University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2019
Program: B. Sc Engineering (2nd Year 2nd Semester)

Course Title: Principle of Economics | Course Code: ECN (CE) 201 | Credit: 2.00

Time: 2.00 Hours. | Full Marks: 50

Attach the question paper with answer script.

Answer all questions. Provide graph and "real-life" examples where necessary.

1. a. Classify the distinctive features between land and capital in production process. (10)

b. Daily production of a shirt manufacturing company varies with the number of workers employed, as shown in the table below:

Labor	Total Production (Shirt per day)	Marginal production (Shirt per day)	Average Production (Shirt per day)
0	0		
1	80		
2	200		
3	250		
4	270		
5	280		
6	270		

i) Complete the table and attach with answer script.
ii) Draw total production, marginal production and average production curve.

2. **a.** Briefly discuss the entry barriers for potential competitors in soybean oil industry in Bangladesh. (10)

b. When can monopolistic competitive market overlap with oligopoly market? Explain in details.

3 **a.** Write short notes with example and diagram, where necessary (any six) (10)

a) Production efficiency
b) Net domestic product (NDP)
c) Disposable income
d) Economic Cost
e) Skilled labor
f) Direct taxation
g) Central bank
h) Fiscal policy

b. Clarify the role of money in economy. Why paper is considered as money instead of tea?

4 **a.** What is real GDP, nominal GDP and inflation? Discuss the major differences between GDP & GNP? (20)

b. Use the data of below to calculate income-based and expenditure-based GDP

Particulars	**Amount (taka in million)**
Personal consumption expenditure	24500
Net foreign factor income	400
Transfer payments	1200
Rents	1400
Consumption of fixed capital	2700
Pension and bonus	2000
Interest	1300
Proprietor's income	3300
Net exports	1100
Dividend	1600
Compensation of employees	22300
Indirect business tax	1800
Undistributed corporate profit	2100
Personal taxes	2600
Corporate income taxes	1900
Corporate Profit	5600
Government Purchases	7200
Net Private domestic investment	3300
Personal savings	2000

University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination, Spring-2019
Program: B. Sc. in Civil Engineering

Course Title: Mathematics-IV | Course Code: MTH 203
Time: 3.00 Hour | Full Marks: 150

There are **Eight** questions. Answer any **Six**. All questions are of equal value. Figures in the right margin indicate marks.

1. **(a)** A fossilized bone is found to contain one-thousandth the original amount of C-14. The rate of decay is proportional to the amount of C-14 at present. Determine the age of the fossil. The half-life of radioactive C-14 is 5600 years. **13**

(b) Define Cauchy-Euler equation and solve $x^2\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + 4y = 0$ **12**

2. **(a)** Define Bernoulli's equation and solve $x\frac{dy}{dx} + y = \frac{1}{y^2}$ **10**

(b) Find the differential equation of $y^2 = 4b(x + b)$, where b is a constant and also write down the order and degree of this differential equation. **8**

(c) Solve: $(1 + e^{\frac{x}{y}})dx + e^{\frac{x}{y}}(1 - \frac{x}{y})dy = 0$ **7**

3. Solve the following differential equations: **25**

(i) $(D^4 - 256)y = 0$
(ii) $(D^2 + D - 2)y = 2(1 + x - x^2)$
(iii) $(D^2 - 2D)y = e^{2x}sinx$.
(iv) $(D^3 + 3D^2 + 3D + 1)y = e^{-x}$.

4. **(a)** State Convolution theorem. Evaluate $\mathcal{L}^{-1}\left\{\frac{3}{s^2(s+2)}\right\}$ by using Convolution theorem. **10**

(b) Use Heaviside's expansion formula to find $\mathcal{L}^{-1}\left\{\frac{2s^2-4}{(s+1)(s-2)(s-3)}\right\}$ **10**

(c) Solve: $\mathcal{L}^{-1}\left\{\frac{3s+2}{(s-1)^5}\right\}$ **5**

5. **(a)** Find Laplace transformation of the following functions: **12**

(i) $e^{-t} + 6t^7 - 2sinht + 5cos6t$
(ii) t^2sin8t
(iii) $\frac{e^{-at}-e^{-bt}}{t}$, where a and b are constants.

(b) Graph the function **13**

$$F(t) = \begin{cases} \sin t & , 0 \le t < \pi \\ 0 & , \pi \le t < 2\pi \end{cases}$$

Extended periodically with period 2π and find $\mathcal{L}\{F(t)\}$.

6. **(a)** By applying first shifting theorem prove that **10**

(i) $\mathcal{L}\{tsinat\} = \frac{2as}{(s^2+a^2)^2}$.

(ii) $\mathcal{L}\{tcosat\} = \frac{s^2-a^2}{(s^2+a^2)^2}$.

(b) Solve using Laplace transformation: $Y'' + 2Y' + 5Y = e^{-t}sint$, **15**

$$Y(0) = 0, \qquad Y'(0) = 1$$

7. **(a)** Find the finite Fourier sine and cosine transform of the function **10**

$$F(x) = 5x \ , \quad 0 < x < 4$$

(b) Find the Fourier Series of the function **15**

$$f(x) = \begin{cases} 0 & , -5 < x < 0 \\ 3 & , \ 0 < x < 5 \end{cases}$$ having period 10.

8. **(a)** Use Finite Fourier Sine transform to solve **18**

$$\frac{\partial U}{\partial t} = \frac{\partial^2 U}{\partial x^2} \ , 0 < x < 4 \ and \ t > 0$$

with conditions $U(0,t) = 0, \ U(4,t) = 0, \ U(x,0) = 2$.

