University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2015
Program: B.Sc Engineering (Civil)

Course Title: Numerical Analysis & Computer Programming — Course Code: CE 205
Time: 3 Hours — Full Marks: 90

Section- A :Answer any 6(Six) out of 8(Eight)

1. Solve the following system using Gauss-Jordan elimination method. **10**

$$x + y + z = 5$$
$$2x + 3y + 5z = 8$$
$$4x + 5z = 2$$

2. Find y(1.0) using R-K method of order four by solving the equation **10**

$$dy/dx = 3x^2 + 2y$$

y(0) = 1 with step length 0.5

3. Use Gauss-Seidal method to approximate the solution of the following system of linear equations. **10**

$$5x - 2y + 3z = -1$$
$$-3x + 9y + z = 2$$
$$2x - y - 7z = 3$$

4. Determine the root of the equation $5x^3 - 3x^2 + 2x - 9 = 0$ by Bisection method. Correct upto 4 decimal places. **10**

5. Using Regula-Falsi method determine the root of the following equation which lies between 1 and 1.5 **10**

$$x\cos\left(\frac{x}{x-2}\right) = 0 \text{ ; take } \varepsilon = 0.0001$$

6. Find the least square polynomial approximation of degree two to the data **10**

x	0	1	2	3	4
y	-4	-1	4	11	20

7. By Neville's method approximate f (27.5) from the following data. 10

x	f(x)
32	0.52992
22.2	0.37784
41.6	0.66393
10.1	0.17537
50.5	0.63608

8. Using Rombergs method, compute 10

$$I=\int_1^3 [1/(1+x+x^2)]dx$$

Take at least up to eight intervals for better accuracy.

Section- B :Answer any 3 (Three) out of 4 (Four)

9. Write a program to find the area (A) and moment of inertia (I) of a circular X-section where diameter is known. $A = \frac{\pi d^2}{4}$, $I = \pi d^4/64$ 10

10. Write a program that calculates the real roots of any quadratic equation $ax^2+bx+c=0$ for given values of a, b and c. 10

11. Write a program to find the summation of 1+3+5+7+.......+n. 10

12. Write a program that takes a Centigrade temperature as input and prints its Fahrenheit equivalent. Formula: °F= °C * (9/5) + 32. 10

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2015 (Set A)
Program: B. Sc. Engineering (Civil)

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

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

1. For the structure ABCDE shown in Fig. 1, calculate the torque (T_0) required to make the maximum shear stress in CDE equal to 12 ksi. For this value of T_0, calculate the maximum shear stress in ABC.

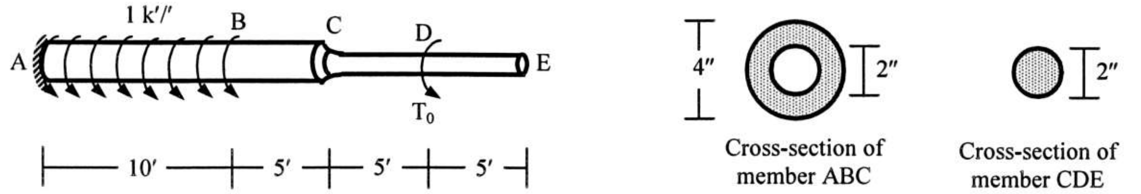


Fig. 1

2. Calculate the maximum torsional shear stress and torsional rotation in member BCD of the structure ABCDEF shown in Fig. 2 [Given: G = 1500 ksi and the cross-section is a 20″ square as shown].

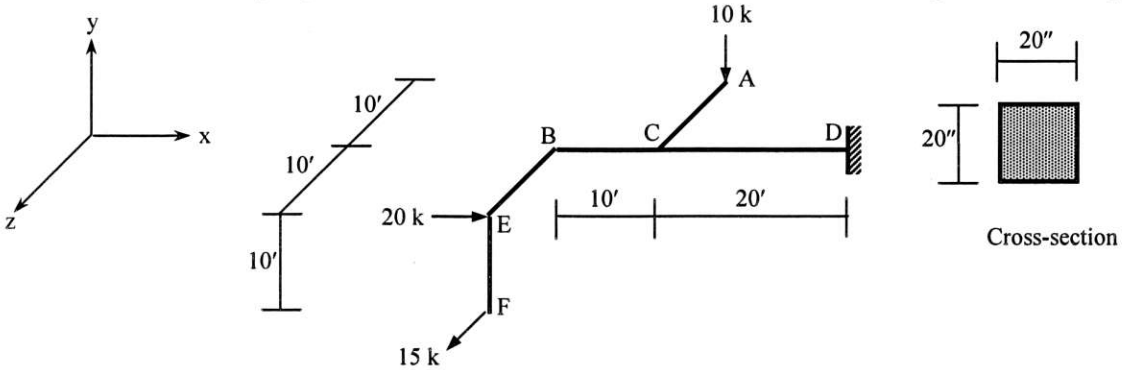


Fig. 2

3. Calculate flexural rigidity (EI) of beam ABC shown in Fig. 3, if the deflections at B and C due to the point load 10 k are the same, and stiffness of spring A is twice the stiffness of spring C

[Given: For spring A
Coil diameter = 1″, Average spring diameter = 6″, Number of coils = 6, Shear modulus = 12000 ksi].

