.

[9]



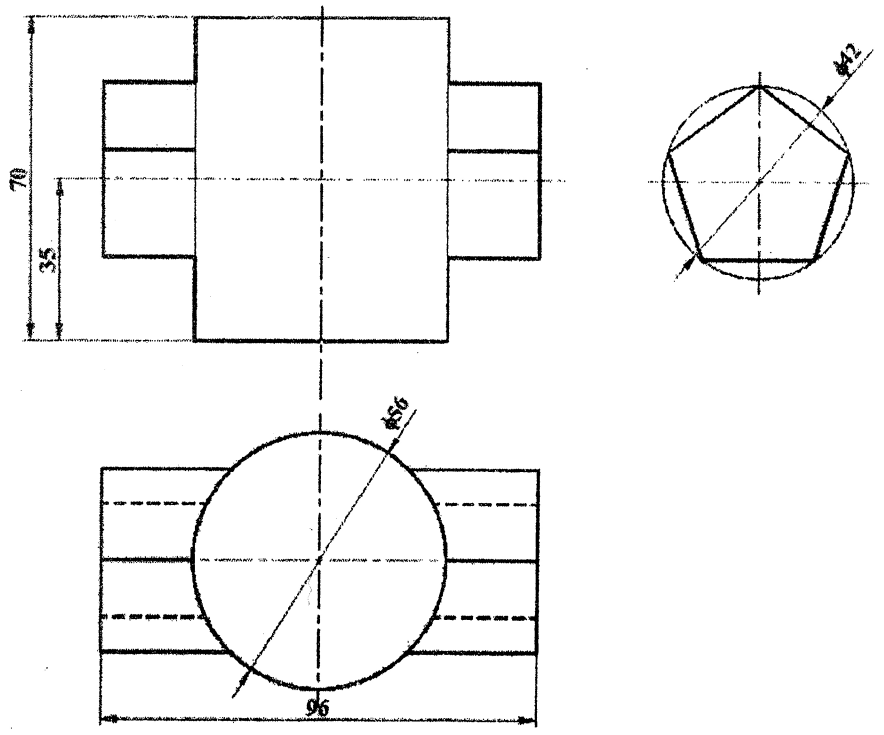
4. Draw front and top views of a right solid cut by a plane as shown in figure below. Find the true shape of the section. Then develop lateral surface of the solid. [8]



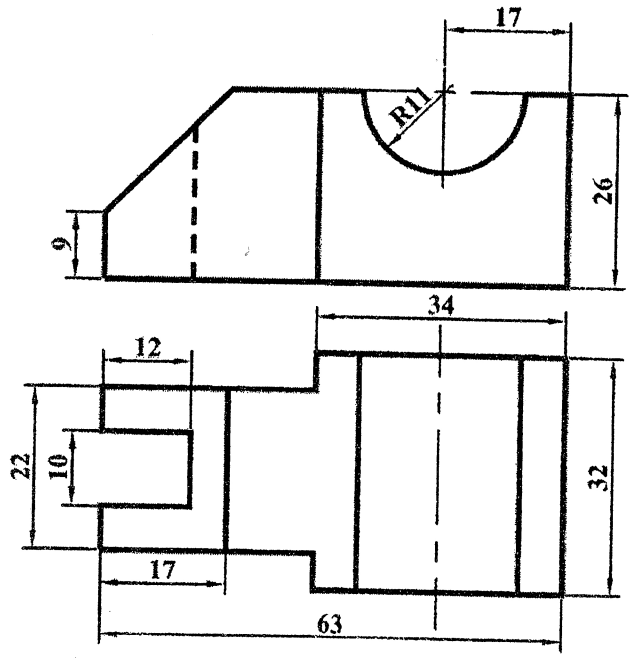


OR

Draw the lines of intersection of the surfaces of geometrical solids shown in figure below. Also develop the lateral surface of the vertical solid.