(b) Find the Fourier integral of the function $f(x) = e^{-x}$ when $x > 0$ and **7**

$f(-x) = f(x)$ and hence prove that $\int_0^\infty \frac{cosux}{u^2+1} du = \frac{\pi}{2} e^{-x}$.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2019
Program: B. Sc. Engineering (Civil)

Course # : CE-203 | Course Title: Engineering Geology & Geomorphology
Full Marks: 120 (6 X 20 = 120) | Time: 3 hours

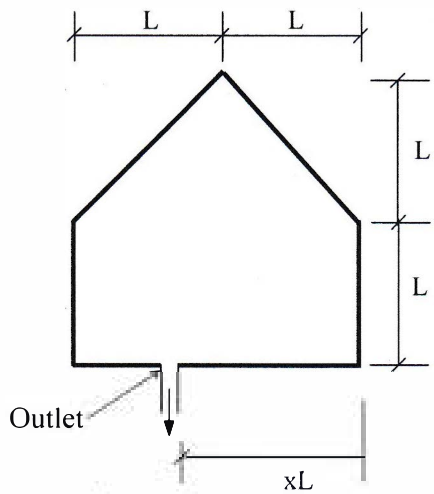
Answer to all questions

1. (a) Discuss metamorphic rock. Giving examples distinguish between igneous and sedimentary rocks. **11**
(b) Distinguish among different geomorphic processes based on origin. **6**
(c) Mention a few major physical and chemical weathering processes. **3**

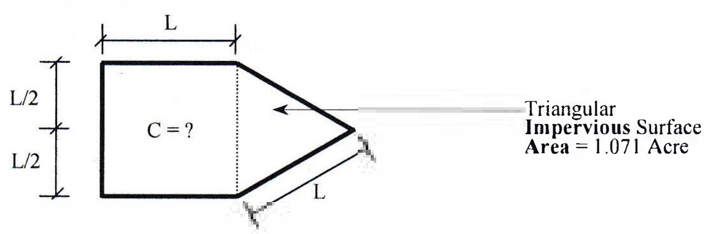
2. (a) Draw neat sketch of a typical fold geometry showing its major features. **3**
(b) Write short notes on folds, faults, joints and rock cleavages. **8**
(c) What is mineral? Distinguish between Ferromagnesian and Non-Ferromagnesian mineral. **5**
(d) Draw a schematic diagram of rock cycle. **4**

3. (a) Classify (mention names only) folds and discuss any two types showing neat sketches. **6**
(b) Discuss liquefaction phenomenon in the light of its mechanism and aftermaths. **9**
(c) Distinguish between epicenter and focus. Also distinguish between epicentral and hypocentral distance. **5**

4. (a) Mention a few factors affecting runoff. No description is required. **4**
(b) For the following basin, x is a constant factor. Analyze for three basins where values of x are 0.5, 1 and 2, respectively and identify the one that would exhibit maximum runoff. Justify your answer. Also calculate the FF and CC of the identified basin. **8**



(c) For the drainage area as shown below, calculate co-efficient of runoff (C) for $Q_p = 3.072$ ft^3/sec and I =25.4 mm/hour. **8**



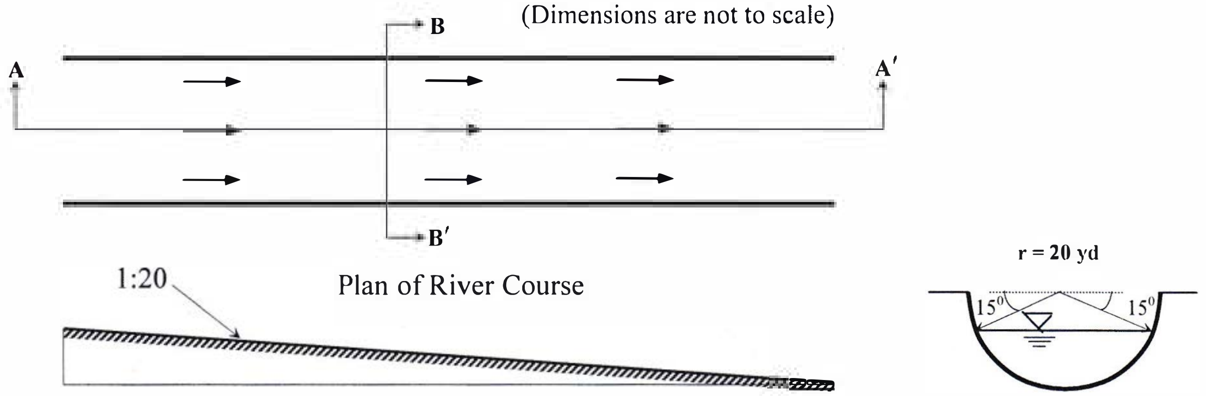
5. (a) What are the major causes of river erosion? Mention three hydraulic actions responsible for river erosion **3**

(b) Prove that $d \alpha v^2$; where symbols carry their usual meanings. **6**

(c) Velocity of flow of one river (R-1) is five times the velocity of flow of another river (R-2). Derive a correlation between the two rivers in terms of their ability of transporting maximum size of sediments. **3**

(d) Consider the following river having the longitudinal and cross-sectional profiles as follows. Calculate traction pressure in Pa (Pascal). **8**

(Dimensions are not to scale)



Section A-A′
(Longitudinal Profile)

Section B-B′
(Cross-Sectional Profile)

