

121

Q. P. Code: 11701

(3hours)

[Total marks: 80]

- N.B.** (1) Question No. 1 is compulsory.
 (2) Answer **any Three** from remaining
 (3) Figures to the right indicate full marks.

1. (a) Find Laplace transform of $e^{-4t} \sin ht \sin t$. 5
 (b) Does there exist an analytic function whose real part is $x^3 - 3x^2y - y^3$. Give justification. 5
 (c) Show that $\{\cos x, \cos 2x, \cos 3x, \dots\}$ is a set of orthogonal functions over an interval $(-\pi, \pi)$. 5
 (d) Evaluate $\int_0^{2+i} z^2 dz$ along the line joining the point $z_1 = 0$ and $z_2 = 2 + i$. 5
2. (a) Obtain the Taylor's and Laurent series which represent the function,
 $f(z) = \frac{1}{(z+1)(z+3)}$ valid in the regions,
 (i) $|z| < 1$ (ii) $1 < |z| < 3$ (iii) $|z| > 3$ 6
 (b) Find the bilinear transformation which maps the points $z = \infty, i, 0$ into the points $w = 0, i, \infty$. 6
 (c) Using Laplace transform, solve the differential equation :
 $\frac{d^2x}{dt^2} + 4x = t$ with $x(0) = 1, x'(0) = -2$ 8
3. (a) Solve $\frac{\partial^2 u}{\partial x^2} - 2 \frac{\partial u}{\partial t} = 0$ by Bender-Schmidt method, given
 $u(0, t) = 0, u(x, 0) = x(4 - x), u(4, t) = 0$, assuming $h = 1$, find u upto $t=5$. 6
 (b) Using convolution theorem find the inverse Laplace transform of
 $\frac{s}{(s^2 + 1)(s^2 + 4)}$ 6
 (c) Determine the solution of one-dimensional heat equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$
 under boundary condition $u(0, t) = u(l, t) = 0, u(x, 0) = x$, l being the length of rod. 8

[TURN OVER]

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4. (a) Using Residue theorem, evaluate, $\int_0^{2\pi} \frac{d\theta}{5 + 3\sin \theta}$. 6

(b) Find the inverse Laplace transform of the following:

$$\frac{s^2 + 2s + 3}{(s^2 + 2s + 2)(s^2 + 2s + 5)}$$
 6

(c) Obtain Half Range Sine Series of $f(x) = x(\pi - x)$ in $(0, \pi)$.

Hence, evaluate $-\sum_{m=0}^{\infty} \frac{(-1)^m}{(2m+1)^3}$.

8

5. (a) If $f(x) = e^{-3x}$, $-1 < x < 1$. Obtain Complex form of $f(x)$ in $(-1, 1)$. 6

(b) Find the orthogonal trajectory of the family of curves $3x^2y - y^3 = c$. 6

(c) Solve by Crank-Nicholson simplified formula $\frac{\partial^2 u}{\partial x^2} - \frac{\partial u}{\partial t} = 0$,

$u(0, t) = 0$, $u(1, t) = 2t$, $u = 0$, for two time steps taking $h = 0.25$. 8

6. (a) Obtain the Fourier series for $f(x)$ where

$$f(x) = x + \frac{\pi}{2} \quad -\pi < x < 0$$

$$= \frac{\pi}{2} - x \quad 0 < x < \pi$$
 6

(b) Prove that $\int_0^{\infty} e^{-t} \frac{\sin^2 t}{t} dt = \frac{1}{4} \log 5$ 6

(c) Find bilinear transformation which maps the points $z = 1, i, -1$ onto the points $w = i, 0, -1$. Hence, find the image of $|z| \leq 1$ onto the w -plane. 8

(3 Hours)

Maximum Marks: 80

Question No.1 is compulsory.

Attempt any three from remaining.

Assume suitable data if required, state the same clearly.

Figures to the right indicate full marks.

Attempt sub questions in order.

Explain with neat sketches, wherever necessary

1. Write detailed notes on:

(4x5=20)

(i). Principle of surveying.

(ii). Principle of Chain surveying and its applications in civil engineering projects.

(iii). Principle of Plane table surveying and advantages of plane table surveying.

(iv). Principle of leveling and importance of leveling in civil engineering projects.