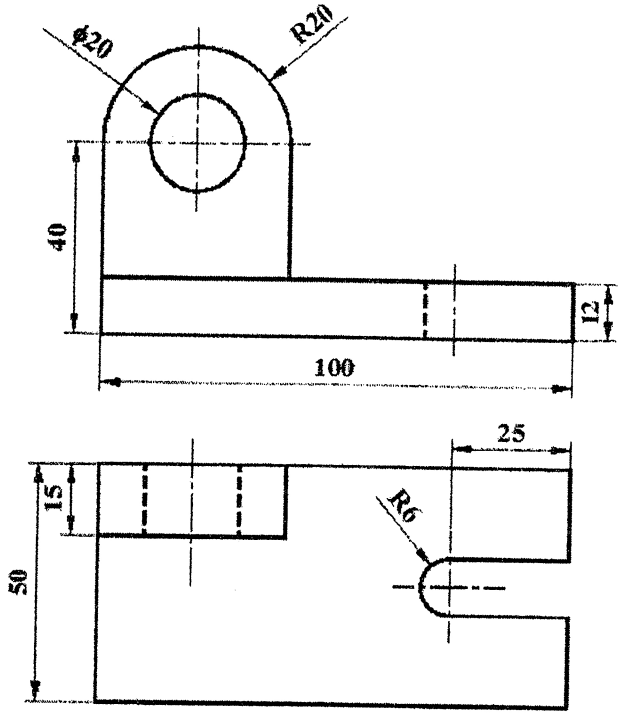


5. Draw isometric drawing from the given orthographic views as shown in figure below. [7]



OR

Draw oblique drawing from the given orthographic views as shown in figure below.



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Examination Control Division
2081 Ashwin

Exam.	Regular (New Course-2080 Batch)		
Level	BE	Full Marks	30
Programme	BCE	Pass Marks	12
Year / Part	I / II	Time	$1\frac{1}{2}$ hrs.

Subject: - Engineering Geology II *(CE 152)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ ***Necessary chart is attached herewith.***
- ✓ *Assume suitable data if necessary.*

1. Explain different techniques for artificial recharge of groundwater in the context of Kathmandu valley. [2]
2. Describe the mechanical properties of rocks. [4]
3. What is Rock Mass? Describe Rock Mass Rating (RMR) classification. [1+3]
4. What are the major hazards in the context of Nepal? Differentiate between magnitude and intensity of the earthquake. [5]
5. a) Describe the sub-surface investigation phase of an engineering geological site investigation. [5]

   b) Three boreholes are sunk at SW, SE, and NW corners of square level ground. The side of the square is 1500 m long. The boreholes are A, B, C respectively. The boreholes meet the coal seam at 150 m in A, 450 m in B, and 600 m in C. [5]

   (i) Determine the attitude of the coal seam.
   (ii) Fourth borehole is proposed at D, the NE corner of the square land. Calculate at what depth, the borehole encounters the coal seam.
   (iii) Find out the true thickness of coal seam if its apparent thickness is found to be 50m.
6. A hill slope with the orientation N40°W/55° has outcrop of Phyllite Rock containing discontinuity orientation N51°W/37°. The friction angle of plane of discontinuity is 28°. Design a cut slope for stable road with the possible mode of failure by using Sterographic Projection Method. [5]

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Exam.	Regular (New Course -2080 Batch)		
Level	BE	Full Marks	60
Programme	All(Except BAR)	Pass Marks	24
Year / Part	I / II	Time	3 hrs.

Subject: - Engineering Mathematics II *(SH 151)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) By using Euler's theorem show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \sin 2u$ where, $u = \tan^{-1}(x^2 + 2y^2)$ [2]

   b) If $u = x^2$ and $v = y^2$, then find $\frac{\partial(u,v)}{\partial(x,y)}$ [2]

2. a) Evaluate $\int_0^1 \int_0^z \int_{x-z}^{x+z} (x + y + z)\, dy\, dx\, dz$ [2]

   b) Evaluate the mass of the solid region bounded by $z = 1 - x^2$ and planes $z = 0$, $y = 1, y = -1$ with $\rho(x,y,z) = z(y+2)$ [2]

3. a) Find the directional derivative of $\Phi(x,y) = 4x^2 + 3y - 4z$ at $(1, 2, 1)$ in the direction of $2\vec{i} + 2\vec{j} + \vec{k}$ [2]

   b) A particle moves along the curve $x = \sqrt{2}\cos t$, $y = \sqrt{2}\sin t$, $z = 4t$, then find the velocity and acceleration at time $t = \frac{\pi}{4}$ [2]

   c) If $\phi = x^3 + y^3 + z^3 - 3xyz$, then find *div (grad* ϕ*)* at the point $(1, -1, 1)$ [2]