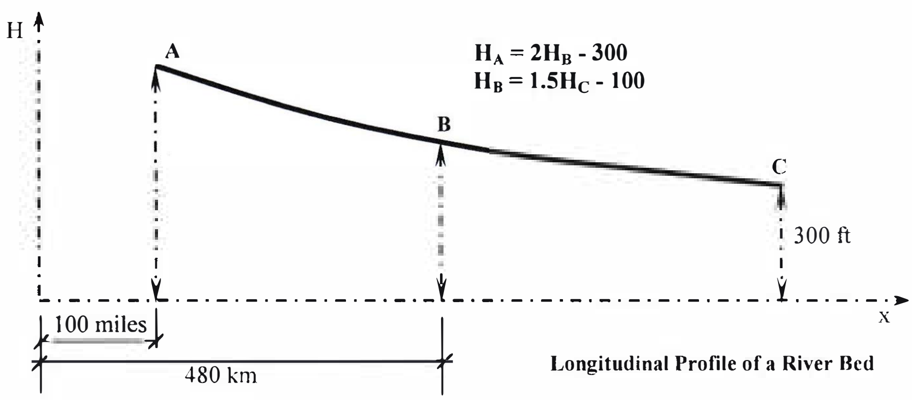
6. (a) For a stream having triangular x-section and T <<<<< D, prove that $\tau \; \alpha \; T$ **3**

where

τ = tractive pressure along the stream T = Top width of stream

D = depth of stream

(b) Using the figure shown below, calculate the horizontal distance between B and C. **5**



(c) Mention the factors affecting drainage pattern. Discuss, in brief, the ways valleys are deepened. **5**

(d) Calculate Drainage Density (DD) of a catchment area (having SF = 0.000963/Km^2) from the information provided in the table below. **7**

Stream Rank	No. of Streams (Ns_i)	BR	ABR	Mean Length (Lm_i, Km)	LR	ALR
1	---	2.143	2.492	---	3.0	2.5
2	---			---		
3	3	---		---	---	
4	---	---		200	2.5	

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2019
Program: B.Sc. Engineering (Civil)

Course Title: Numerical Analysis and Computer Programming — Course Code: CE 205

Time- 3 hours — Full marks: 100

(Answer all the following questions. Assume reasonable values for any missing data)

1. Apply the regula falsi method to determine a real root of the equation $x^3 - 5x^2 + 7 = 0$ between the interval [1, 2]. Required accuracy is upto 0.001. **(10)**

2. Derive the equation of the polynomial passing through (1,1), (2,5), (4,9) and (6,11). **(12)**

3. Apply Euler's method and second-order Runge-Kutta method to obtain numerical solution to **(15)**
$\frac{dy}{dx} = \frac{x+y}{y-x}$ for x= 4 and step size equal to 2. Given that, $y(0)$ =1.

   Which method gives more accurate results and why?

4. The costs of concrete mixes (by volume) at the ratios 1: 3.5: 5.5, 1: 2.5: 4.5 and 1: 2: 3 are 280, 300 and 350 Taka/ft^2 respectively. Calculate the cost per ft^2 of cement, sand and coarse aggregate using Gauss Jordan Elimination. **(10)**

5. Calculate the velocity of an automobile at t=12.5 seconds for the following data using Gregory Newton Interpolation method. **(10)**

Time (seconds)	5	10	15	20
Velocity (m/s)	0.0253	0.5871	1.3698	2.8443

6. Calculate the area shown in ***Figure 1*** using both Trapezoidal and Simpson's rule. If the exact area is 528.25 ft^2, calculate Relative error and Percentage error for both the methods. **(15+3)**

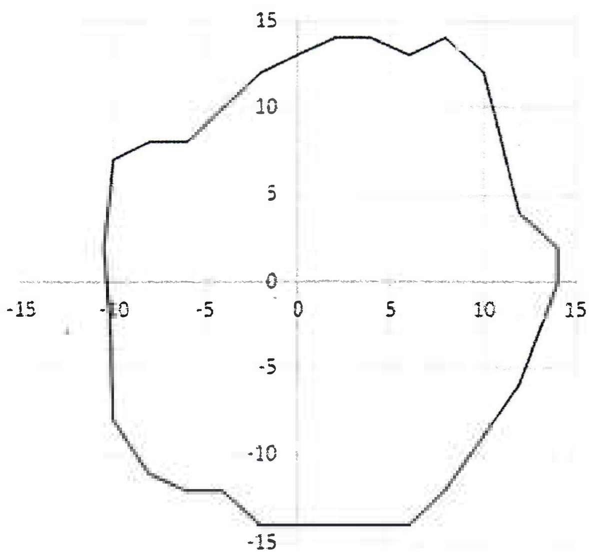


Figure 1

7. Write a program in C++ that reads a matrix and calculates its determinant. **(10)**

8. Write a program that finds the best fit straight line in the form of $y = mx + c$ from a given set of data using least square method. **(10)**

9. Write a program in C++ to compute the maximum shear force and bending moment in a simply supported beam subjected to uniformly distributed load as shown in ***Figure 2***, with "L" ft length from the support at A point and the applied uniformly distributed load is "w" kips/ft. **(5)**

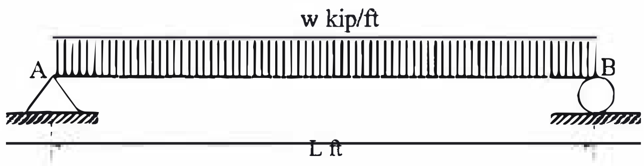


Figure 2

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2019 (Set 1)
Program: B. Sc. Engineering (Civil)

Course Title: Mechanics of Solids II	Credit Hours: 3.0	Course Code: CE 213
Time: 3 hours		Full Marks: 100 (= 10 × 10)

[Answer **any 10 (ten)** of the following 14 questions]

1. Fig. 1 shows beam *abcdef* is carrying concentrated loads (2 k, 2 k) at *b*, *c* from a cannon and distributed load (1 k/ft) over the length *ef* from Aedes mosquitoes.