2. a. The following readings have been taken from a page of an old level book. The readings in level book were written with pencil and some of these got erased. The erased readings were marked with question marks. It is required to reconstruct the page. Fill up the missing quantities showing the calculation & apply the usual checks. (08)

STATION	B.S	I.S	F.S	RISE	FALL	RL	REMARKS
1	?					150.000	BM
2		2.457			0.827	?	
3		2.400		0.057		?	
4	2.697		?		?	148.07	TP
5	?		2.051	0.646		148.716	TP
6		2.500		1.068		148.784	
7		2.896			?	149.388	
8		?			0.124	?	
9			2.672	0.348		149.612	

2. b. Describe procedure and application of reciprocal leveling. (06)

2. c. Define any three from following: (06)

i) GTS bench marks & Permanent bench marks.

ii) Leveling staff & Open cross staff.

iii) Reduced level & Line of collimation.

iv) Telescope normal & axis of telescope.

3. a. List accessories required for PTS and explain traversing method with its suitability. (06)

3. b. The circle of a theodolite is divided into degree and $\frac{1}{4}$ of degree. Design a suitable decimal vernier to read up to 0.005° . (02)

3. c. Define Contour. State engineering applications of Contour maps. (06)

3. d. A big pond obstructs chain line PQ. Line PL was measured as 901m on left of the line PQ for circumventing the obstacle. Similarly line PM was measured as 1100m on right of line PQ such that points L-Q-M are in the same straight line. Lengths of QL and QM are 502m and 548m respectively. Find distance PQ. (06)

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4. a. The following bearings were taken for a closed compass traverse in survey project:

Line	AB	BC	CD	DE	EA
FB	$48^{\circ} 25'$	$177^{\circ} 45'$	$104^{\circ} 15'$	$165^{\circ} 15'$	$259^{\circ} 30'$
B B	$230^{\circ} 0'$	$356^{\circ} 0'$	$284^{\circ} 55'$	$345^{\circ} 15'$	$79^{\circ} 0'$

- (i). State which stations are affected by local attraction and by how much? (01)
(ii). Determine correct bearings. (06)
(ii). Calculate the true bearings, if the declination was $1^{\circ} 30'$ W. (02)
(iii). Tabulate the correct bearings and true bearings. (01)

4. b. Write short note on any two from following: (10)

- i) Declination and variation of magnetic declination.
ii) Trough Compass and Prismatic compass with their use in surveying.
iii) Direct and indirect ranging

5. a. The following table gives the corrected latitudes and departures of the closed traverse.

Calculate its area by DMD method. (05)

Side	Latitude in m		Departure in m	
	Northing	Southing	Easting	Westing
PQ	128		9	
QR	15		258	
RS		143	9	
SP	0			276

5. b. Describe in detail procedure of taking bearing of a line with theodolite. (05)

5. c. Explain in detail the use of theodolite as a level (05)

5. d. Attempt following: (05)

- (i) One hectare of an area is equal to _____
(ii) What will be the curvature correction for a distance of 1000m?
(iii) The magnetic bearing of sun at noon is 178° , what is magnetic declination at that place?
(iv) Define offset
(v) Sketch symbol for Lake in contour map

6. a. For a closed traverse ABCD, due to some obstructions, it was not possible to observe bearings of lines BC & CD. Calculate missing bearings. (07)

Line	AB	BC	CD	DA
Length in m	500	1200	880	1050
W C B	60°	?	?	310°

6. b. Explain working of Amsler polar planimeter. (05)

6. c. Write short note on: (08)

- (i) Trapezoidal and parabolic rule for area calculation.
(ii). GTT.

(30)

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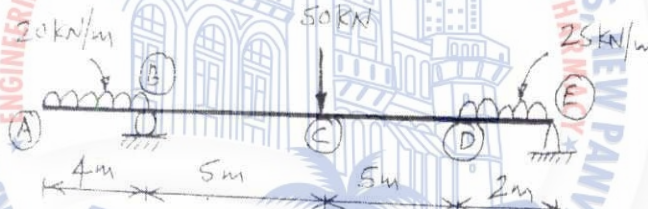
(3 hours)

