2-2

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2017
Program: B.Sc in Civil Engineering

Course Title: Principles of Economics | Course Code: ECN 201
Time: 2 Hours | Full Marks: 50

Answer any five questions.

Question 1 **7+3**

a. Suppose, Kamrul operates a factory that dumps its garbage into a river that nobody owns. Anis makes his living by fishing from this river. What should be the required level of production by the factory if Kamrul takes the externality effect into his consideration? Explain with graphical presentation.

b. What are the features of externalities?

Question 2 **2.5+5+2.5**

a. What do you understand by monetary policy? What are its purposes?
b. How does open market operation control the liquidity in the economy? Explain both open market purchase and open market sale.
c. An expansionary fiscal policy often leads to a cut in private investment known as crowd out effect. How does it happen?

Question 3 **7+3**

a. Explain contractionary fiscal policy with graph.
b. Define pure public goods. What are the two criteria of it?

Question 4 **4+4+2**

a. Discuss 4 types of market structures. Give example from the perspective of Bangladesh.
b. Show a comparison of the different attributes of the market structures.
c. Define market power. Which company holds the largest market share in the cement industry of Bangladesh?

Question 5 **2+2+6**

a. Habib hairdressing salon is planning to increase the price of men's trim from BDT 80 to BDT 110. They expect that weekly customer will fall from 500 to 450 customers per week. What will be the price elasticity of demand?
b. Demand for which of the following product is generally considered to be price elastic? Why?

i.) Daily newspaper
ii.) Apple iPhones
iii.) Cigarette

iv.) Petrol and Diesel

c. Illustrate price elasticity, inelasticity, perfect elasticity and perfect inelasticity of demand with appropriate examples and graphs.

Question 6 **3+4.5+2.5**

a. Calculate real GDP of 2015 and 2016.

b. Calculate nominal GDP for all the years

Products	*Year (2014)*		*Year (2015)*		*Year (2016)*	
	Taka/unit	**Output**	**Taka/unit**	**Output**	**Taka/unit**	**Output**
Product A	9	120	15	150	19.75	210
Product B	12	130	22	150	23	350
Product C	11	122	17	133	25	218
Product D	12	122	17.5	165	20	274

c. The price of gasoline was BDT 180/liter in 2015. If the inflation was 7.7% what would be the price in 2016? Now in 2017, the price is BDT 205/liter. Calculate the inflation.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2017
Program: B. Sc. Engineering (Civil)

Course Title: Numerical Analysis and Computer Programming | Course Code: CE 205
Time: 3.00 Hours | Full Marks: 150

Section A

*There are **twelve (12)** questions in this section. Answer any **ten (10)**.*
Assume any missing data reasonably.

1. (a) What are the main motivations of learning numerical methods? [2+10]
(b) Derive Simpson's one third rule for numerical integration.

2. (a) Mention the difference between Jacobi method and Gauss-Seidel Method. [2+10]
(b) Apply Gauss-Seidel Iteration method to solve the following systems of linear equations.

$$3x + 9y - 2z = 11$$
$$4x + 2y + 13z = 24$$
$$8x - 4y + 3z = -8$$

use x=1, y=1, z=1 as initial approximate solution. Show minimum 4 iterations.

3. Find the root of $f(x) = sinx + e^x - 4x^2$ by Newton Raphson's method beginning with x_0=1. [12]
How accurate is the estimate after four iterations?

4. (a) Use the following data to construct a forward difference table and determine interpolated value of x=0.8 [10+2]

x	0.3	0.5	0.7	0.9
f(x)	0.4049	0.8243	1.4096	2.2136

(b) Would it have been more appropriate to use the backward difference method? Why or why not?

5. From the following data use Lagrange's interpolation formula to find the value of ln(3). [12]

ln(1)=0
ln(2)=0.69315
ln(5)=1.60944

6. (a) What is the difference between round off error and truncation error? [2+10]
(b) Find to four places of decimal, the root of the equation $Sinx = e^x - 1$ using bisection method. Correct the result up to two significant figures.

7. Calculate the value of the following integral by (i) Trapezoidal rule (ii) Simpson's 1/3 rule. [6+6]
Consider n=6.
$\int_{0.2}^{1.4} (\sin x - lnx + e^x)\, dx$

8. If $(x^2 + e^x)\frac{dy}{dx} = 2xy + e^x$; y(0)=1, solve for y at x=1.5 by Modified Euler Method. Use step size h=0.75. [12]

9. Fit a function of the form $y = ax^b$ to the following data

x	1	2	3	4	5	6	7	8
y	1	5	14	40	125	300	320	400

10. Find y (0.75) by solving the following differential equation using the fourth-order Runge-Kutta method which has an initial value y(0)=1.Use the step length h=0.25 [12]

$\frac{dy}{dx} = (x - y + 4)/(x + y)$

11. Solve the following boundary value problem to estimate the value for the unknown nodes by the Finite Difference method with step length h=0.25 [12]

$y'' + 2y' + y = 30x$; $y(0)=0, y(1)=4$;

12. Evaluate numerically the following using the 4-point Gauss Quadrature. [12]

$I = \sum_{0}^{10} \frac{1}{x^2-2}$

Table: Gauss points and weight factors for integration

n	*ui*	*wi*
4	$u_1 = +0.86114$	*0.34785*
	$u_2 = +0.33998$	*0.65215*
	$u_3 = -0.33998$	*0.65215*
	$u_4 = -0.86114$	*0.34785*

$$x = \frac{1}{2}u(b-a) + \frac{1}{2}(a+b)$$

Section–B

*There are four **(04)** questions in this section. Answer any **three (03)**.*
Assume any missing data reasonably.

