University of Asia Pacific
Department of Civil Engineering
Mid Examination Fall - 2017
Program: B.Sc in Civil Engineering

Course Title: Principles of Economics — Course Code: ECN 201
Time: 1 hour — Full Marks: 20

(Answer all the following questions)

1. Market demand and supply schedule for apples are given below:

Price (Tk. Per Kg)	Quantity Demanded (Millions of Kg)	Quantity Supplied (Millions of Kg)
700	11	19
600	13	17
500	15	15
400	17	13
300	19	11

   a) Draw the demand and supply curve for apples.
   b) Is there any equilibrium point in the curve you drawn? If yes then identify the equilibrium level with explanation. 4 (2+2)

2. Supply schedule of T-Shirt of X & Y:

Price (Tk.)	Quantity Supplied (X)	Quantity Supplied (Y)
2000	8	12
1500	6	10
1000	4	8
500	2	6

   a) Draw the supply curve of X & Y.
   b) What is the market supply of T Shirt? Draw the market supply curve. 4 (2+2)

3. Production possibilities schedule of laptops and smart phones:

Laptops (Units)	Smart phones (Units)
20	0
18	1
12	2
0	3

Draw the production possibilities curve putting smart phones on the horizontal axis and laptops on the vertical.axis. (4)

4. A photocopy shop can produce its daily output of 35,000 copies with either of two processes. Process A uses 4 workers and 3 photocopy machines. Process B uses 3 workers and 4 photocopy machines.

   a. If each worker's daily wage is TK. 130 and the daily rental of a photocopy machine is TK. 30, will the shop owner choose Process A or B?

b. Besides the costs of labor and capital, the owner daily pays TK. 450 in building rent. What is the shop's daily explicit cost?

c. If the shop's price per photocopy is TK. 2.50, what is the daily accounting profit?

d. The owner estimates that he could earn TK. 300 a day if he managed another shop instead of his own shop. What are the shop's daily implicit costs? What are the shop's daily economic costs?

e. What is the shop's daily economic profit? (8)

University of Asia Pacific
Department of Basic Sciences & Humanities
Mid Examination, Fall-2017
Program: B.Sc. in Civil Engineering

Course Title: Mathematics IV | Course Code: MTH 203 | Credit: 3.00
Time: 1.00 Hour | Full Marks: 60

There are **Four** Questions. Answer any **Three**. All questions are of equal value. Figures in the right margin indicate marks.

1. (a) Find the differential equation of $y = ae^x + be^{-x} + c\cos x + d\sin x$ and also write down the order and degree of this differential equation. **8**

(b) Solve: **6+6**

(i) $e^x y \frac{dy}{dx} = e^{-y} + e^{-2x-y}$

(ii) $xy^2 dy = (x^3 + y^3)dx$

2. (a) Solve: $(1+x)\frac{dy}{dx} - xy = x + x^2$ **10**

(b) Solve: **5+5**

(i) $\frac{d^4y}{dx^4} - 81y = 0$

(ii) $(D^2 + 4)y = \sin 2x$

3. (a) Define Bernoulli's equation and solve $\frac{dy}{dx} = y(xy^3 - 1)$ **10**

(b) Define Cauchy-Euler equation and solve **10**

$$x^2\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + 4y = 0$$

4. (a) A culture initially has P_0 number of bacteria. At $t = 2$ hour the number of bacteria is measured to be $\frac{5}{2}P_0$. If the rate of growth is proportional to the number of bacteria $P(t)$ present at time t, determine time necessary for the number of bacteria to triple. **12**

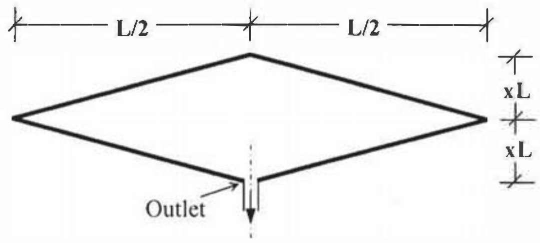
(b) Solve: $(D^2 - 9)y = e^{3x}\cos x$ **8**

The University of Asia Pacific
Department of Civil Engineering
Midterm Examination Fall 2017