Total Marks :80

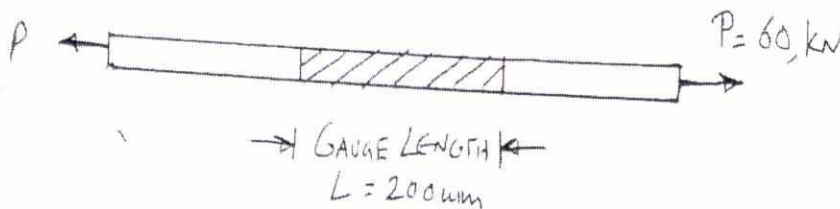
NOTE-

1. Question No 1 is compulsory. Answer any 3 from remaining 5 questions.
2. Illustrate your answers with neat sketches where ever necessary.
3. Assume suitable data wherever necessary if not given. However justify the same.

- Q.1 Answer the following (any four)
- a) What do you mean by " Pure Bending " and the term " Beam of uniform strength " 5
 - b) State the relationship between modulus of elasticity, modulus of rigidity and bulk modulus. 5
 - c) State the assumptions made in theory of Torsion. 5
 - d) Derive the expression for volumetric strain for a thin cylindrical shells 5
 - e) Draw shear stress distribution diagram for , T (inverted) , C (channel) , and I (symmetrical & un symmetrical) section 5
- Q.2 a) Draw SFD and BMD for the beam loaded as shown in figure below. 8

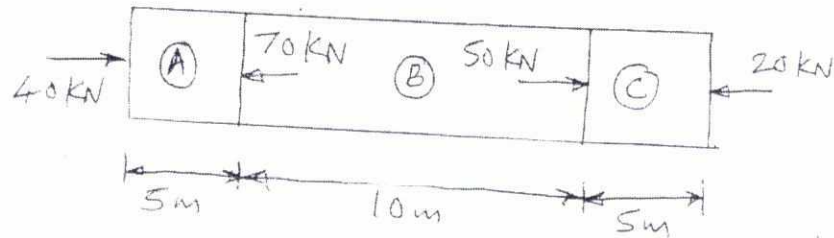


- b) In an experiment a bar of 30 mm diameter is subjected to an axial pull of 60 KN. 6
The measured extension on gauge length of 200 mm and is 0.09 mm and the change in diameter is 0.0039 mm. Calculate the Poisson's ratio and the values of three elastic modulus.

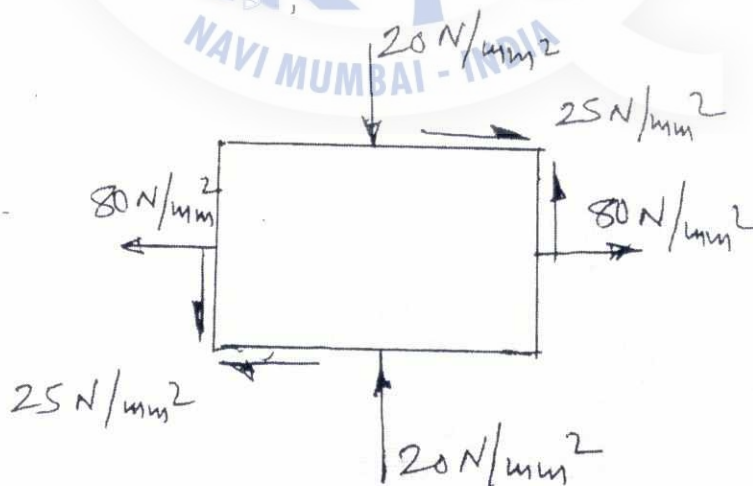


Turn Over

- c) A bar 20m long an 400mm^2 in cross section carries a axial load as shown . 6
Calculate the deformation of the bar. Take $E = 200 \text{ KN/mm}^2$.