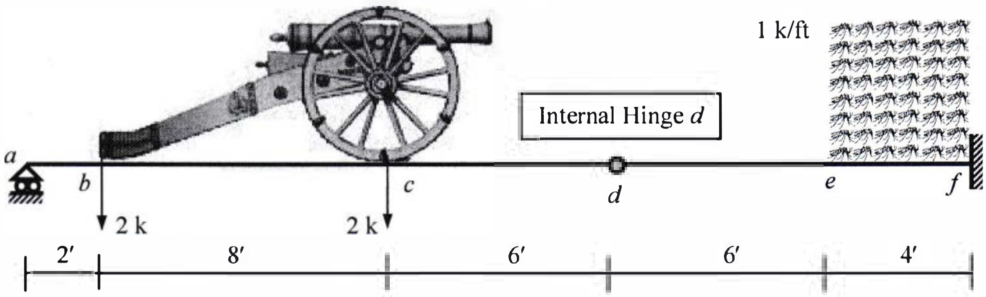


Fig. 1

Use *Singularity Functions* to calculate

(i) The value of *EI* to make *d* deflect 2-inches vertically

(ii) Rotation at *a*, for the value of *EI* calculated in (i).

2. Answer Question 1 using the *Moment-Area Theorems*.

3. Answer Question 1 using the *Conjugate Beam Method*.

4. Fig. 2(a) shows deflected shape of a mosquito net, which is represented schematically in Fig. 2(b). From symmetry, support reactions at springs *a* and *d* (of stiffness $k_a = k_d = 100$ lb/in) are $R_a = R_d$, and reactions at roller supports are $R_b = R_c$.

If $EI = 1000$ lb-in^2, calculate the vertical deflection of the springs *a* and *d*.

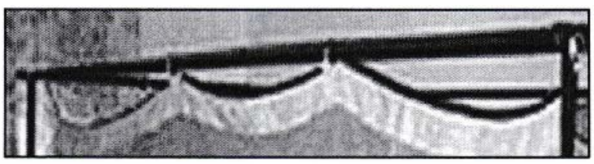


Fig. 2(a)

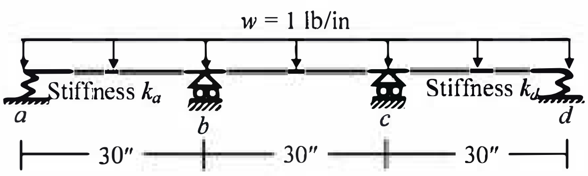


Fig. 2(b)

5. (i) For Fig. 3 showing the mosquitoes growing on water
   - Write equation for load *w(x)* using singularity functions
   - Write down the boundary conditions
   - Draw the qualitative deflected shape
   - Determine if it is statically determinate or indeterminate.

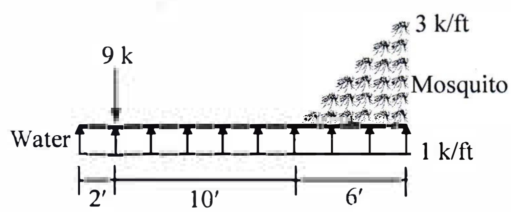


Fig. 3

(ii) Explain the

(a) Difference between buckling and crushing of columns.

(b) Effect of load eccentricity on the buckling behavior of slender columns.

6. Fig. 4(a) shows a clenched fist applying force P on Aedes mosquito, while Fig. 4(b) models a hind leg (mno) of the mosquito subjected to vertical force $P/6$ (since the mosquito has six legs).

   Calculate the

   (i) Buckling force P_{cr} of member mn, assuming $EI = 5$ N-mm^2

   (ii) Force P required to cause mn to deflect 3^{mm} at midspan, if it has initial deflection $v_{0i} = 2^{mm}$.

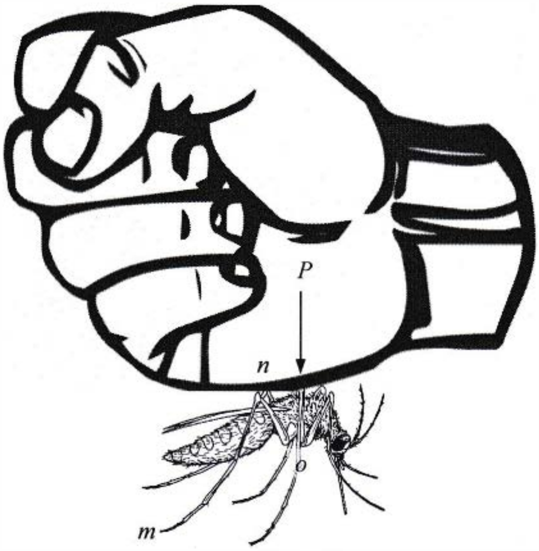


Fig. 4(a)

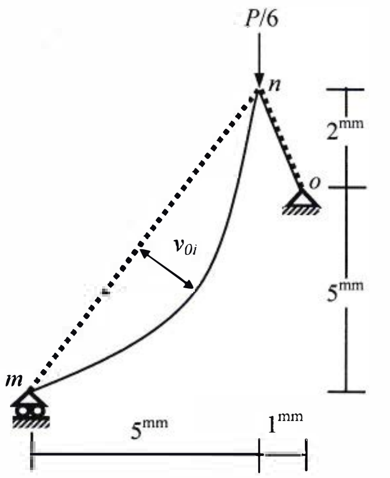


Fig. 4(b)

7. The mosquito net shown in Fig. 5(a) and Fig. 5(b) is supported on a nonlinear material with stress-strain relationship given by

   $\sigma = 150\,(1 - \mathrm{Cos}(1400\varepsilon))$],

   where σ is compressive stress (MPa) and ε is the strain.

   Calculate the critical force for the member bg, which has a circular section of 5-mm diameter.

8. For the mosquito net shown in Fig. 5(a) and Fig. 5(b), use AISC-ASD method to calculate the

   (i) Allowable compressive force for member bg

   (ii) Distributed load w (kN/m) that can be applied to keep the force on member bg within the force calculated in (i)

   [Given: bg is a Circular section with 5-mm Diameter,
   Yield strength $f_y = 300$ MPa,
   Modulus of elasticity $E = 210{,}000$ MPa].