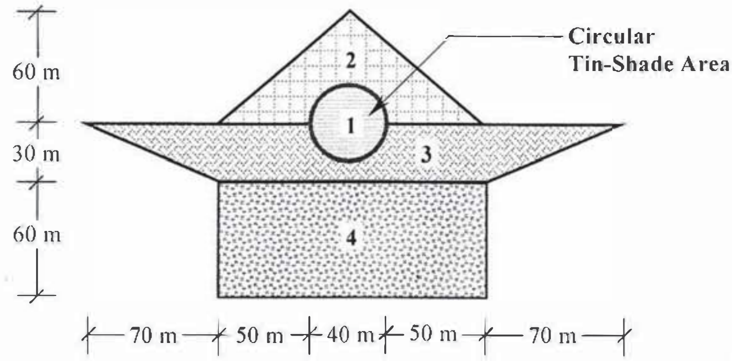
Course # : CE-203 — Course Title: Engineering Geology & Geomorphology
Full Marks: 45 (15 X 3 = 45) — Time: 1 hour

Answer any **three** (3) questions of your choice out of the following **four** (4)

1a)	Mention the principal zones of the earth from geologic point of view. Describe any one.	5
1b)	Draw a schematic diagram of the rock cycle and provide one example of each type of rock.	5
1c)	Classify (mention names only) geomorphic processes based on origin. Also classify (mention names only) physical and chemical weathering processes.	5
2a)	Define precipitation, infiltration and percolation. Draw a schematic diagram of hydrologic cycle and show their relative locations of occurrences in conjunction with runoff.	7
2b)	In the following basin, for what value of x, the flow rate (Q) or runoff will be the maximum? Also calculate the CC of this basin.	8



3a)	Mention (no detail description required) the factors affecting runoff.	4
3b)	Write down the assumptions used in rational formula.	3
3c)	For the drainage area as shown below, calculate peak runoff in ft^3/s. Use $C_2 = 0.8$, $C_3 = 0.5$ and $C_4 = 0.7$ and $I = 0.2$ cm/min.	8



4a)	Classify (mention names only) folds based on their origin. Draw a neat sketch of typical fold geometry.	6
4b)	Define fault. Classify fault (mention names only) and sketch faults according to net slip. Draw a neat sketch of a horst.	9

University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination Fall 2017
Program: B.Sc. Engineering (Civil)

Course Title: Numerical Analysis and Computer Programming　　　Course Code: CE 205
Time- 1 hour　　　Full marks: 20

Answer any 2 among the 3 questions

1. a. Determine the real root of the equation $xe^x = 1$ using Secant method. Correct up to three decimal places. Let two initial approximations 0.5 and 0.6. (05)

   b. Using iterative method to find the real root of the equation $5x^3 - 20x + 3 = 0$. Correct up to three decimal. Let two initial approximations 0.1 and 0.2. (05)

2. Use inverse matrix to solve the system (10)

$$2x_1 + x_2 - x_3 = 1$$
$$x_1 - 2x_2 + 3x_3 = 9$$
$$3x_1 - x_2 + 5x_3 = 14$$

   Check your answer by substituting into original equation.

3 a. The table below gives the temperatures $T\ (in\ ^0C)$ and lengths l (in mm) of a heated rod. If $l = a_0 + a_1T$, find the best values for a_0 and a_1. (03)

$T\ (in\ ^0C)$	20	30	40	50	60	70
$l\ (in\ mm)$	800.3	800.4	800.6	800.7	800.9	801.0

b. Determine the constants a and b by the method of least squares such that $y = ae^{bx}$ fits the following data and draw the curve using corrected data. (07)

x	2	4	6	8	10
y	4.077	11.084	30.128	81.897	222.62

University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination Fall 2016 (Set 1)

Course #: CE 213 | Course Title: Mechanics of Solids II

Full Marks: 40 (= 4 × 10) | Time: 1 hour

1. Use the yield criteria suggested by

   (i) Rankine, (ii) St. Venant, (iii) Tresca, and (iv) Von Mises

   to determine center and radius of Mohr's circle of stresses at yield for a material with Y = 400 MPa, Poisson's ratio = 0.25, if its major principal stress σ_1 is twice the minor principal stress σ_2 [i.e. $\sigma_1 = 2\sigma_2$].