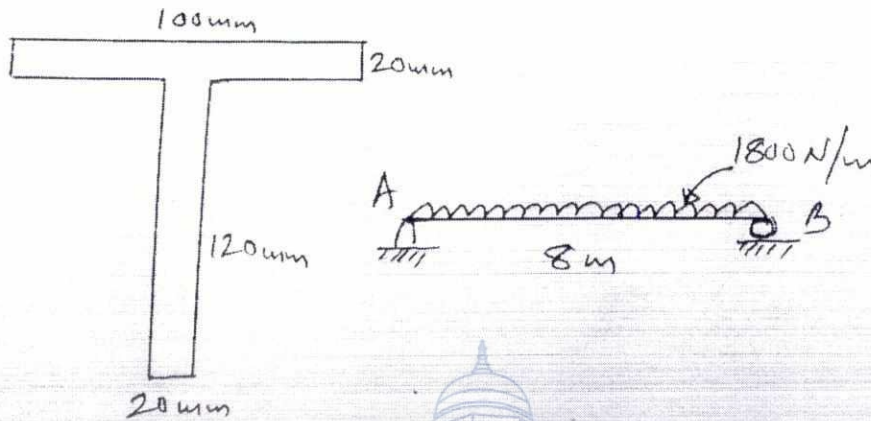


- Q.3 a) A copper rod 36 mm in diameter is encased and rigidly attached at the end of a steel tube which is 50 mm external diameter, thickness of metal being 5 mm. The composite section is then subjected to an axial pull of 100 KN. Find the stresses induced in each metal and extension on the length of 1.5m . Take $E_s = 2 \times 10^5 \text{ N/mm}^2$ and $E_c = 1.1 \times 10^5 \text{ N/mm}^2$. 8
- b) A T beam of span 5 m has a flange 125 mm x 12.5 mm and web 187.5 mm x 8 mm. If the maximum permissible stress is 150 MPa, find the maximum udl the beam can carry. 6
- c) Derive Flexural formula. (Bending Equation) 6
- Q.4 a) A plane element in the body is subjected to the stresses as shown in the figure. Determine 8
- The magnitude of principle stresses & respective principal planes.
 - Maximum shear stresses and the plane on which they occur. Sketch the stresses on properly oriented planes. Solve analytically or graphically.



Turn Over

- b) A cast iron beam is of T section as shown in figure. Sketch the bending distribution diagram at point C. 6



- c) Draw shear stress distribution diagram for the above Question 4(b) 6

- Q.5 a) A short vertical column is of rectangular section 40 cm x 30 cm. It carries a load 80 kN at a point 5 cm away from the centre of the section along one of the diagonals. Calculate the intensity of the stress at the corners of the column in the plan. 8
- b) Determine suitable diameter of a solid shaft to transmit 1 MW power rotating at 220 RPM, if the following working conditions are to be satisfied - 8
- the shaft must not twist more than 1 degree on length of 12 times the shaft diameter and
 - the shear stress must not exceed 60 N/mm^2 .
Take $G = 84 \text{ kN/mm}^2$.
- c) What do you mean by Middle third rule? Explain with neat sketches. 4
- Q.6 a) A cylindrical shell 1 m in diameter and 3 m in length has a metal thickness of 10 mm. If it is subjected to an internal pressure of 3 N/mm^2 , determine change in length, change in diameter and change in volume. Take $E_s = 2 \times 10^5 \text{ N/mm}^2$ and Poisson's ratio = 0.3 8
- b) Find Euler's Crippling load for a hollow cylindrical column of 80 mm external diameter and 10 mm thick. Both ends of the column are fixed and length of column is 5.5 m. Take $E_s = 2 \times 10^5 \text{ N/mm}^2$. Also determine Rankine's crippling load for the same column. Take $f_c = 350 \text{ MPa}$ and Rankine's constant $\alpha = 1/7500$ 8
- c) Define the terms- (i) slenderness ratio (ii) radius of Gyration (iii) torsional rigidity and (iv) core ore kernrl of a Section 4

Subject: Correction: T0923 / T1473 - STRENGTH OF MATERIALS QP code : 27319
From: University of Mumbai (support@muapps.in)
To: controllerkrc@yahoo.com;
Date: Thursday, 7 December 2017 4:27 PM



University of Mumbai

Correction: T0923 / T1473 - STRENGTH OF MATERIALS **QP code : 27319**
Question No. 4(b): point C in the Diagram shall be taken at the centre of length AB.

University of Mumbai
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CBSGS

80 Marks

3 Hours

N. B. 1. Question no. 1 **compulsory.**

2. Answer any three questions out of remaining
3. Assume any data, if required and state them clearly
4. Attempt sub questions in order
5. Illustrate answer with neat sketches wherever required
6. Figures to the right indicate full marks.