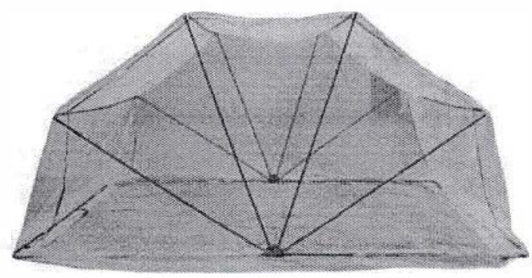


Fig. 5(a)

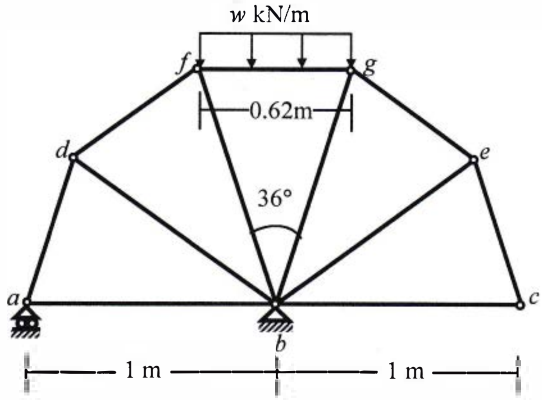
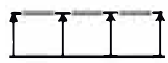


Fig. 5(b)

9. For member fg (circular section with 5-mm Diameter) in the mosquito net [Fig. 5(a) and Fig. 5(b)], calculate

   (i) Euler Buckling Load (P_{cr}), and reason why fg cannot buckle under this loading (acting downward)

   (ii) Distributed load w (kN/m) (applied upward) required to make the Moment Magnification Factor MMF = 2.0



   (iii) Maximum bending moment (M_{max}) at midspan, for the load w kN/m calculated in (ii).

10. Calculate equivalent polar moments of inertia (J_{eq}) for the cross-sections shown in Figs. 6(a)~(c) by centerline dimensions [Given: Wall thickness = 0.10′].

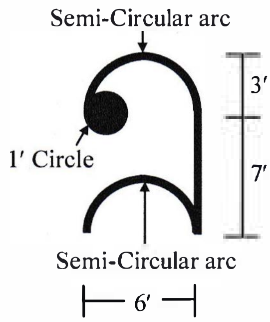


Fig. 6(a)

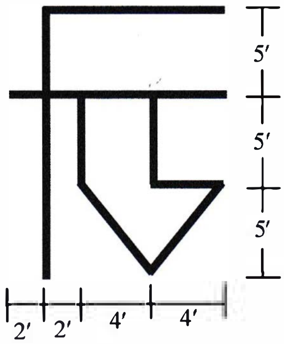


Fig. 6(b)

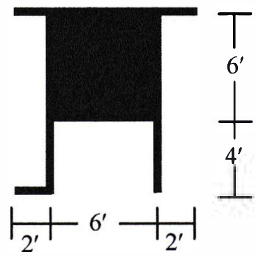


Fig. 6(c)

11. Fig. 7(a) shows a boy blowing air (horizontally) upon an Aedes mosquito.

Fig. 7(b) shows schematic diagram of the mosquito, whose six legs (A, B, C, D, E, F) are shown as six columns supporting a rigid body (with center of gravity at G).

If all legs of the mosquito have the same cross-sectional area, calculate maximum shear force (including direct shear and torsional shear) on the legs for $P = 8 \times 10^{-5}$ N.

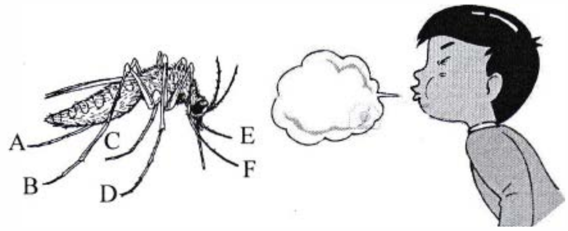


Fig. 7(a)

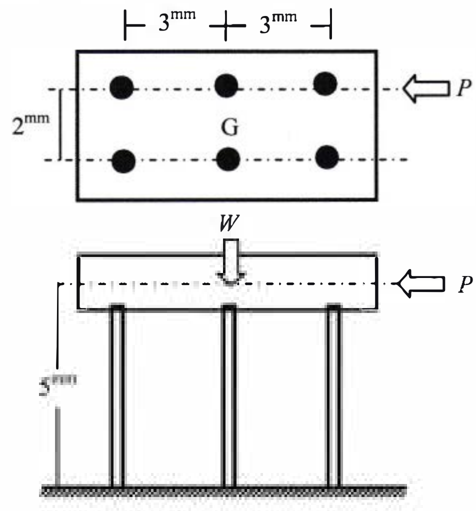


Fig. 7(b)

12. Calculate the axial force on all legs of the Aedes mosquito (weighing $W = 5 \times 10^{-5}$ N) subjected to the blown air shown in Fig. 7(a) and supported on arrangements shown in Fig. 7(b)
$[F(x,y) = W/N + M_x\, y/(\sum y_i^2) + M_y\, x/(\sum x_i^2)]$.

13. Blood vessels in Fig. 8(a) show many leaks and ruptures (in small vessels) of a dengue-affected person.

Fig. 8(b) represents such a small blood vessel, showing longitudinal stress $\sigma_l = 2$ MPa, hoop stress $\sigma_h = 4$ MPa in a small element.

Draw the Mohr's Circle of stresses for the element shown in Fig. 8(b), showing the Principal Stresses and Principal Planes also.