13. Write a program to find the real root of a quadratic equation ($ax^2 + bx + c = 0$). [10]
14. Write down a C++ program which can declare an array of 3*4 Matrix. [10]
15. Write a program to swap value of two variables . [10]
16. Write down a C++ Program For Factorial Value Using loop function. [10]

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2017
Program: B.Sc. Engineering (Civil)

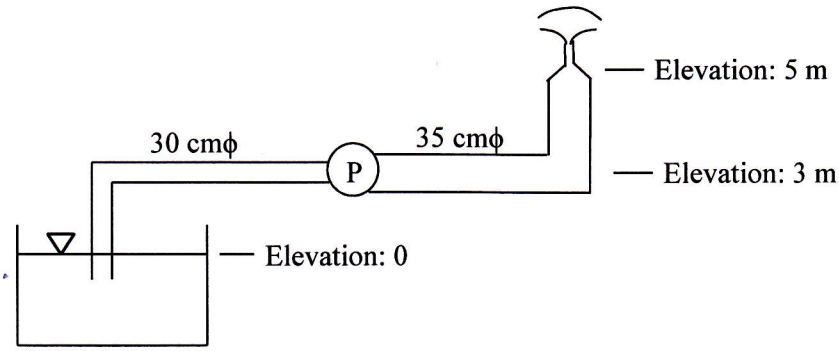
Course Title: Fluid Mechanics | Course Code: CE 221
Full Marks: 150 | Time: 3 hours

[There are **Eight (08)** questions. Answer any **Six (06)** of them.]

1. (a) Briefly Explain: (i) Cavitation (ii) Head at submerged discharge (4)

   (b) Determine the height of a mercury column equivalent to a pressure of 4 kN/m^2. (6)

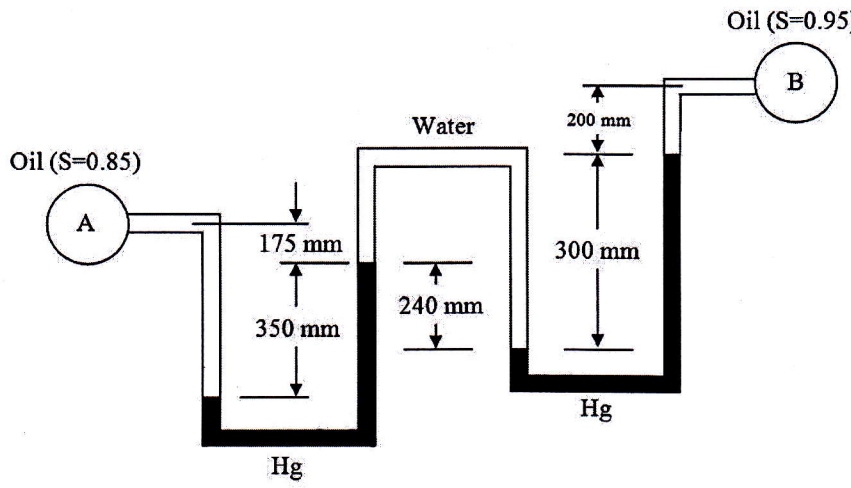
   (c) A pump is 3 m above the water level and has a pressure of -4 m of water at suction side. The suction pipe is 30 cm diameter and the delivery pipe is 35 cm diameter pipe ending in a nozzle of 10 cm diameter. The nozzle is directed vertically upward at an elevation of 5 m from water level. Determine: i) Discharge ii) Power of pump iii) Elevation at end point of jet. (15)



2. (a) Briefly discuss Absolute pressure and Gauge pressure. What is the relation between these? (5)

   (b) Explain the phenomena of cohesion and adhesion. (5)

   (c) The pressure at B in the following figure is 65 Kpa (gauge). Find out the pressure at A. (15)



3. (a) List down two important characteristics of streamline. (4)

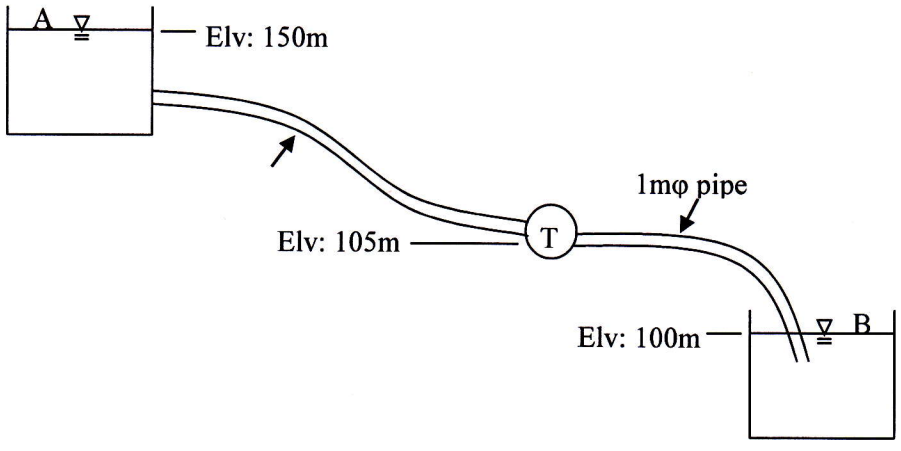
(b) Explain with mathematical expression (8)
i) Steady-Uniform flow ii) Unsteady-Uniform flow iii) Steady- Non Uniform flow
iv) Stagnation point