1 Write short notes on any four :- [20]

- a) Load Bearing and Frame Structure
- b) Grades of cement
- c) Properties of construction materials
- d) Pointing
- e) Water Proofing materials

2. a) Explain under reamed pile foundation with neat sketch. [5]
 b) Explain manufacturing process of clay bricks [10]
 c) Give the details of 2'3 wall constructed in Double Flemish Bond [5]
3. (a) Mention the experiments performed in laboratory on tiles and cement? Explain any one experiment (either of tile or of cement) in detail. [7]
 (b) Compare paints & varnishes. [5]
 (c) Enumerate (any ten) ferrous and non ferrous metals and alloys used in construction Explain the use of aluminium and steel as construction materials [08]
4. (a) List out the various types of glasses and state their properties & uses in construction. [7]
 (b) What is form-work? Which are the forces acting on form-work? [5]
 (c) Explain the defects in timber with neat sketches [8]
5. (a) Sketch the cross-section of lean to roof truss and name the various members in it. [6]
 (b) Explain the field tests performed to find the quality of any two construction materials [6]
 (c) Sketch the cross-sections and elevations of:
 (i) Needle or cantilever scaffolding [8] (ii) Un-coursed Random Rubble Masonry.
6. (a) Define sound insulation. Explain acoustical defects [8]
 (b) Write short notes on (any three): [12]
 (i) Plastering
 (ii) Ventilation
 (iii) Flooring materials.
 (iv) Hydraulic Lime

REVISED COURSE)

(3 Hours)

Q.P.Code: 017073

[Total Marks : 80

- N.B. : (1) Question no 1 is **compulsory**.
 (2) Attempt any **three** questions out of remaining **six**.
 (3) Draw sketches wherever necessary.
 (4) Figures to the right indicate full marks.

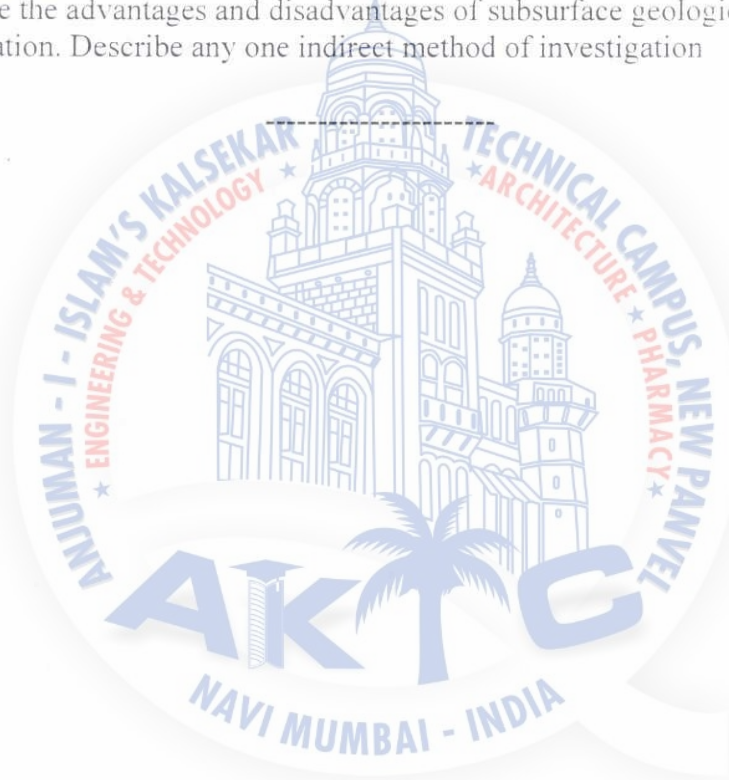
1. (a) Explain the following terms in brief 10
 (i) Cleavage (ii) Dykes
 (iii) Phacolith (iv) Core recovery
 (v) Mohorovicic discontinuity (vi) Intermediate rock
 (vii) Texture (viii) Exfoliation
 (ix) Water table (x) Volcanic tuff
- (b) Name the following. 6
 (i) Two minerals show basal pinacoid cleavage.
 (ii) Fold with sharp crest and trough and planar limbs.
 (iii) Parent rock of marble.
 (iv) Geological agent responsible for the formation of hanging valley.
 (v) Layered structure where thickness of each layer is less than 1cm.
 (vi) The structure shows linear arrangement of platy and flaky minerals.
- (c) Draw neat labelled sketch of the following. 4
 (i) Horst and Graben
 (ii) Recumbent fold
2. (a) Describe two landforms each created by depositional action of glacier and running water. 10
 (b) Describe various textures of igneous rocks with proper diagram 10
3. (a) Describe the quartz family of minerals. 10
 (b) Define fold and explain the types of folds on the basis of behaviour with depth. 10
4. Write the difference between 20
 (a) Graded bedding and Ripple marks.
 (b) Mechanical weathering and chemical weathering.
 (c) Dip-slip fault and strike-slip fault.
 (d) Plutonic rock and volcanic rock.