2. In Fig. 1, OABCD represents a (20′ × 10′) 'Bhela' (1′-thick) weighing 10,000 lb and used to transport refugees (weighing W) across waterways. For safety purpose, the Bhela must neither overturn nor drown (i.e. the pressure underneath should be between zero and 62.5 lb/ft^2).

   Calculate the maximum allowable value of W

   (i) If the refugees are evenly distributed over the entire Bhela (area ABCD)

   (ii) If the refugees are crammed in one quarter of Bhela only (area Oa$_1$Ab$_1$).

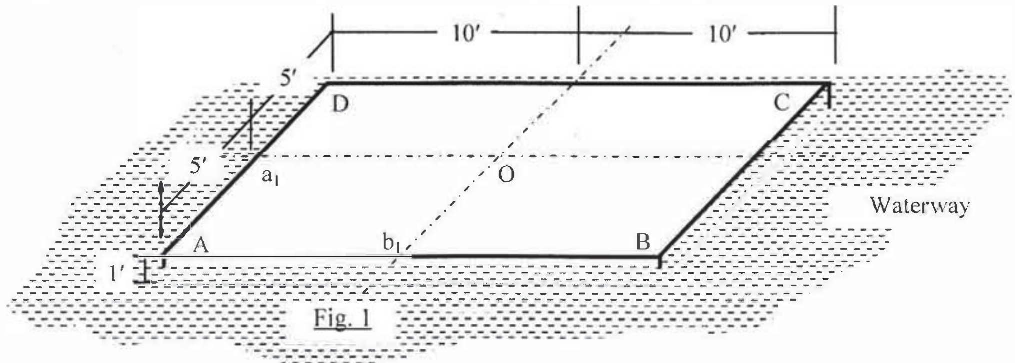


Fig. 1

3. Fig. 2 shows a 60″-long cantilever beam with rectangular cross-section consisting of areas A_1 and A_2, made of materials with unit weight of 100 lb/ft^3 and 50 lb/ft^3 respectively. Determine the

   (i) Maximum shear force and torsional moment due to its self-weight (at fixed-end of the beam)

   (ii) Maximum combined shear stress in the section (including flexural shear stress and torsional shear stress), assuming uniform G over the entire cross-section and beam length.

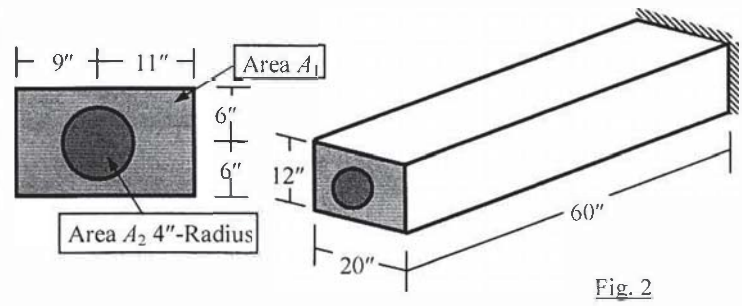


Fig. 2

4. Calculate the equivalent polar moments of inertia (J_{eq}) for the three cross-sections shown in Fig. 3(a)~(c) by centerline dimensions [Given: Wall thickness = 0.10″ throughout].

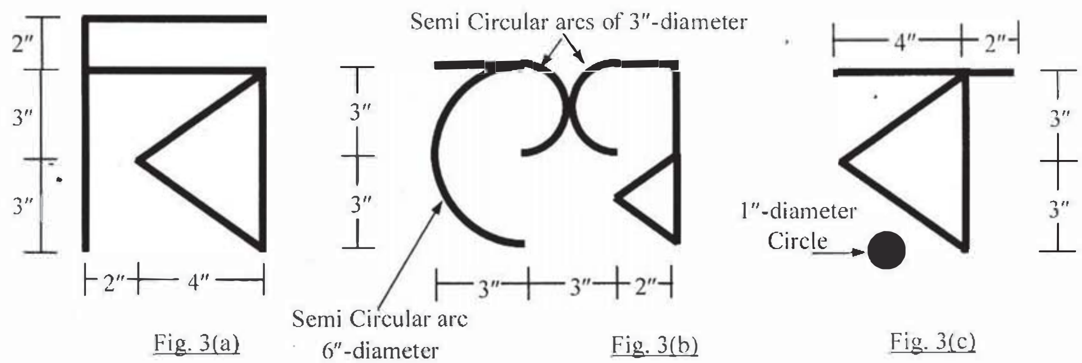


Fig. 3(a) Fig. 3(b) Fig. 3(c)