(c) A stream function is given by the expression $\psi = 3x^2 - 3y^2$. Find the velocity potential (φ). (6)

(d) A flow the velocity vector is given by $v = 3xi + 4yj$. Determine the equation of the streamline passing through a point (1, 4). (7)

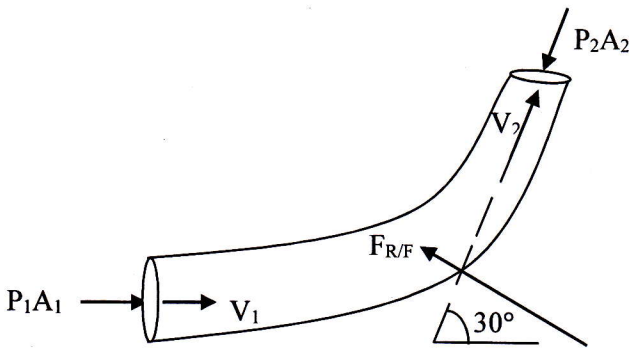
4. (a) Sketch typical Energy Line and Hydraulic Grade Line for pipe connection with: (5)
i) Pump ii) Nozzle

(b) A turbine T draws water from a reservoir A through a 1m diameter pipe and discharges through another pipe of same diameter into tailrace B. The head loss for first pipe is 10 times of its velocity head and for second pipe it is only 0.5 times. If the discharge is 1 m^3/s calculate: (20)
i) Power given up by the water to the turbine in Horse Power (HP).
ii) The pressure head at inlet and exit of turbine.
Also draw the HGL and EL for the entire connection.



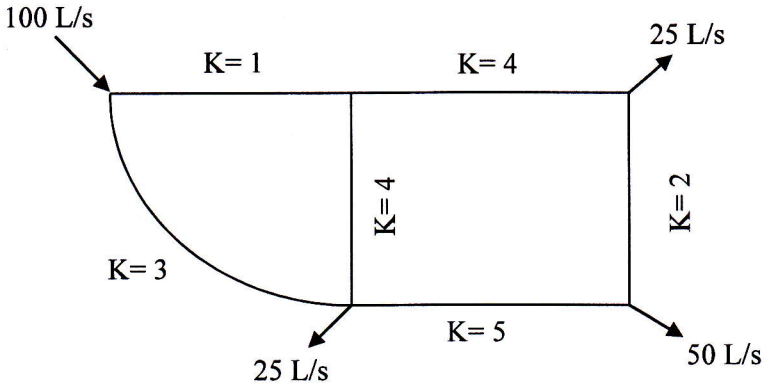
5. (a) State & prove Bernoulli's Equation. (13)

(b) Determine the magnitude and direction of the resultant force ($F_{R/F}$) exerted by the reducing bend on the fluid flow shown in the following figure. The jet has a velocity of 12 ms^{-1} at exit. Neglect friction. The pipe lies in a horizontal plane. (12)
(Given: $D_1 = 15$ cm, $D_2 = 10$ cm, $\gamma = 8.34$ kN/m^3)



6. (a) Derive the Darcy-Weisbach formula for pipe friction. (12)

(c) Determine the distribution of flow in the pipe network shown below. The flows are in liters/sec.Use Hardy Cross method. (13)



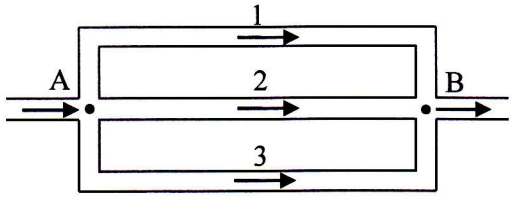
7. (a) Briefly discuss : (8)

i) Hydraulic Radius

ii) Minor head loss

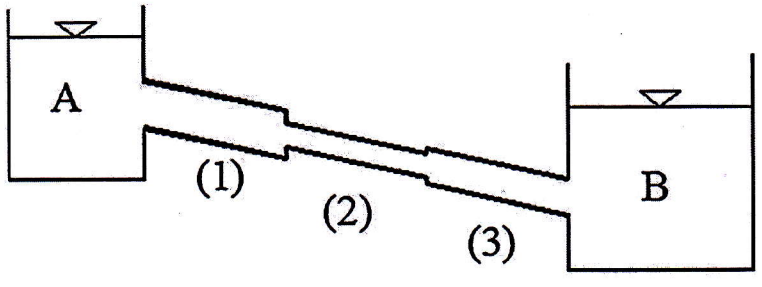
(b) Derive an expression for the normal force when a jet of water strikes a stationary plate. (5)

(c) The following information are given for the parallel pipe connection with three pipes: (12)
$L_1 = 0.9$ km, $d_1 = 300$ mm, $f_1 = 0.021$; $L_2 = 0.6$ km, $d_2 = 200$ mm, $f_2 = 0.018$; $L_3 = 1.2$ km m, $d_3 = 400$ mm, $f_3 = 0.019$.
The head loss between A and B is 12 m. Determine the rate of the flow in Liters/sec.