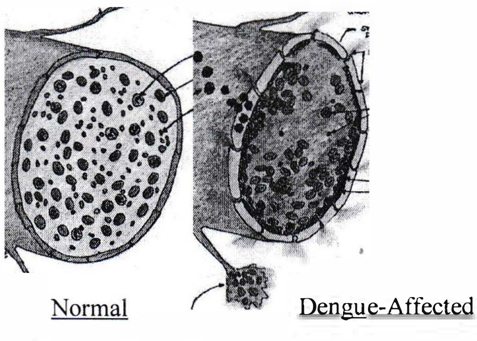
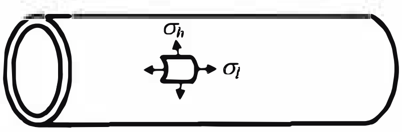


Fig. 8(a)



Longitudinal stress
$\sigma_l = 2$ MPa

Hoop stress
$\sigma_h = 4$ MPa

Fig. 8(b)

14. Use the yield criterion of

(i) St. Venant [with Poisson's ratio = 0.20], (ii) Tresca

to calculate the yield strength Y required to avoid rupture of the small blood vessel stressed as shown in Fig. 8(b): i.e. with Longitudinal stress $\sigma_l = 2$ MPa, Hoop stress $\sigma_h = 4$ MPa.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2019
Program: B.Sc. in Civil Engineering

Course Title: Fluid Mechanics — Course Code: CE 221

Time- 3 hours — Full marks: 120

Answer any six among the eight questions

Marks Distribution [6×20=120]

Assume reasonable number for the missing values

1. (a) Derive the formula for Newton's equation of viscosity with net sketch. **[5]**

   (b) Differentiate between **[5]**
   (i) Cohesion and Adhesion
   (ii) Hydraulics and Hydrodynamics

   (c) A cubical block weighing 25 kg and having a 25 cm edge is allowed to slide down on an inclined plane surface making an angel of 25 degrees with the horizontal on which there is a thin film having a viscosity of 0.25×10^{-2} kg-sec/m. What terminal velocity will be attained if the film thickness is estimated to be 0.25 mm thick? **[10]**

2. (a) What do you understand by the term "center of pressure"? Prove mathematically that center of pressure and center of gravity is not same for a submerged plane surface. In which cases it becomes identical? **[1+7]**

   (b) Calculate the total pressure and the depth of the center of pressure on the inclined gate AB shown in Figure 1, the width of the gate is perpendicular to the plane of paper is one meter. **[7]**

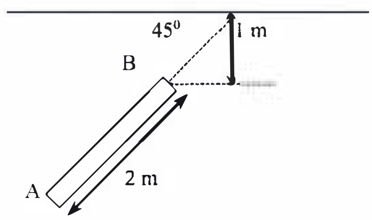


Figure :1

   (c) Convert a pressure head of 10 m of water column to a carbon-tetra-chloride of specific gravity of 1.62. **[5]**

3. (a) What is flow net? Write down the uses and limitations of flow net. **[1+2+2]**

   (b) 'In steady uniform flow there is no acceleration'. Prove mathematically. **[8]**

   (c) In a flow the velocity vector is given by $V = 2.5\,xi + 3\,yj - 9zk$. Determine the equation of the streamline passing through a point $M(2,3\,,4)$. **[7]**

4. (a) Derive the general equation of continuity for flow through pipes. Reduce the equation for steady incompressible flow. **[7]**

(b) A pipe AB (Figure 2) is of uniform diameter. The pressure at A is 170 KN/m^2 and at B is 280 KN/m^2. If a crude oil (S=0.90) is flowing through the pipe, determine the direction of flow and head loss. **[6]**

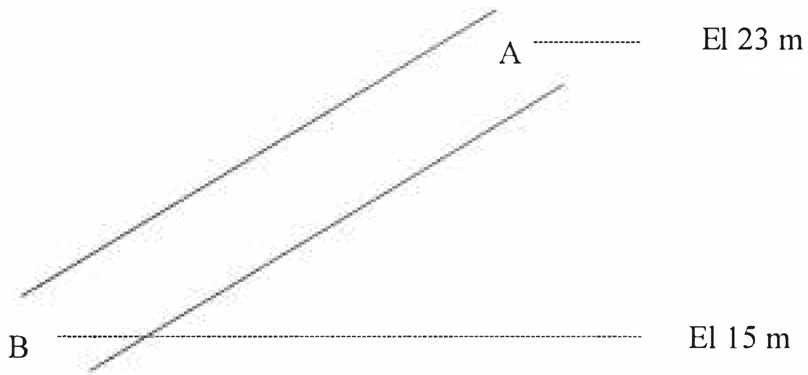


Figure :2

(c) Water flows in a tapped pipe as shown in Figure 3. Determine the magnitude of deflection "h" of differential mercury manometer corresponding to a discharge of 0.150 m^3/s/. The friction in the pipe may be neglected and specific gravity of mercury is 13.6. **[7]**

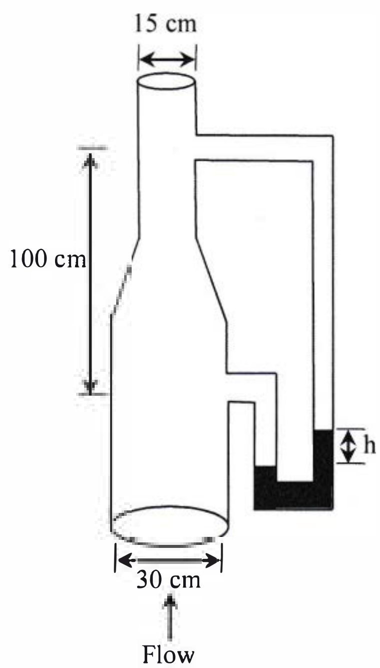


Figure :3

5. (a) Water is flowing through a pipe. The energy grade line is shown in Figure 4. Calculate flow of water through the pipe. Take f=0.04 **[6]**