TURN OVER

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5. Explain the following in short.(any 4) 4*5=20
- (a) Elastic rebound theory.
 - (b) Factors that influence landslides..
 - (c) Principles of stratigraphy.
 - (d) Qualities of good building stones.
 - (e) Water bearing properties of rocks.
6. (a) Enumerate the suitable and unsuitable geological structures for tunnel construction. 10
- (b) What are the advantages and disadvantages of subsurface geological investigation. Describe any one indirect method of investigation 10



(3 hours)

Note:

Max. Marks: 80

Question no.1 is compulsory

Solve any 3 questions out of remaining

Assume data wherever necessary and clearly mention the assumptions made.

Draw neat figures as required.

1. Answer any 4 of the following. 20
 - a. Explain Doublet flow.
 - b. Explain Cipolletti weir or notch along with formula and neat sketch.
 - c. Write Eulers equation of motion and derive Bernoulli's equation from it. Mention all assumptions made.
 - d. Write a note on working of Bourdon Pressure Gauge with a neat sketch.
 - e. Define: Density; Weight density; specific Volume; Specific Gravity and; viscosity.

2. a. An oil film of thickness 1.5 mm is used for lubrication between a square plate of size 0.9 m x 0.9 m and an inclined plane having an angle of inclination 20° . The weight of the square plate is 392.4 N and it slides down the plane with a uniform velocity of 0.2 m/s. Find the dynamic viscosity of oil. 08

 b. Find the discharge of water flowing through a pipe 30 cm diameter placed in an inclined position where a venturimeter is inserted, having a throat diameter of 15 cm. The difference of the pressure between the main and throat is measured by a liquid of sp. gr. 0.6 in an inverted U-tube which gives a reading of 30 cm. The loss of head between the main and throat is 0.2 times the kinetic head of the pipe. 12

3. a. An external cylindrical mouthpiece of diameter 100 mm is discharging water under a constant head of 8 m. Determine the discharge and absolute pressure head of water at vena-contracta. Take $C_d = 0.855$ and C_c for vena-contracta = 0.62. Take atmospheric pressure head = 10.3 m of water. 10

 b. A circular plate of 3 m diameter is under water with its plane making an angle of 30° with the water surface. If the top edge of the plate is 1 m below the water surface, find the force on one side of the plate and its location. 10

Turn Over

4. a. An open circular cylinder of 20 cm diameter and 100 cm long contains water upto a height of 80 cm. It is rotated about its vertical axis. Find the speed of rotation when: no water spills and; axial depth is zero. 10
- b. A weir 36 m long is divided into 12 equal bays by vertical posts, each 0.6 m wide. Determine the discharge over a weir if the head over the crest is 1.20 m and velocity of approach is 1.2 m/s. Use Francis formula. 10
5. a. A rectangular pontoon 8.0 m long, 7 m broad and 3 m deep weighs 588.6 kN. It carries on its upper deck an empty boiler of 4 m diameter weighing 392.4 kN. The center of gravity of the boiler and pontoon are at their respective centers along a vertical line. Find the metacentric height. Weight density of sea water is 10104 N/m³. 12
- b. Describe experimental determination of Hydraulic Coefficients. 08
6. a. State & Derive Pascal's Law 06
- b. An oil of sp. gr. 0.8 under a pressure of 137.2 kN/m². What is the pressure head expressed in meters of water? What is the pressure head expressed in meters of oil? 04
- c. If for a two dimensional potential flow, the velocity potential is given by $\phi = x(2y - 1)$; determine the velocity at the point (4, 5). Determine also the value of stream function at that point? 10