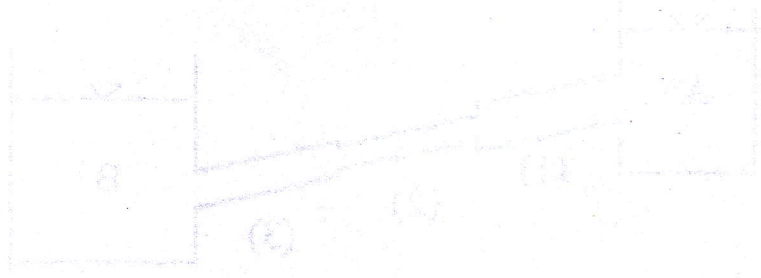
8. (a) Show that shear stress varies linearly with radius. (5)

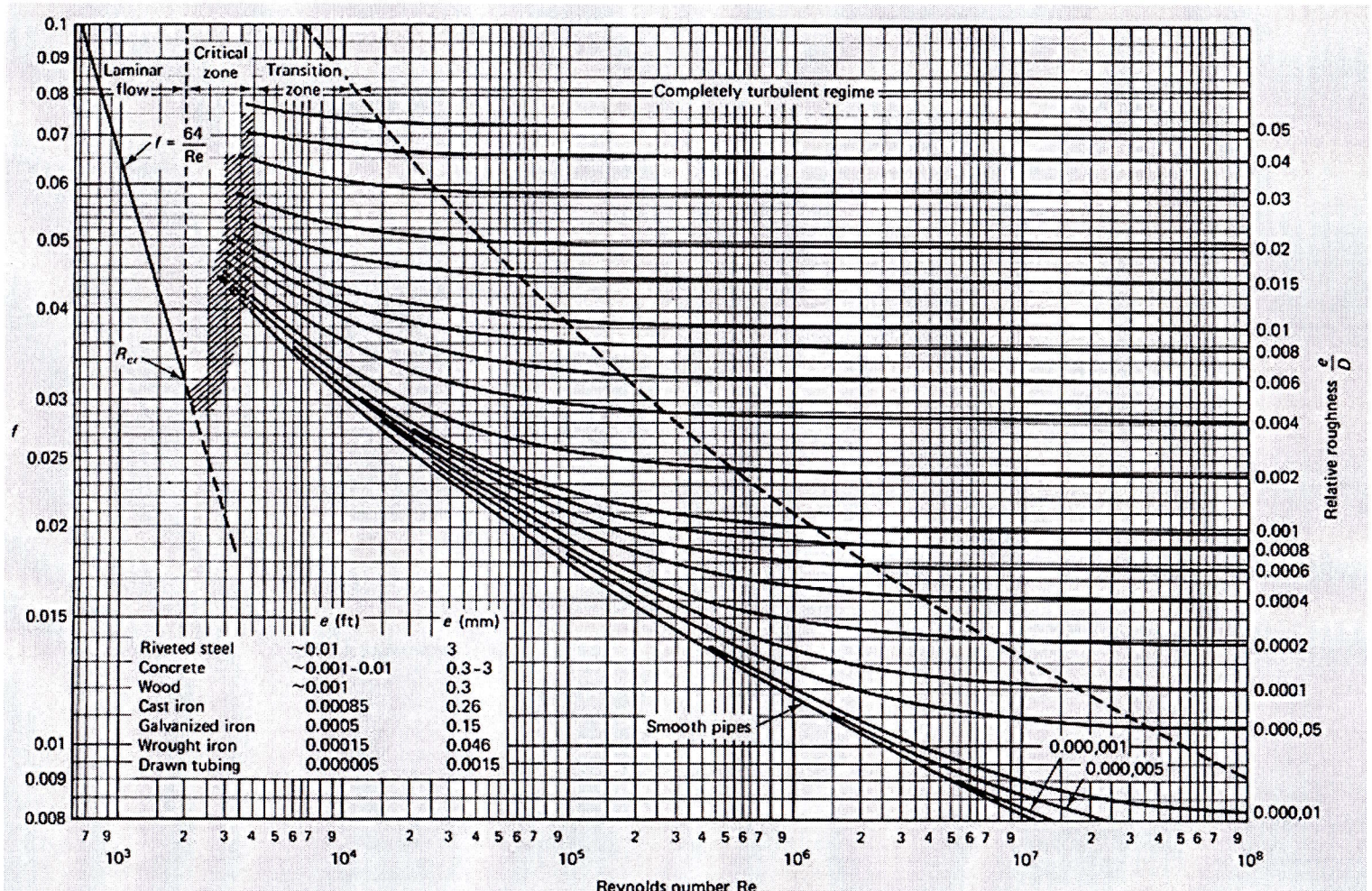
(b) A fluid is flowing through a series of pipes which is shown in the following figure. Determine the rate of flow from A to B when total frictional head loss is 10 m and the kinematic viscosity of the fluid is 1.14×10^{-6}. Use Moody diagram to determine fiction factor. Neglect minor losses. (20)



Pipe properties are given in the following table: (next page)

Pipe No.	Diameter (mm)	Length (m)	Equivalent Roughness, e (mm)
1	300	300	0.25
2	200	150	0.3
3	250	250	0.275





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

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

Course Title: Mathematics IV | Course Code: MTH 203

Time: 3.00 Hours | Full Mark: 150

There are **Eight** questions. Answer any **Six**. All questions are of equal values, indicated in the right margin.