List of Useful Formulae for CE 213

* Torsional Rotation $\phi_B - \phi_A = \int(T/J_{eq}G)\,dx$, and $= (TL/J_{eq}G)$, if T, J_{eq} and G are constants

Section	Torsional Shear Stress	J_{eq}
Solid Circular	$\tau = Tc/J$	$\pi d^4/32$
Thin-walled	$\tau = T/(2Ⓐ\, t)$	$4Ⓐ^2/(\int ds/t)$
Rectangular	$\tau = T/(\alpha b t^2)$	$\beta b t^3$

b/t	1.0	1.5	2.0	3.0	6.0	10.0	∞
α	0.208	0.231	0.246	0.267	0.299	0.312	0.333
β	0.141	0.196	0.229	0.263	0.299	0.312	0.333

* Normal Stress (along x-axis) due to Biaxial Bending (about y- and z-axis): $\sigma_x(y, z) = M_z\, y/I_z + M_y\, z/I_y$
* Normal Stress (along x-axis) due to Combined Axial Force (along x-axis) and Biaxial Bending (about y- and z-axis): $\sigma_x(y, z) = P/A + M_z\, y/I_z + M_y\, z/I_y$
* Corner points of the kern of a Rectangular Area are (b/6, 0), (0, h/6), (−b/6, 0), (0, −h/6)

* Maximum shear stress on a Helical spring: $\tau_{max} = \tau_{direct} + \tau_{torsion} = P/A + Tr/J = P/A\,(1 + 2R/r)$
* Stiffness of a Helical spring is $k = Gd^4/(64R^3N)$

* $\sigma_{xx}' = (\sigma_{xx} + \sigma_{yy})/2 + \{(\sigma_{xx} - \sigma_{yy})/2\}\cos 2\theta + (\tau_{xy})\sin 2\theta = (\sigma_{xx} + \sigma_{yy})/2 + \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}\cos(2\theta - \alpha)$
  $\tau_{xy}' = -\{(\sigma_{xx} - \sigma_{yy})/2\}\sin 2\theta + (\tau_{xy})\cos 2\theta = \tau_{xy}' = -\sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}\sin(2\theta - \alpha)$
  where $\tan\alpha = 2\,\tau_{xy}/(\sigma_{xx} - \sigma_{yy})$
* $\sigma_{xx(max)} = (\sigma_{xx} + \sigma_{yy})/2 + \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2,\ \alpha/2 + 180°$
  $\sigma_{xx(min)} = (\sigma_{xx} + \sigma_{yy})/2 - \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2 \pm 90°$
* $\tau_{xy(max)} = \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2 - 45°,\ \alpha/2 + 135°$
  $\tau_{xy(min)} = -\sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2 + 45°,\ \alpha/2 - 135°$

* Mohr's Circle of Stresses: Center (a, 0) = $[(\sigma_{xx} + \sigma_{yy})/2,\ 0]$ and radius $R = \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$

* For Yielding to take place
  - Maximum Normal Stress Theory (Rankine): $|\sigma_1| \geq Y$, or $|\sigma_2| \geq Y$.
  - Maximum Normal Strain Theory (St. Venant): $|\sigma_1 - \nu\sigma_2| \geq Y$, or $|\sigma_2 - \nu\sigma_1| \geq Y$.
  - Maximum Shear Stress Theory (Tresca): $|\sigma_1 - \sigma_2| \geq Y$, $|\sigma_1| \geq Y$, or $|\sigma_2| \geq Y$
  - Maximum Distortion-Energy Theory (Von Mises): $\sigma_1^2 + \sigma_2^2 - \sigma_1\sigma_2 \geq Y^2$

University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination Fall 2017 (Set 3)

Course #: CE 213 | Course Title: Mechanics of Solids II
Full Marks: 40 (= 4 × 10) | Time: 1 hour

1. Fig. 1 shows a Mohr's circle of stresses with σ_{xx} = 9 MPa, τ_{xy} = 9 MPa on plane A and σ_{xx}'= 30 MPa, τ_{xy}'= 12 MPa on plane B.
   (i) - Determine the angle θ between the planes A and B and
   - Show the angle θ on the Mohr's circle
   (ii) - Determine the stress σ_{yy} and angle θ_l of Principal Plane and
   - Show the angle θ_l on the Mohr's circle.