4. a) Find the Laplace Transform of the function: $\frac{1-e^t}{t}$ [2]

   b) Find the inverse Laplace transform of $\frac{s}{(s+2)^3}$ [2]

5. a) Find the rank of the following matrix:
$$\begin{bmatrix} 2 & -4 & 3 & 1 & 0 \\ 1 & -2 & 1 & -4 & 2 \\ 0 & 1 & -1 & 3 & 1 \end{bmatrix}$$ [2]

   b) Test whether the vectors $(1,1,1), (1,-1,1)$ and $(2,0,3)$ are linearly independent or dependent. [2]

6. Express $2x^2 - 4x + 2$ as the Legendre's polynomials. [2]

7. Find the minimum value using Lagrange multiplier method of $x^2 + xy + y^2 + 3z^2$ subject to the condition $x + 2y + 4z - 60 = 0$. [4]

8. Change the order of integration and evaluate $\int_0^a \int_0^x \frac{\cos y}{\sqrt{(a-x)(a-y)}}\, dx dy$. [4]

9. Prove that the necessary and sufficient conditions for a vector function $\vec{a}$ of a scalar variable t to have a constant direction is $\vec{a} \times \frac{d\vec{a}}{dt} = 0$ [4]

10. Find the area of asteroid $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{2/3}$ using Green's theorem. [4]

11. Apply Gauss-Divergence theorem to evaluate $\int\int_s \vec{F}.\vec{n}ds$ for $\vec{F} = x\vec{\imath} - y\vec{\jmath} + (z^2 - 1)\vec{k}$ and s is the cylinder formed by the surface $z = 0$, $z = 1$, and $x^2 + y^2 = 4$ [4]

12. Using the Laplace transform technique, solve the initial value problem: [4]

$$y''(t) - y'(t) + 6y(t) = e^{-t},\ y(0) = 0, y'(0) = 0$$

13. Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} 3 & 2 & 2 \\ 1 & 4 & 1 \\ -2 & -4 & -1 \end{bmatrix}$ [4]

14. Reduce the quadratic form $Q(x) = 6x_1^2 + 3x_2^2 + 3x_3^2 - 4x_1x_2 - 2x_2x_3 + 4\,x_1x_3$ into canonical form. [4]

15. Solve $y'' - 4xy' + (4x^2 - 2)y = 0$ by power series method. [4]

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Level	BE	Full Marks	60
Programme	BCE, BME, BAG, BCH	Pass Marks	24
Year / Part	I / II	Time	3 hrs.

Subject: - Engineering Physics (*SH 152*)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) Define degree of freedom. What is its value for monoatomic gas due to translatory motion? [1]
   b) As the laser light is produced from neon atom, what is the purpose of helium atom in He-Ne laser? [1]
   c) What is electric dipole and dipole moment? [1]
   d) Write the basic concept of eddy current production. [1]
2. a) A thin uniform rod of length 1m hangs from a pivot fitted at one end. Calculate the time period if amplitude is small. [2]
   b) Calculate the kinetic energy of one mole of diatomic gas at 273°C. Take R=8.31 $Jmol^{-1}K^{-1}$. [2]
   c) Calculate the kinetic energy of a neutron having de-Broglie wavelength of 0.1 nm. [2]
   d) Mention the Maxwell's electromagnetic equation in integral and differential form. [2]
3. Show that the radius of gyration in a bar pendulum is equal to half of the distance between point of suspension and oscillation when the time period is minimum. [4]

   OR

   Using the expression for time period in physical pendulum, prove that the point of suspension and oscillation are at equal distance from C. G. when the time period is minimum.
4. The volume of auditorium hall is 600 m^3, wall area is 200 m^2, the floor area is 120 m^2 and ceiling area is 120 m^2. The average coefficient of absorption for wall, ceiling and floor are 0.03, 0.80 and 0.06 respectively. Calculate the average absorption coefficient and reverberation time. [2+2]
5. Present the assumptions in Einstein's quantum theory of specific heat and derive the expression for specific heat of solids. Explain the results for low temperature and high temperature regions. [1+2+1]

   OR

   Discuss with reason for correction in pressure and volume of real gas and derive Vander-Waal's equation of real gas. [3+1]