1. (a) Define homogeneous differential equation. Test the following differential equation is homogeneous or not. If not reduce it to homogeneous differential equation and then solve it. **15**

$$(2x + 2y + 1)dy = (x + y + 1)dx$$

(b) Find the differential equation from the relation $y = c_1 \cos \omega t + c_2 \sin \omega t$, where c_1 and c_2 are arbitrary constants and ω is fixed. **10**

2. Solve the following differential equations using appropriate methods

(a) $(x^2 + y^2)dx - xydy = 0.$ **15**

(b) $(x^5 + 3y)dx - xdy = 0.$ **10**

3. (a) Define Bernoulli's differential equation. Solve the initial value problem: **15**

$$2xy\frac{dy}{dx} = y^2 - 2x^3 \; ; \quad y(1) = 2$$

(b) Solve the differential equation (use auxiliary equation): **10**

$$(D^3 - 4D^2 + D + 6)y = 0$$

4. (a) Define Cauchy-Euler differential equation. Solve the differential equation **13**

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

(b) Find the general solution of the differential equation **12**

$$x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = \sin(\ln x^2)$$

5. (a) If $\mathcal{L}\{F(t)\} = f(s)$ then prove that $\mathcal{L}\{F''(t)\} = s^2 f(s) - sF(0) - F'(0)$. **10**

(b) If $\mathcal{L}\{F(t)\} = f(s)$ then prove that 15

$$\mathcal{L}\{t^n F(t)\} = (-1)^n \frac{d^n}{ds^n} f(s) = (-1)^n f^n(s)$$

Where $n = 1, 2, 3, \cdots\cdots$

6. **(a)** Show that $\mathcal{L}\{J_0(t)\} = \frac{1}{\sqrt{s^2+1}}$, where $J_0(t)$ is a Bessel function of order zero. 10

(b) Solve the following differential equation by using Laplace transformation 15

$$Y'' + 9Y = \cos 2t \; ; \; Y(0) = 1, \; Y\left(\frac{\pi}{2}\right) = -1$$

7. **(a)** Evaluate: 10

$$\mathcal{L}^{-1}\left\{\frac{2s^2 - 4}{(s+1)(s-2)(s-3)}\right\}$$

(b) Using Laplace transformation solve the following boundary value problem 15

$$\frac{\partial U}{\partial t} = \frac{\partial^2 U}{\partial x^2}$$

$$U(0,t) = U(1,t) = 0, \quad U(x,0) = 3\sin 2\pi x$$

where $0 < x < 1, \; t > 0$

8. **(a)** Define Fourier Series. Obtain the Fourier Series of the function 15

$$f(x) = \begin{cases} 0 & , -\pi \le x \le 0 \\ 1 & , \; 0 \le x \le \pi \end{cases}$$

(b) Find the finite Fourier Sine transform of the function 10

$$F(x) = e^{-x} \; , \quad x \ge 0$$

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2017 (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. Calculate the equivalent polar moments of inertia (J_{eq}) for the three cross-sections shown in Fig. 1(a)~(c) by centerline dimensions

   [Given: Wall thickness = 0.10′].

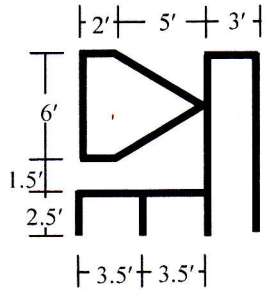


Fig. 1(a)

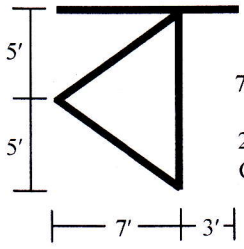


Fig. 1(b)

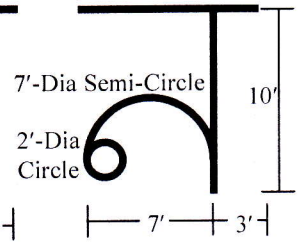


Fig. 1(c)

2. Fig. 2 shows side-view of a 15′-high concrete wall *abcd* supported on the concrete foundation *efgh*.

   If it retains 13′-deep flood water, calculate the normal stress on foundation *efgh* and soil underneath, considering

   (i) Axial stress from weights of wall, foundation and water on foundation

   (ii) Flexural stress from
   - Moments due to eccentricity of the weights
   - Overturning moment due to water pressure

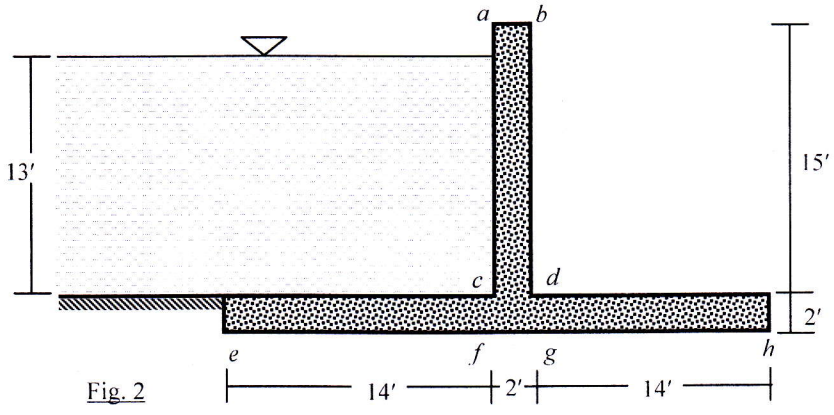


Fig. 2

   [Given: Unit weight of concrete = 150 lb/ft^3, Unit weight of water = 62.4 lb/ft^3].

3. Consider axial stress, bending stress and flexural shear stress to draw the Mohr's circle of stresses at (i) point *c*, and (ii) midpoint of section *cd* of wall *abcd* (described in Question 2) shown in Fig. 2.