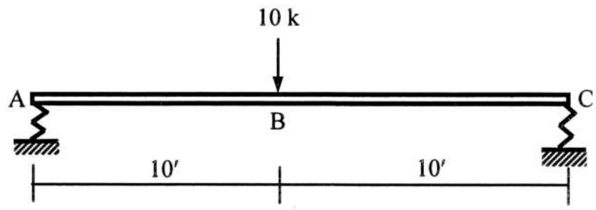


Fig. 3

Midspan deflection of the beam = $PL^3/48EI$

4. The shaded area shown in Fig. 4 represents the kern of the rectangular footing ABCD.
Calculate the normal stresses at A, B, C, D and specify the neutral axis for the given loads.

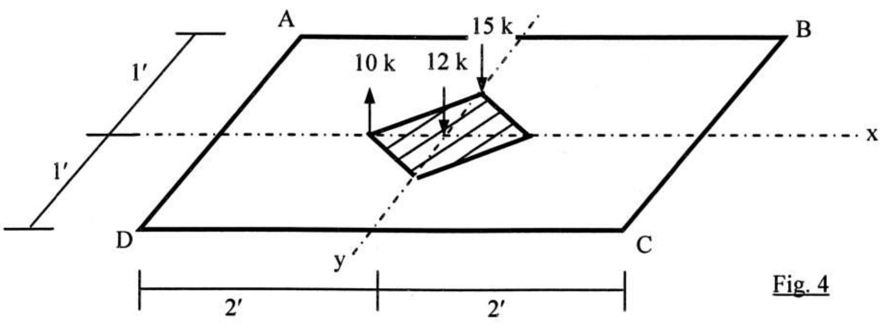


Fig. 4

5. For an infinitesimal element, $\sigma_{xx} = -35$ ksi, $\sigma_{yy} = 18$ ksi, and $\tau_{xy} = -12$ ksi.
In Mohr's circle of stress, show the normal and shear stresses acting on a plane defined by $\theta = -25°$.

on two retaining walls *abc*.

Compute and compare between the deflections at *a*, if the wall is initially assumed to be a cantilever, but subsequently braced at *b* to control deflections, i.e.

(i) Calculate the deflection at *a* assuming reaction $R_b = 0$, i.e. if the retaining wall is a cantilever

(ii) Calculate the new deflection at *a* assuming $v_b = 0$, i.e. if the retaining wall is braced at *b*

[Given: EI = constant = 100×10^3 kN-m^2].

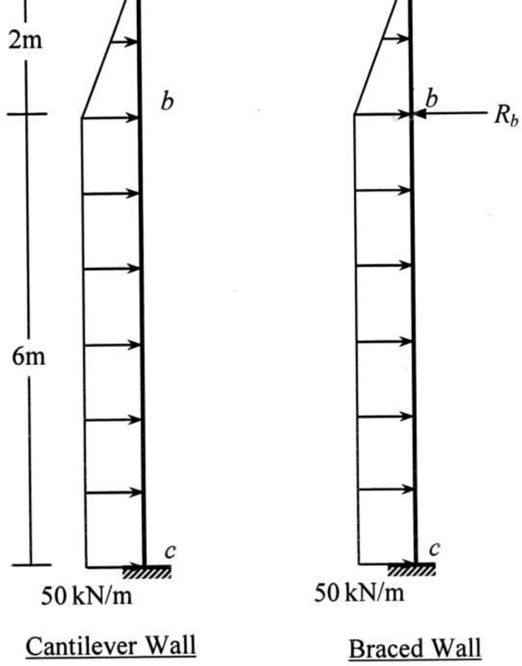


Fig. 5

7. For the beam *abcd* loaded as shown in Fig. 6, use *Singularity Functions* to calculate the

   (i) Vertical reaction and deflection at spring *b*

   (ii) Vertical deflection at *c*

   (iii) Rotation just at the right of *c*

   [Given: K_b = Stiffness of spring *b* = 100 k/ft, EI = constant = 80×10^3 k-ft^2].

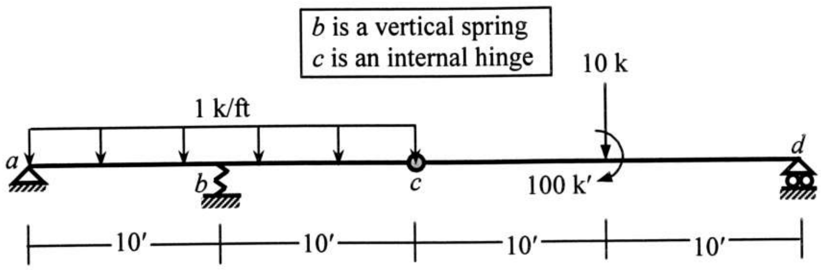


Fig. 6

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

9. Answer Question 7 using the *Conjugate Beam Method.*

10. Briefly answer the following questions

    (i) Draw the qualitative deflected shapes of the beams loaded as shown in Fig. 5 and Fig. 6.