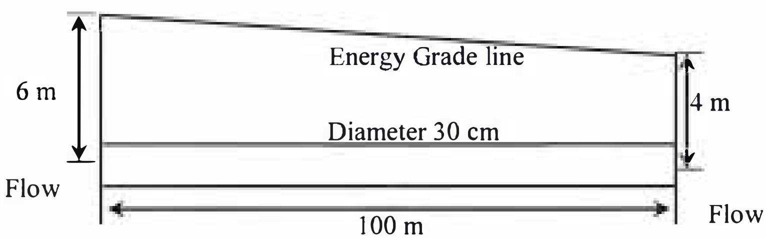


Figure :4

(b) A pipeline with a pump leads to a nozzle as shown in Figure 5. Find the flow rate when the pump develops a head of 24 m. Assume that the head loss in the 15 cm diameter pipe may be expressed by $h_L = 5\ v_1^2/2g$, while the head loss in the 10 cm diameter pipe is $h_L = 12\ v_2^2/2g$. **[11]**

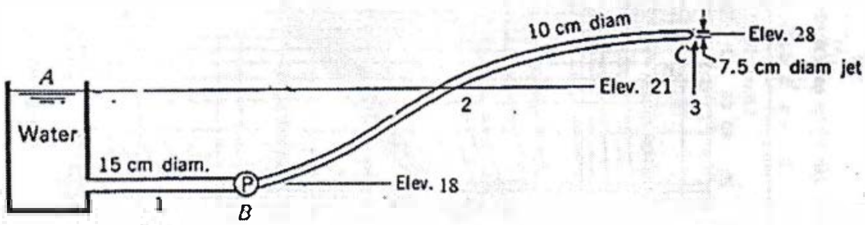


Figure :5

(c) What is piezometer? Can a piezometer be used for measuring pressure in the pipe in which a gas is flowing? **[1+2]**

6. (a) Write short notes on (i) Hydraulics radius **[3+3]**
(ii) Critical Reynolds Number

(b) Two reservoirs with a difference in water surface elevation of 10 m are connected by two pipes in series as shown in Figure 6. The equivalent roughness coefficient of the two pipes are 2.2 and 0.5 mm respectively. Find discharge. Given kinematic viscosity=$3*10^{-6}$ m^2/s. Use moody diagram for friction factor. **[10]**

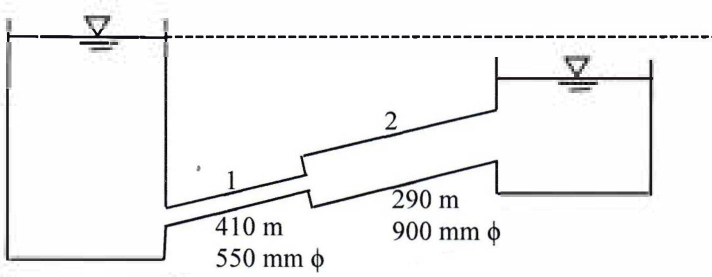


Figure :6

(c) Compute the hydraulic radius for a trapezoidal channel given in Figure 7. The depth of flow is 5m, the bottom width is 15 m, and the slope is 2(horizontal):1 (vertical). [4]

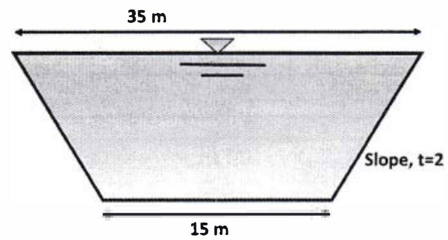


Figure :7

7. (a) Establish the equivalent length equation in case of pipes in series connection. [7]

(b) Sketch the HGL and EGL for Figure 08 given below and mention the name of the losses. [6]

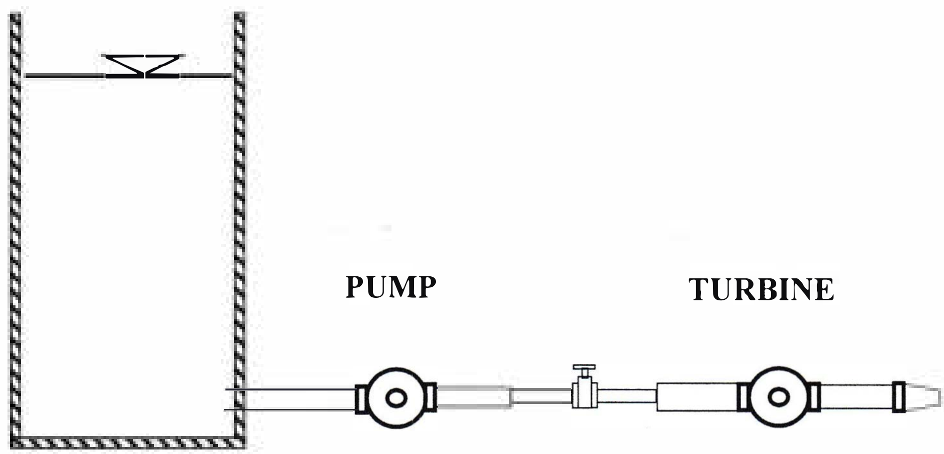


Figure :8

(c) The following information are given for the parallel pipe connection with three pipes: [7]
$L_1 = 0.45$ km, $d_1 = 600$ mm, $f_1 = 0.021$; $L_2 = 0.3$ km, $d_2 = 400$ mm, $f_2 = 0.018$; $L_3 = 0.6$ km, $d_3 = 800$ mm, $f_3 = 0.019$.
The head loss between A and B is 12 m. Determine the rate of the flow in liters/sec.