4. Figs. 3(a) and 3(b) show the side views of a 'Floating House' (weighing W = 20 k, floor area = 150 ft^2) supported on four helical springs at four corners (only two are shown in the side views) of shear modulus = 12000 ksi, coil diameter = 1.5″, spring mean diameter = 6″, number of coils = 6.

   Calculate spring deflection for the case

   (i) Without flood water [shown in Fig. 3(a)]

   (ii) With 1′ flood water [shown in Fig. 3(b)], considering weight of house and buoyancy (uplift) force due to flood water

   [Given: Unit weight of water = 62.4 lb/ft^3].

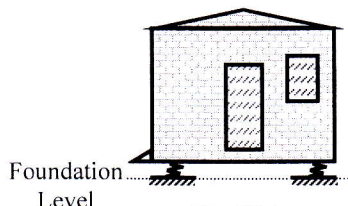


Fig. 3(a)

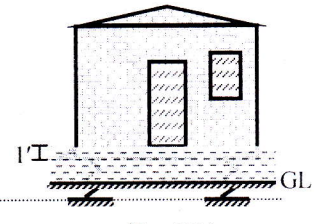


Fig. 3(b)

5. Calculate the principal stress and maximum shear stress at

   (i) Point *d* of the wall *abcd* shown in Fig. 2

   (ii) Helical springs shown in Fig. 3(a)

   (iii) Water at 1′ depth of flood-water, as shown in Fig. 3(b).

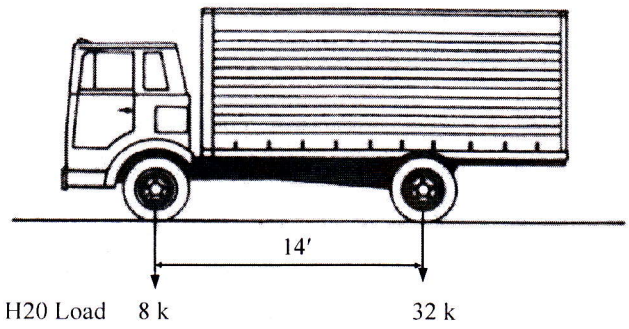


Fig. 4

6. Fig. 4 shows the standard truck load H20, while Fig. 5 represents a flexible pavement *abcde* carrying the H20 load. The pavement's support (soil underneath) is eroded by flood, and only remains in *ab* and *de*.

   Determine the distributed loads w_1 (k/ft) and w_2 (k/ft) to maintain structural equilibrium.

   If there is no deflection at free ends *a* and *e* (in Fig. 5), use *Singularity Functions* to calculate

   (i) The value of *EI* to make *c* deflect 6-inches vertically

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

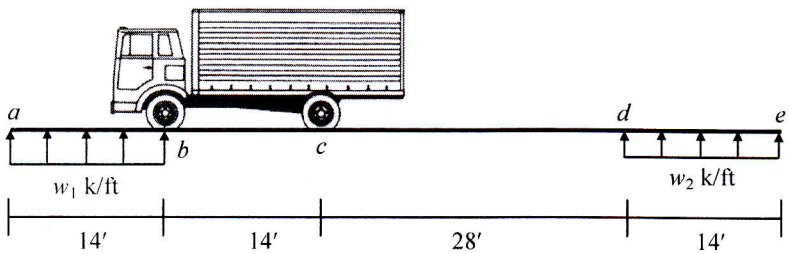


Fig. 5

7. Answer Question 6 using the *Moment-Area Theorems*.

8. Answer Question 6 using the *Conjugate Beam Method*.

9. Beam *abcdef* in Fig. 6 represents a 15′-long 'Bhela' used for transport in flood-affected areas.

   Calculate the

   (i) Distance *x* and distributed load *w* (lb/ft) to maintain equilibrium of the beam.

   (ii) Vertical deflections at the free ends *a* and *f*

   [Given: $EI = 40 \times 10^6$ lb-ft^2].

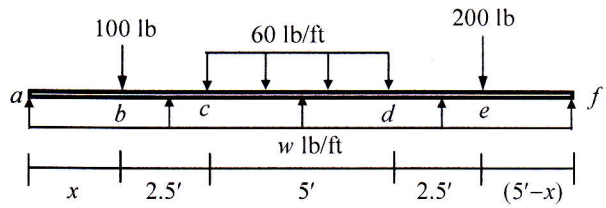


Fig. 6

10. (i) For the beam loaded as shown in Fig. 7

    - Write the equation for load *w(x)* using singularity functions
    - Write down the boundary conditions
    - Draw qualitative deflected shape
    - Determine if the beam is statically determinate or indeterminate.

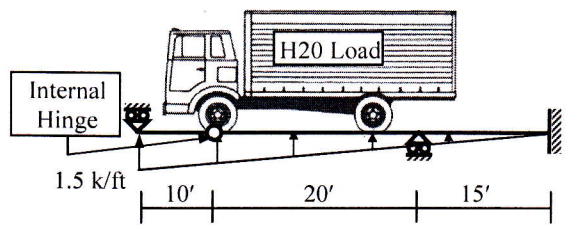


Fig. 7

   (ii) Explain why

   (a) Effective length of column increases with ψ factors at both ends

   (b) Bending moments are magnified when columns deflect transversely.

11. Fig. 8(a) shows an 'unbraced' steel frame *ABCD* subjected to 'circus' loads (from a Tiger and Kangaroo) on beam *AB*.