    (ii) Explain why fixed support in a beam is converted to free support in a conjugate beam.

    (iii) Explain why columns with initial imperfection deflect transversely at the application of axial force.

    (iv) Explain why actual buckling loads are less than the loads determined by Euler's formulation.

11. Fig. 7 shows a force P acting at point a of the frame abc.

Calculate the

(i) Force P causing the node b to deflect 0.5m downwards

(ii) Deflection at b if the force is doubled

[Given: EI_{abc} = constant = 20×10^3 kN-m^2].

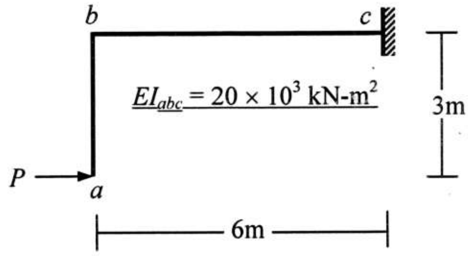


Fig. 7

12. For the frame abc shown in Fig. 7, calculate the

(i) P_{cr} for member bc, and bending moment at node c, if $P = P_{cr}$, assuming the frame is un-deformed

(ii) Maximum allowable axial force if plastic moment (M_p) at c is equal to the moment calculated in (i)

(iii) Deflection at node b for the force calculated in (ii).

13. To resist the lateral force F applied at joint a, truss abc [shown in Fig. 8(i)] is modified to truss $abcde$ [shown in Fig. 8(ii)] by adding members be and de.

Use the AISC-ASD criteria to calculate the allowable value of F to avoid buckling of any member of the

(i) Truss abc, (ii) Truss $abcde$ [Given: E = 29000 ksi, f_y = 50 ksi].

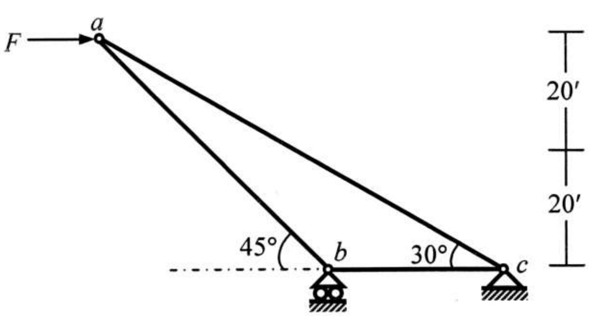


Fig. 8(i)

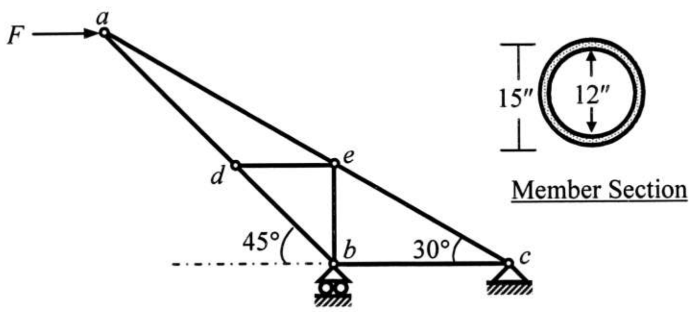


Fig. 8(ii)

14. Fig. 9 shows the distributed vertical load as well as the column Axial Force Diagram (AFD) and Bending Moment Diagram (BMD) for the frame $abcdef$. Calculate the

(i) Minimum distributed load (w k/ft) needed to cause buckling of one of the columns

(ii) Maximum bending moment in the two members if w is equal to half the load calculated in (i)
[Given: Modulus of elasticity E = 3000 ksi].