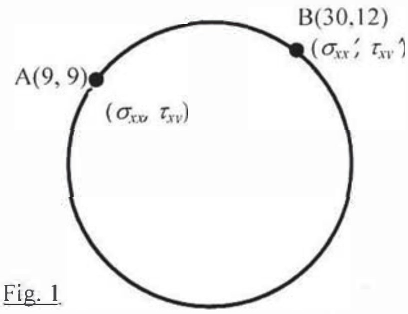


Fig. 1

2. For the beam ABCD shown in Fig. 2, calculate the
   (i) Required diameter (d), if the allowable axial stress is 5000 kPa.
   (ii) Maximum total normal stress for the value of d calculated in (i).

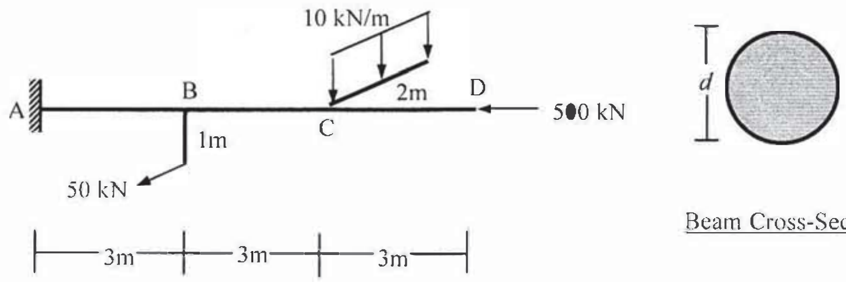


Fig. 2

Beam Cross-Section

3. Calculate the equivalent polar moments of inertia (J_{eq}) for the three cross-sections shown in Fig. 3(a)~(c) by centerline dimensions [Given: Wall thickness = 0.10″ throughout].

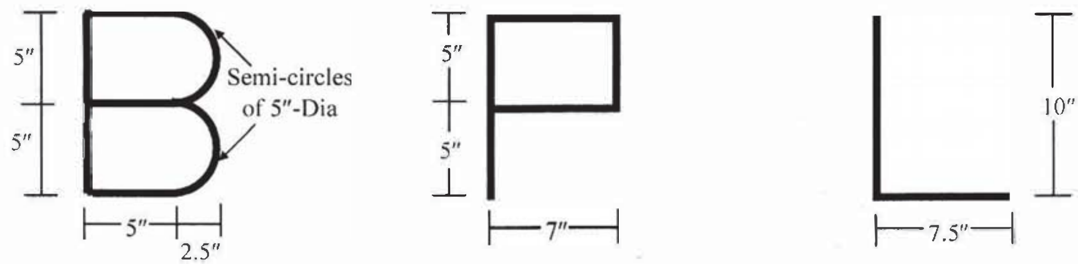


Fig. 3(a) Fig. 3(b) Fig. 3(c)

4. A (10′× 6′) flag is supported by a 20′-high post abc (4″-dia circular section, weighing 100 lb), shown in Fig. 4, and subjected to horizontal pressure (in z-direction) 100 lb/ft^2 over area A_1 and 50 lb/ft^2 over A_2.

   At the center of section a of post abc, calculate
   (i) Combined normal stress (σ_{yy}) and shear stress (τ_{xy})
   (ii) Yield strength (Y) required to avoid yielding, according to Von Mises criteria.