6. a) What is circle of least confusion? Prove that the diameter of circle of least confusion for a lens is independent with its focal length when the object is taken at large distance. [1+3]

   b) Newton's rings arrangement is used with a source emitting two wavelength $\lambda_1 = 6 \times 10^{-5}\ cm$ and $\lambda_2 = 5.9 \times 10^{-5} cm$. It is found that n^{th} dark ring due to λ_1 coincides with $(n+1)^{th}$ dark ring due to λ_2. Find the diameter of n^{th} dark ring if the radius of curvature of the used lens is 90 cm. [4]

   c) A diffraction grating 3 cm wide produces the second order at 33^0 with light of wavelength 600 nm. What is the total no. of lines in the grating? [4]

   d) What is double refraction? Explain mathematically, how you can produce linearly, circularly and elliptically polarized light? [4]

7. a) Derive an expression for the electric field intensity at any point on the axial line at a distance 'r' from the center of a short quadrupole. [4]

   OR

   Derive an expression for electric field intensity due to a ring of charge along the axis. Also, find the position at which the field is maximum.

   b) A Capacitor is discharged through resistor R. After how many time constant does its (i) charge drop to half of its initial value? (ii) energy stored fall to half of its initial value? [2+2]

8. Calculate the displacement current between the circular plates of area $1.5 \times 10^{-2}\ m^2$ and rate of electric field change $1.5 \times 10^{12}\ Vm^{-1}s^{-1}$. Also calculate the displacement current density and induced magnetic field for r = R=69 mm. [4]

9. The electromagnetic wave is travelling through a vacuum with a frequency of 5×10^{14} Hz. The amplitude of electric field is 3 V/m, Calculate [2+2]

   a) The amplitude of magnetic field
   b) The intensity of wave.

10. Using Schrodinger wave equation, calculate the values of energy of a particle in one-dimensional infinitely deep potential well. Indicate graphically the first three wave functions for such a particle. [3+1]

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Exam.	Regular (New Course-2080 Batch)		
Level	BE	Full Marks	60
Programme	BCE	Pass Marks	24
Year / Part	I / II	Time	3 hrs.

Subject: - Engineering Survey I (*CE 153*)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) Define surveying. List the principle of surveying in chronological order. Explain any two with suitable examples. [1+1+2]
   b) What are the factors affecting the selection of scale. Describe the types of errors. [2+2]
   c) A rectangular plot of land of area 0.96 hectare is represented on map of similar rectangle area of 6 cm^2. Calculate the R.F. of scale of map. Draw a scale to read up to a meter from a map. The map should be long enough to measure up to 500m. Also show distance of 369 m. [4]
2. a) What is principle of Chain survey and Plane table survey? Also write down advantages and disadvantages of Plane table survey. [1+1+2]
   b) Define bearing and meridians. [1+1]
   c) The following bearing was observed in the compass traverse

Lines	AB	BC	CD	DE	EA
FB	188°45'	119°15'	346°30'	337°00'	293°30'
BB	7°45'	298°15'	168°30'	158°30'	113°00'

   At which stations do you suspect local attraction? Find the correct bearing of the lines by included angle method. [6]
3. a) What are the points to be considered while doing fly levelling? If RL of one TBM is known give the example to calculate RL of another TMB at k loop distance in km. [3+1]
   b) Explain the Longitudinal and cross section levelling with sketch. [3]
   c) The consecutive readings taken during a levelling operation at 20 m intervals are as follows: 0.685, 1.315, 1.825, 0.635, 1.205, 1.235, 2.631, 1.355 and 2.015 m. The instrument was shifted after third and sixth readings. The third reading was taken to a BM of assumed elevation 1580.000 m. Find the reduced level of points using Rise and fall method. Find the gradient from first to last stations. Apply check. [5]
4. a) What are the features of Total Station? List and explain briefly. [4]
   b) What is tangential tacheometry? Explain the cases with sketch. [3]
   c) Calculate the mean horizontal angle <AOB, <BOC and <COA from the following observation. [5]

Instrument station	Sighted to	Face Left	Face Right
O	A	00°10'30"	180°50'30"
	B	150°35'20"	330°15'20"
	C	240°20'30"	60°25'40"
	A	0°05'40"	180°10'40"

5. a) What is triangulation? Write down norms and specification of Third Order Triangulation. [1+3]

b) Differentiate between manual plotting and computer aided plotting. [4]

c) Following observations were made in a tacheometric survey a station A of RL 1085.550, the height of instrument being 1.385 m. [4]

Inst Station	HI	Staff Station	Azimuth	Zenithal angle	Staff Reading
A	1.385	B	18°00'	71°30'	1.295, 1.820, 2.345
		C	127°00'	96°00'	1.010, 1.790, 2.570

The instrument is fitted with an anallactic lens and the multiplying constants is 100. Determine the RL of B and C and the gradient of line BC.