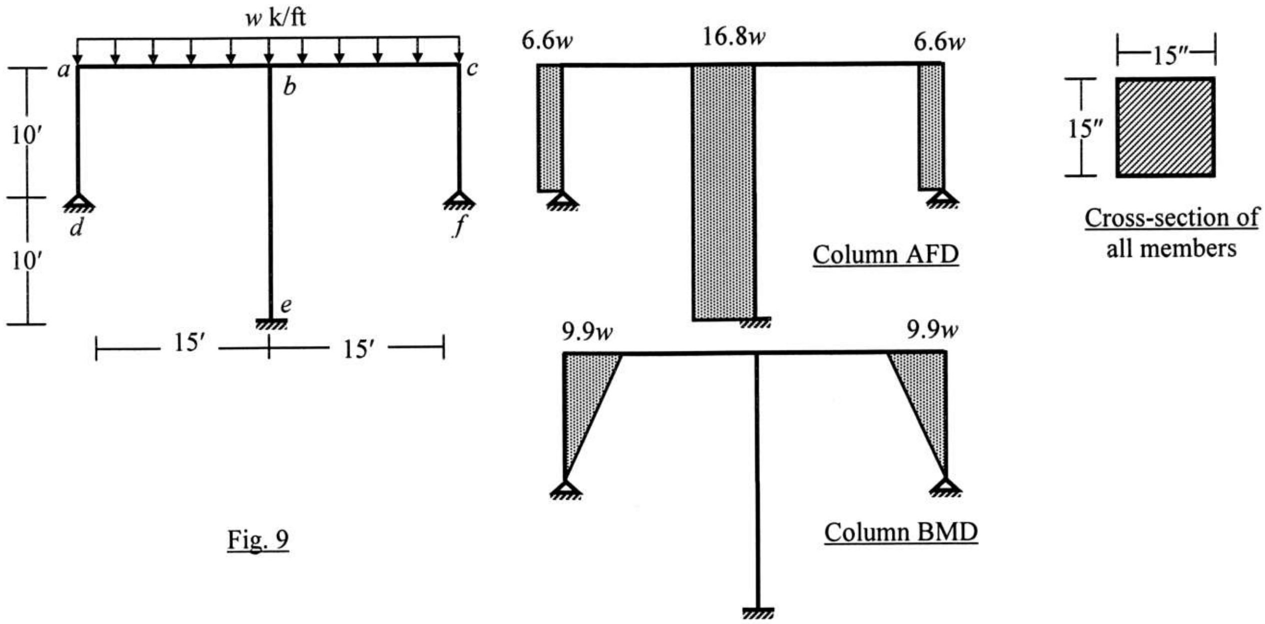


Fig. 9

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2015
Program: B.Sc. Engineering (Civil)

Course Title: Fluid Mechanics — Course Code: CE 221

Time: 3 hours — Full Marks: 150

Section A

[There are **four (04)** questions in this section. Answer any **three (03)** of them.]

1. (a) Briefly explain the application of fluid mechanics in Civil Engineering. (10)

   (b) Define and classify viscosity. Derive Newton's Law of Viscosity. (10)

   (c) Two liquids A and B have same mass but volume of B is 2.2 times of volume of A. Which liquid has greater unit weight? (05)

2. (a) Define absolute and gage pressure. Differentiate between them. (10)

   (b) A rectangular tank is shown in figure 2(b). The tank contains Kerosene which has a unit weight of 12 kN/m^2. Determine (15)

      i. Hydrostatic pressure at point A and P.

      ii. Total hydrostatic force on ABCD and ABEF.

      iii. Location of center of pressure of ABCD.

3. (a) Derive Continuity Equation for steady incompressible flow. (12)

   (b) A liquid (S=1.25) with a $P_v = 50$ kN/m^2, absolute flows through the horizontal pipe as shown in figure 3(b). P_{atm}= 76 cm of Hg. Find the maximum theoretical flow rate without cavitation to occur. Neglect head loss. (13)

4 (a) Derive hydrostatic law of variation of pressure. (13)

   (b) A U-tube manometer containing Hg (sp. gr. 13.6) has its right limb open to the atmosphere as shown in the figure 4(b). The left limb is full of water and is connected to a pipe containing water under pressure. Find the absolute pressure of water in the pipe for the manometer readings as shown in the figure 4(b) (12)

Section B

[There are **four (04)** questions in this section. Answer any **three (03)** of them.]

5. (a) What is energy correction factor? Why is it needed? Derive an equation for energy correction factor. (10)

(b) A 15 HP pump working with 85% efficiency is discharging crude oil (S=1.50) to the overhead tank as shown in figure 5(b). If losses of the whole system are 2 m of the flowing fluid find the discharge. (15)

6. (a) Briefly explain Reynolds Experiment. How can you determine characteristics of flow from Reynolds Experiment? (10)

(b) A fluid (S=0.70) is flowing through a pipe of 1.0 m diameter. The actual velocity is expressed by an equation of $u = 0.50(1 - \frac{r^2}{0.25})$ where u=velocity (m/s) and r = radius (m). Find out momentum correction factor. (15)

7. (a) Determine the magnitude of the resultant force exerted on the double nozzle shown in figure 7(a). Both nozzle jets have a velocity of 07 m/s. The axis of the pipe and both nozzles lie in a horizontal plane. Neglect friction. [S=1.35]. (15)

(b) An oil (S=1.5) having a kinematic viscosity of 60 stokes is flowing through a pipe of 30 cm radius. Determine the type of the flow if the discharge through the pipe is 100 l/s. (10)

8. A fluid is flowing through a series of pipes which is shown in figure 8. Determine the rate of flow from A to B when total head loss is 10 m and the kinematic viscosity of the fluid is 1.14×10^{-6}. Use Moody diagram shown in figure 8(m) to determine friction factor. Neglect minor losses. Pipe properties are given in table 8. (25)

Table 8

Pipe No	Diameter (mm)	Length (km)	Equivalent Roughness(e), mm
1	300	0.30	0.25
2	200	0.15	0.30
3	250	0.25	0.275