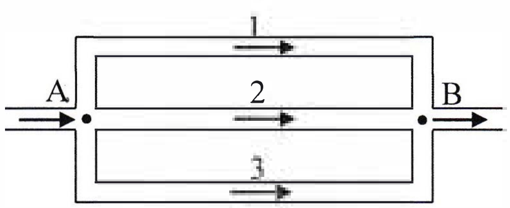


Figure :9

8. (a) Derive the impulse-momentum equation for a fluid system. [7]

(b) Determine the magnitude of the resultant force exerted on this double nozzle Shown in Figure 04. Both nozzle jets have a velocity of 9 m/s. The axis of the pipe & both nozzles lies in a horizontal plane, $\gamma = 9.81$ KN/m^3. Neglect friction. **[10]**

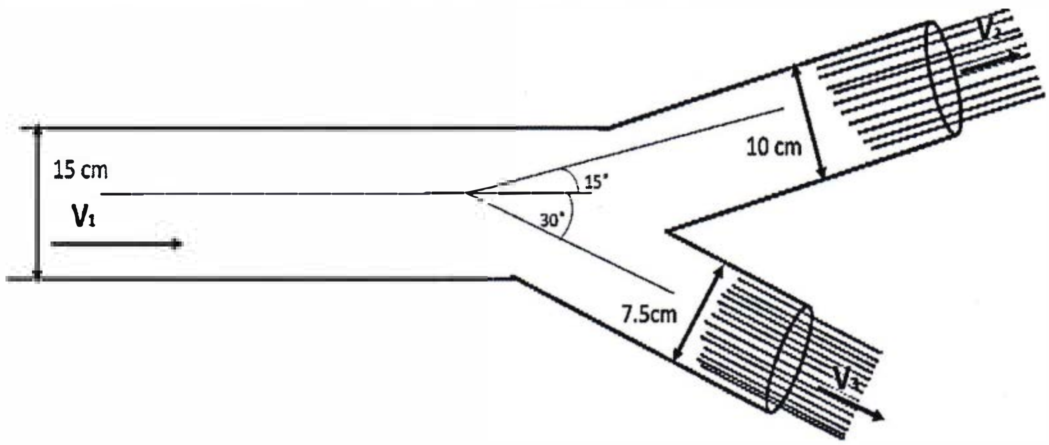


Figure :10

(c) State Bernoulli's Theorem and its limitations . **[3]**

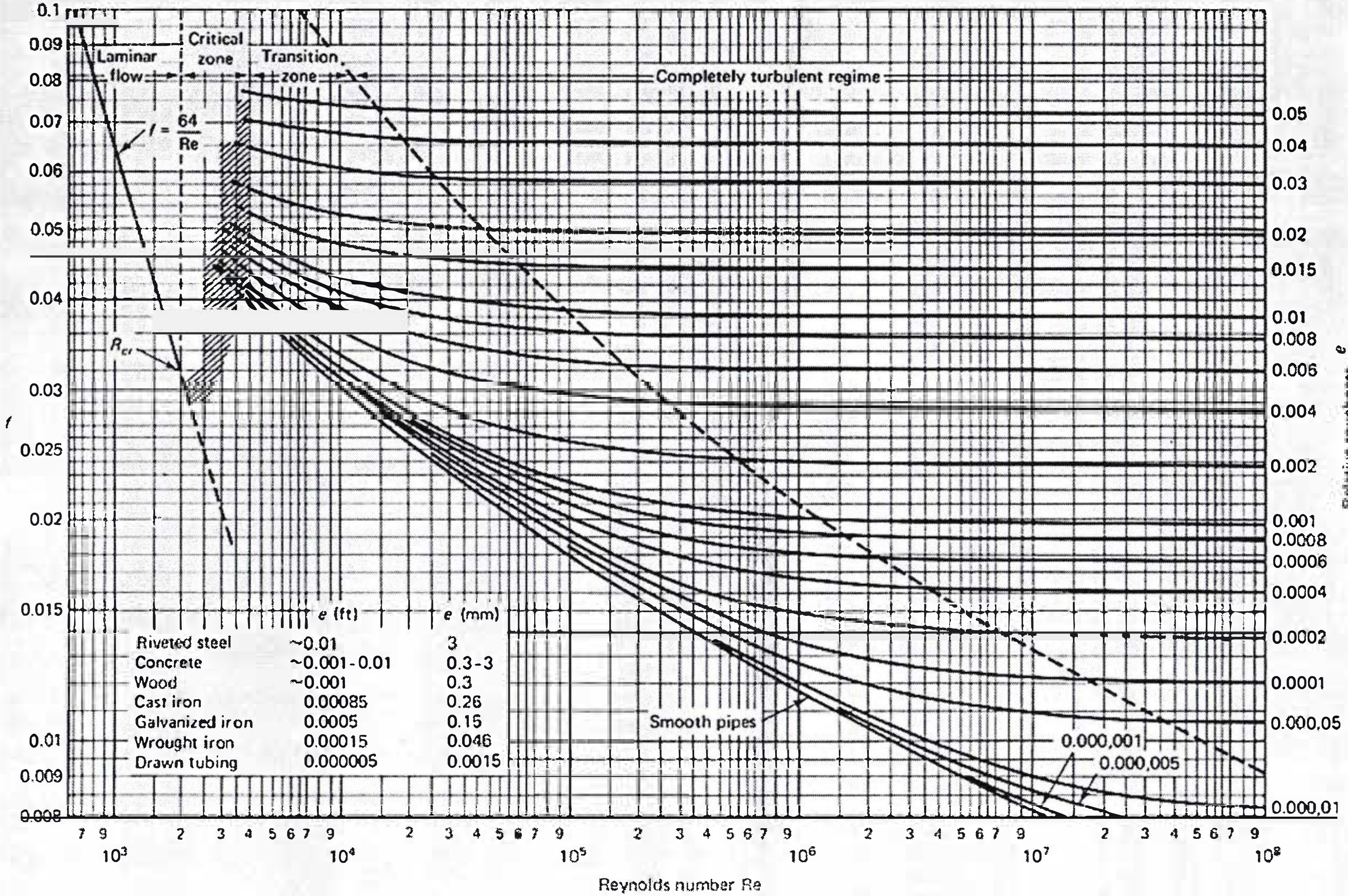


Figure 7.13 Moody diagram. (From L. F. Moody, *Trans. ASME*, Vol. 66, 1944.)