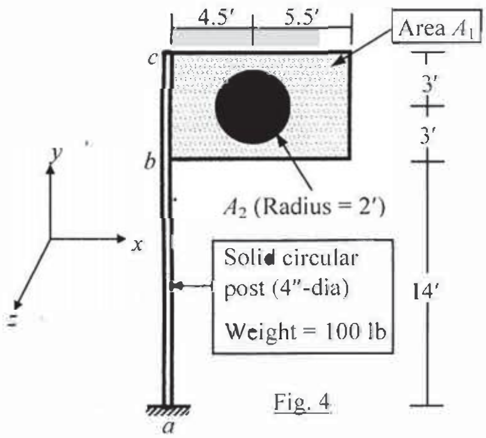


Fig. 4

List of Useful Formulae for CE 213

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  $\tau_{xy}' = -\{(\sigma_{xx} - \sigma_{yy})/2\}\sin 2\theta + (\tau_{xy})\cos 2\theta = \tau_{xy}' = -\sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}\sin(2\theta - \alpha)$

  where $\tan\alpha = 2\,\tau_{xy}/(\sigma_{xx} - \sigma_{yy})$
* $\sigma_{xx(max)} = (\sigma_{xx} + \sigma_{yy})/2 + \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2,\ \alpha/2 + 180°$

  $\sigma_{xx(min)} = (\sigma_{xx} + \sigma_{yy})/2 - \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2 \pm 90°$
* $\tau_{xy(max)} = \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2 - 45°,\ \alpha/2 + 135°$

  $\tau_{xy(min)} = -\sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2 + 45°,\ \alpha/2 - 135°$

* Mohr's Circle of Stresses: Center $(a, 0) = [(\sigma_{xx} + \sigma_{yy})/2, 0]$ and radius $R = \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$

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  - Maximum Normal Strain Theory (St. Venant): $|\sigma_1 - \nu\sigma_2| \geq Y$, or $|\sigma_2 - \nu\sigma_1| \geq Y$.
  - Maximum Shear Stress Theory (Tresca): $|\sigma_1 - \sigma_2| \geq Y$, $|\sigma_1| \geq Y$, or $|\sigma_2| \geq Y$
  - Maximum Distortion-Energy Theory (Von Mises): $\sigma_1^2 + \sigma_2^2 - \sigma_1\sigma_2 \geq Y^2$

University of Asia Pacific
Department of Civil Engineering
Mid Term Examination
Fall 2017
Program: B.Sc. Engineering (Civil)

Course Title: Fluid Mechanics — Course Code: CE 221

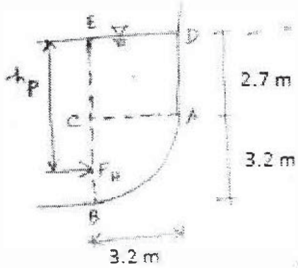
Time- 1 hour — Full marks: 30

Answer any 3 among the 4 questions.
(Assume any missing value)

1. (a) Show that the stream lines and potential lines are orthogonal. [5]
   (b) The velocity along a steam line is given by v=2s+t+3.What would be the convective and local acceleration after 1sec when s=2? [5]

2. (a) A fluid has a dynamic viscosity of 1 poise. Calculate the Velocity gradient and the intensify of shear stress at the boundary if the fluid is filled between two parallel plates 2.5 cm apart and one plate moving at a velocity of 2 m/s, other plate is stationary. Assume that distribution of velocity is $U = 250 - K(5 - y)^2$. [1 poise = $N \cdot sm^{-2}$] [5]
   (b) Derive the formula for Newton's equation of viscosity with net sketch [5]

3. (a) Prove mathematically that center of pressure and center of gravity is not same for a submerged plane surface. In which cases it becomes identical? [5]
   (b) Find the resultant force acting on the curved section AB of the open tank as shown in the figure below. The shape of the curve is quadrant of a circle of radius 3.2m. The upper portion of the curve is at a depth of 2.7m from the free surface. [5]



4. (a) Write short notes i) Density, ii) Specific Weight, iii)Cohesion [3]
   (b) Write the Scope of fluid mechanics [2]
   (c) Show the relationship among the atmospheric pressure, sub-atmospheric pressure and absolute pressure with net sketch. [2.5]
   (d) Calculate the barometric reading with Kerosene in order to find the atmospheric pressure. [2.5]
   Properties: The density of Kerosene is given to be 850 kg/m^3 ,atmospheric pressure at sea level is 101325 N/m^2