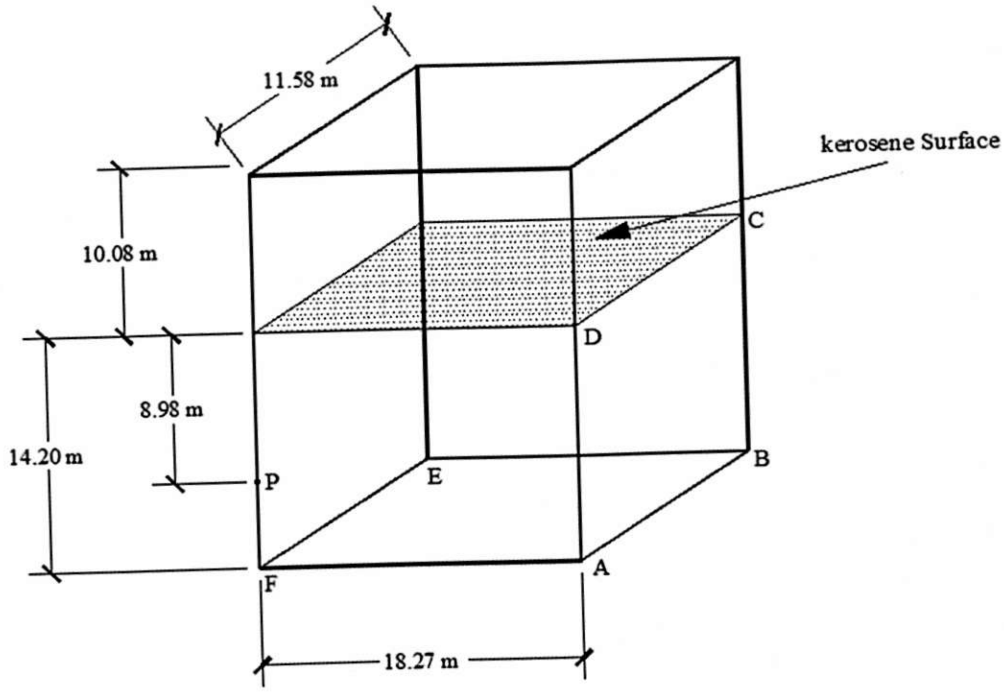


Figure 2(b)

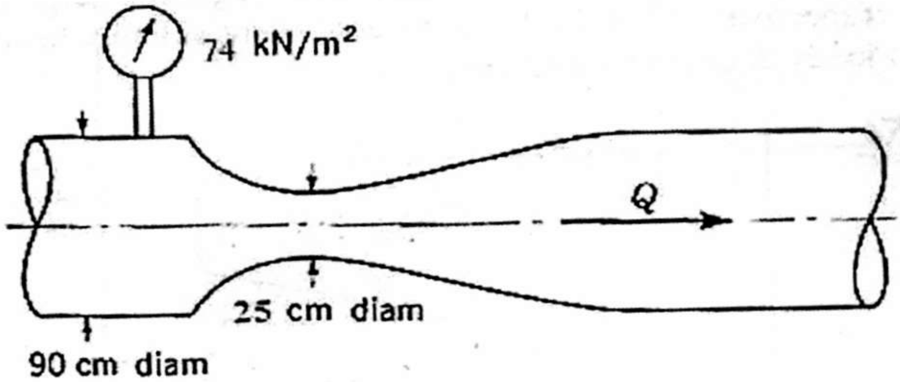


Figure 3(b)

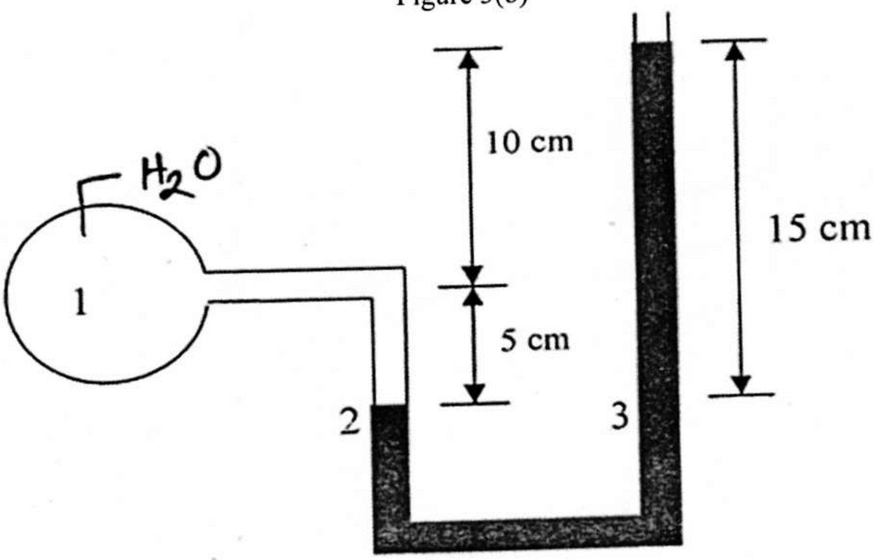


Figure 4(b)