Calculate the required diameter (*d*) of all frame members [having cross-section shown in Fig. 8(b)] to prevent buckling of

(i) Column *AC*,

(ii) Column *BD*

[$E_{Steel} = 2 \times 10^8$ kPa].

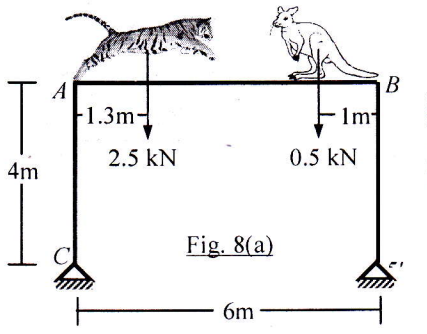


Fig. 8(a)

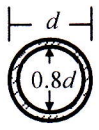


Fig. 8(b)

12. Fig. 9(a) shows a 'braced' frame *ABCD* subjected to 'circus' loads on beam *AB*. Stress-strain relationship of the frame's material is given by

$$\sigma = 700(\varepsilon)^{0.3}$$

where σ is the stress (MPa), ε is the strain.

If cross-section of all the frame members is as shown in Fig. 9(b), determine if it is adequate enough to prevent buckling of column *AC* due to the 'circus' loads.

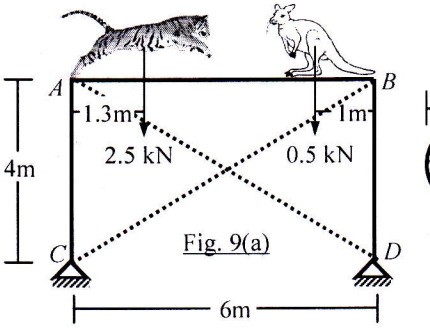


Fig. 9(a)

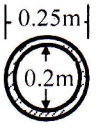


Fig. 9(b)

13. Fig. 10 shows an 24m-long simply supported steel bridge, subjected to 'circus' loads (from Tigers and Kangaroos) shown in Fig. 9(a).

If cross-section of all the frame members is as shown in Fig. 9(b), determine if it is adequate enough (as per AISC-ASD method) to prevent buckling of the truss members across the section *x-x*

[Given: $E_{Steel} = 2 \times 10^5$ MPa, $f_y = 350$ MPa].

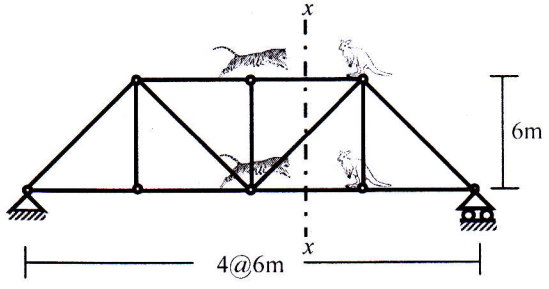


Fig. 10

14. Fig. 11 shows a simply supported beam *ab* subjected to the 'circus' loads (from 11 Tigers and 11 Kangaroos). If the beam cross-section is as shown in Fig. 8(b), calculate the

(i) Maximum 'magnified' bending moment in the beam if $P = 0.5P_{cr}$ [Use MMF given by AISC-ASD]

(ii) Required diameter (*d*) of the cross-section to resist maximum bending stress [Given: $f_y = 350$ MPa]

(iii) Buckling load P_{cr} of the beam and axial force *P* applied.

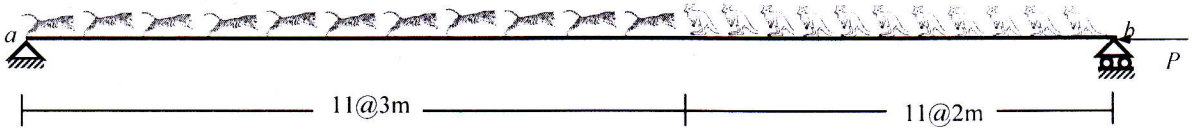


Fig. 11

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2017
Program: B. Sc. Engineering (Civil)

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

There are **seven (7)** questions. Answer **any six (6)**

1. (a) Mention (names only) the principal zones of the earth from geologic point of view and show thicknesses of different parts of lithosphere/geosphere. **5**

(b) What is geomorphic process? Distinguish between physical and chemical weathering processes. Mention the names of major physical and chemical weathering processes. **2+3+3**

(c) Draw a schematic diagram of the rock cycle and discuss (with at least two examples of each) metamorphic rock according to the cycle. **4+3**

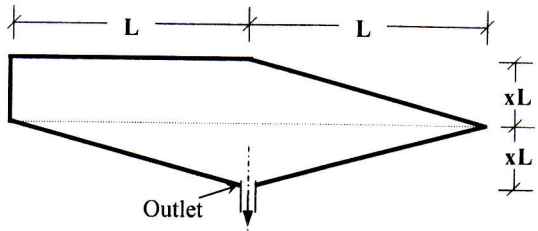
2. (a) Draw neat sketch of a typical fold geometry showing its major components. **4**

(b) Classify fold (mention names only) based on geometry and draw neat sketches of anticline and dome. **6**

(c) Classify and discuss briefly (with neat sketches) various types of faults according to the direction of movement and net slip. **10**