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Exam.	**Regular (New Course -2080 Batch)**		
Level	BE	**Full Marks**	60
Programme	BCE	**Pass Marks**	24
Year / Part	I / II	**Time**	3 hrs.

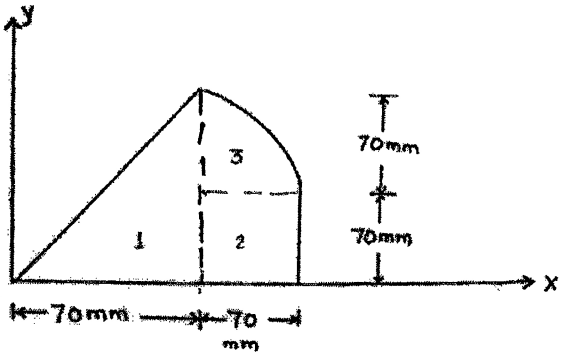
Subject: - Strength of Materials *(CE 151)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

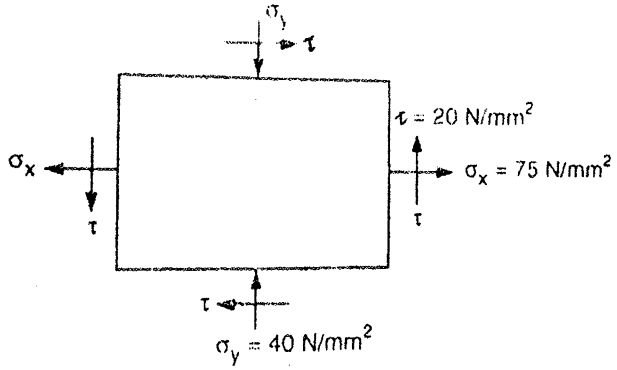
1. a) Derive the expression for the extension in a bar of length 2, uniformly tapering from a diameter d_1 at one end to a diameter d_2 at another end subjected to an axial tensile load P. [7]

   b) A reinforced concrete column is 300mm x 300mm in section. The column is provided with 8 bars of 20 mm diameter. The column carries a load of 360kN.Find the stresses in concrete and the steel bars. Take $E_s = 2.1 \times 10^5$ N/mm^2 and $E_c = 0.14 \times 10^5$ N/mm^2. [5]

2. State the parallel axis theorem. Determine principal MOI for the section shown below. [1+6]



3. a) State the state of stress at a point in a two-dimensional strained material is as shown in the figure. Determine the magnitude of principal stresses, orientation of principal planes and maximum shear stress. Also, determine resultant stress on the plane of maximum shear stress. [7]



   b) Draw the Mohr's circle diagram for plane strain and show on it the value of principal strains. [5]

4. a) A thin cylindrical shell is 4 m long and has 2m internal diameter and 14 mm metal thickness. Calculate the maximum intensity of shear produced and change in dimension of shell if it subjected to an internal pressure of 3 N/mm^2. Take $E = 2\times10^5$ N/mm^2 and $v = 0.3$. [4]

   b) Mention the physical meaning of torsional rigidity. A solid shaft transmits 250 kW at 100 rpm. If the shear stress is not to exceed 75 MPa, what should be the diameter of the shaft. Let the shaft is replaced by a hollow shaft whose internal is 0.6 times the outer diameter. Determine the size and percentage saving in weight if the maximum shear stress being the same. [2+6]

5. A symmetrical I-section beam has 200 mm wide flanges and overall depth 500 mm. Each flange is 25 mm thick and the web is 20 mm thick. Determine (i) the maximum bending moment that should be imposed in the section if the tensile or the compressive stress is not exceed 40 N/mm^2 (ii) Determine the shear stress variation in this section. [6+4]

6. Mention the limitations of Euler's formula for buckling. Derive the relation of crippling load for a long column with one end hinged and other end fixed. [2+5]

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