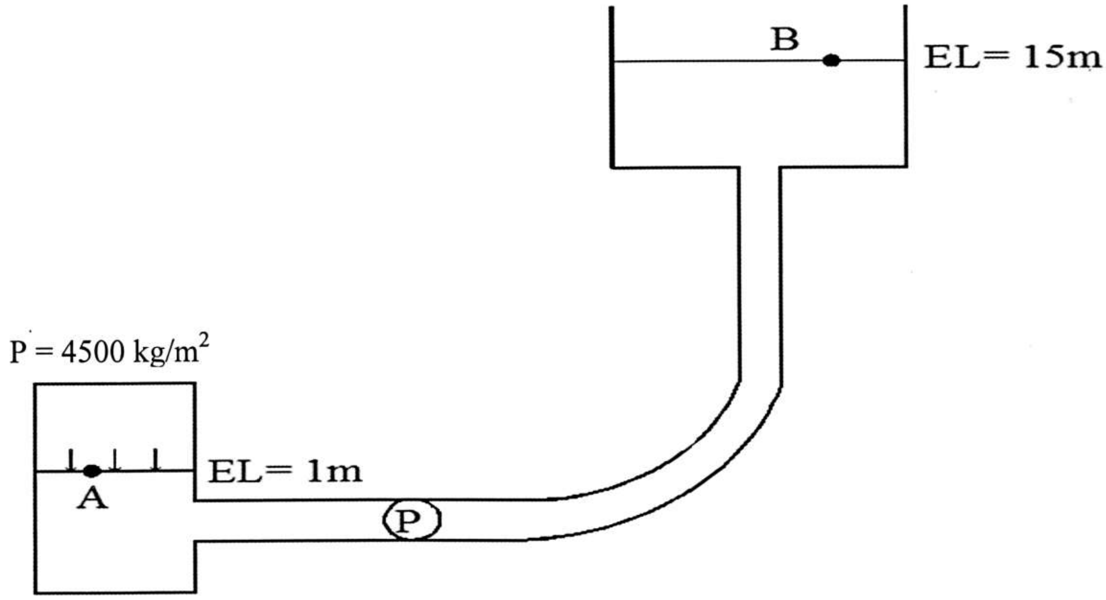


Figure 5(b)

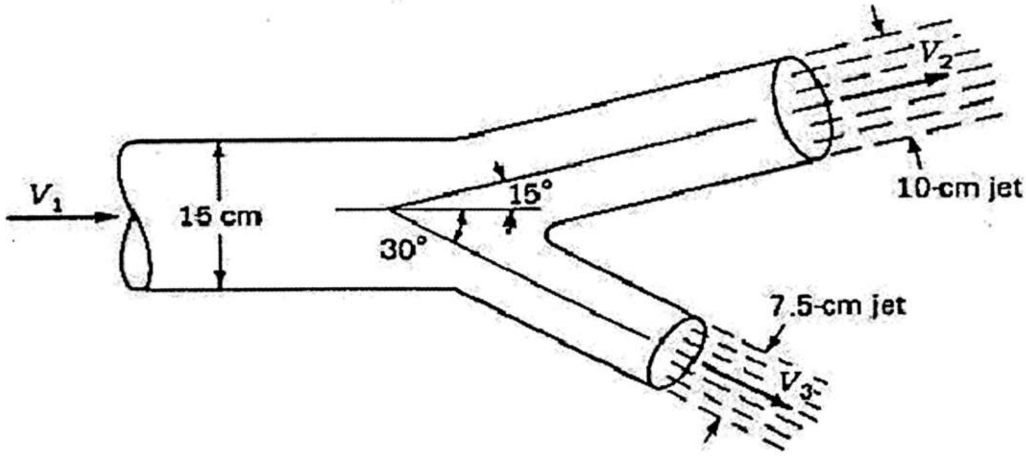


Figure 7(a)