3. (a) Discuss, in brief, the ways basin characteristics affect runoff. **4**

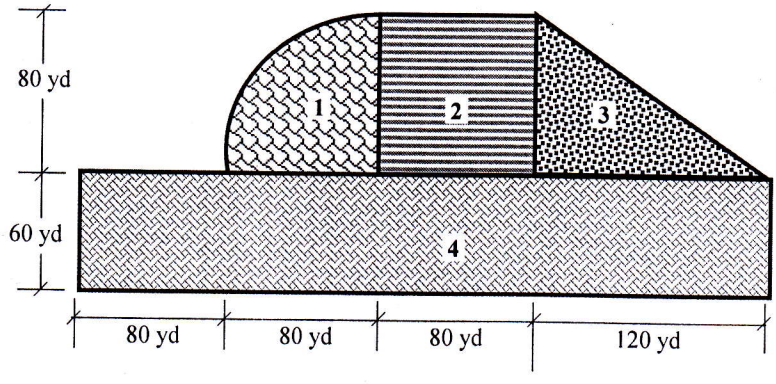
(b) In the following basin x is a constant factor and find the value of x when the flow rate (Q) or runoff will be the maximum? Also find the FF and CC of the basin for maximum runoff. **6+3**



(c) Discuss, in brief, the rational formula. Mention the assumptions used in developing this formula. **3+4**

4. (a) Mention the factors affecting drainage pattern. Classify and discuss, in brief with sketches, any two types of drainage patterns. **4+6**

(b) For the drainage area as shown in the next page, calculate peak runoff in m^3/s. Use C_1 = 0.8, C_2 = 1.0, C_3 = 0.5 and C_4 = 0.7 and I = 0.2 cm/min. **10**

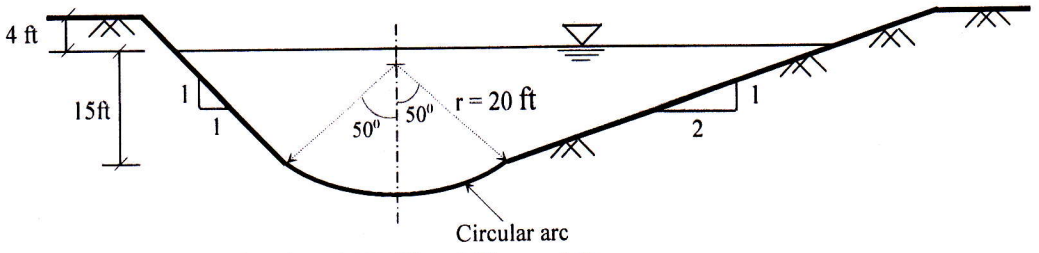


5. (a) What are the major causes of river erosion? Mention three hydraulic actions responsible for river erosion. 3

(b) Prove that $\tau = \gamma_\omega R_H s$; where symbols carry their usual meanings. 5

(c) For a rectangular channel having D >>>> B, prove that $\tau \propto B$, where symbols carry their usual meanings. 3

(d) Cross-sectional profile of a channel is shown below. The gradient of the channel bed is 4.33×10^{-4}. Calculate the tractive pressure along the channel. 9



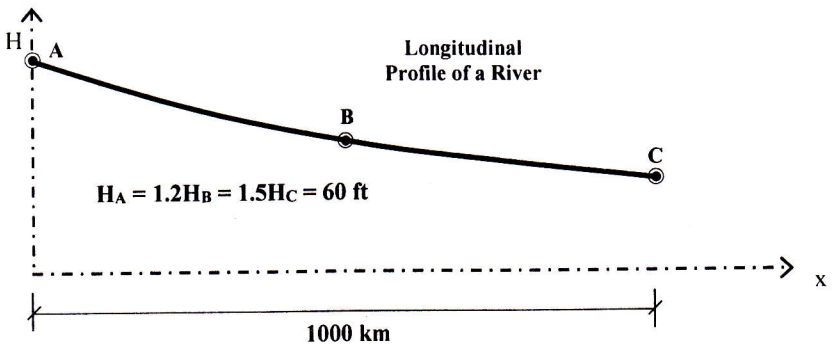
X-Sectional Profile of Channel Course

6. (a) Prove that $d \propto v^2$; where symbols carry their usual meanings. 8

(b) Maximum size of sediment transported by one river (R-1) is nine times than that of another river (R-2). Derive a correlation between the velocities of two rivers. 3

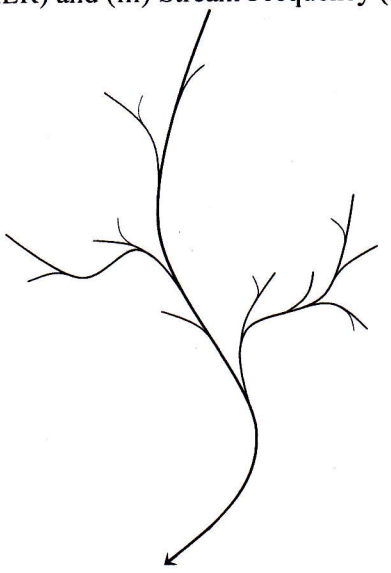
(c) Prove that $H = a e^{-bx}$; where symbols carry their usual meanings. 5

(d) From the figure shown below, calculate the horizontal distance between locations B and C. 4



7. (a) Discuss the ways valleys are deepened and widened. 9

(b) Rank the streams of the following drainage basin having a total catchment area of 15,000 square kilometer. The results of the survey are summarized in the table below. Calculate the following parameters: (i) Average Bifurcation Ration (ABR), (ii) Average Length Ratio (ALR) and (iii) Stream Frequency (SF). 11



Steam Rank	Average Length (km)
1	7.5
2	18.5
3	44.2
4	99.7