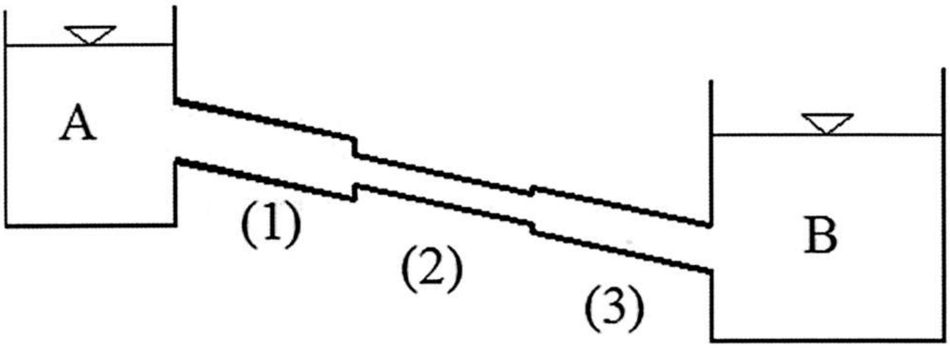


Figure 8

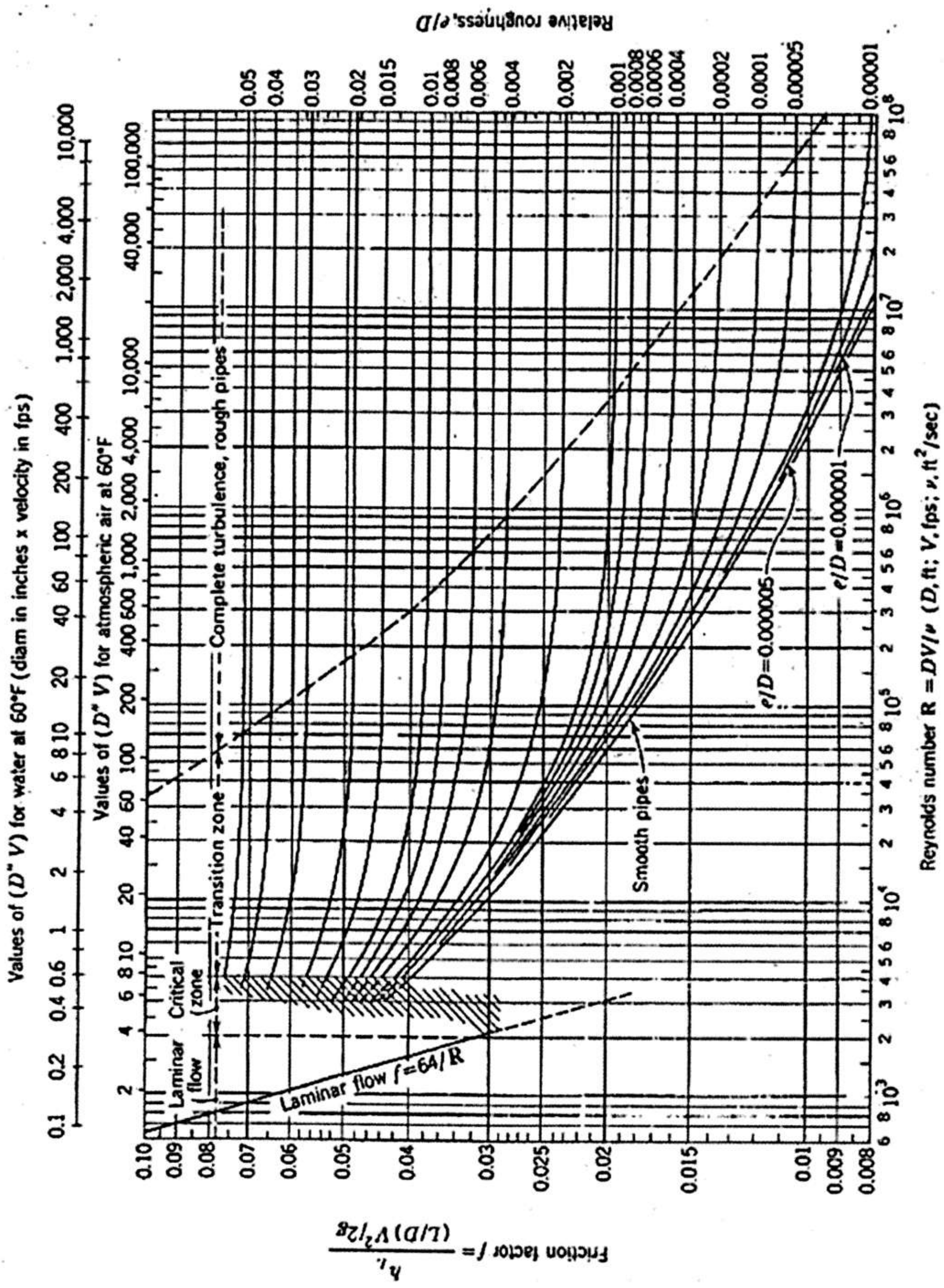


Figure 8(m) Moody Diagram

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2015
Program: B. Sc. Engineering (Civil)

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

Section A

There are **four (4)** questions in this section. Answer **any three (3) [3x20=60]**

1. (a) What is geomorphic process? Classify (mention names only) geomorphic processes based on origin. Write down the names of major geomorphic agents. 5

(b) What are physical and chemical weathering processes? Discuss, in brief, the physical weathering processes. 7

(c) Give two examples of each type of major rocks. Discuss, in brief, sedimentary rocks. 8

2. (a) What is diastraphism? Draw neat sketch of a typical fold geometry showing its major features. 5

(b) Write short notes on folds, faults and joints and rock cleavage. 6

(c) Classify and discuss briefly (with neat sketches) various types of folds. 9

3. (a) Classify (mention names only) faults and draw sketch of any one type of fault. 4

(b) Mention the aftermaths of liquefaction phenomenon. 4

(c) Classify and discuss briefly (no sketch required) different types of waves generated due to earthquake. 8

(d) Tabulate Modified Mercalli Intensity scales of earthquake (IX to XII). 4

4. Briefly discuss, mention or draw sketches, as asked for, on **any four** of the following topics:- 5 X 4 = 20

(i) Schematic diagram of rock cycle

(ii) Principal zones of earth (names only) with a schematic diagram showing the thicknesses of different pats of lithosphere/geosphere.

(iii) Neat sketches of Oblique fault and Graben

(iv) Basic mechanism of liquefaction

(v) Major earthquake parameters (geometric) with neat sketches

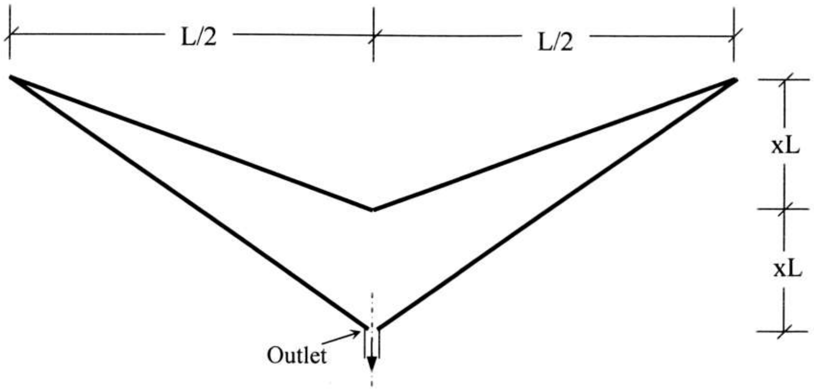
Section B

There are **four (4)** questions in this section, answer **any three (3) [3x20=60]**

5. (a) Distinguish between infiltration and percolation. **3**

(b) Define flood hydrograph with sketch. **1.5**

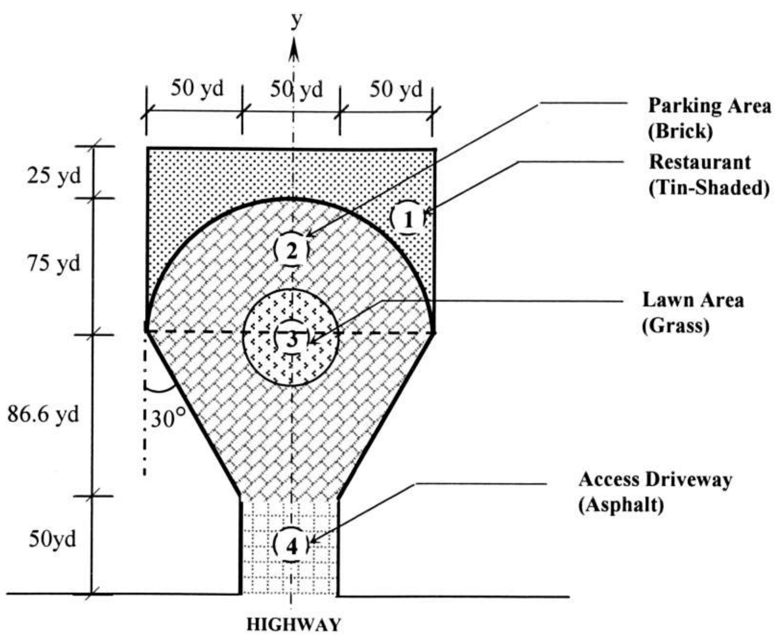
(c) For the basin shown as below, x is a constant factor. For what value of x, the flow rate (Q) will be the maximum for the basin? Find the FF and CC of the basin for maximum runoff. **9**



(e) Calculate the peak runoff (Q_P) for the following highway restaurant complex as shown below. Use the following data/information as necessary. **6.5**

- Rainfall Intensity for the whole area = 0.25 in/hr
- The area is symmetric about y direction.

Area Type	Coefficient of Runoff
Brick	0.70
Asphalt	0.75
Grass	0.25



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

(b) Prove that $d \propto v^2$; where symbols carry their usual meanings. **7**

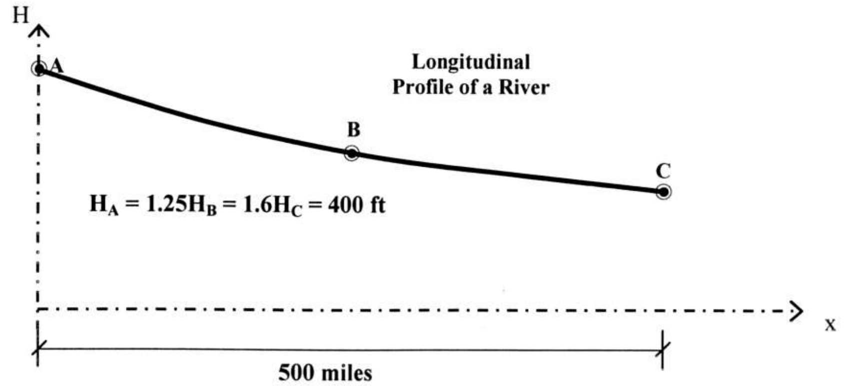
(c) Prove that $\tau = \gamma_{\omega} R_H s$; where symbols carry their usual meanings. **5**

(d) Mention (no description required) three hydraulic actions responsible for river erosion. **1.5**

(e) Maximum size of sediment transported by one river (R-1) is thirteen times than that of another river (R-2). Derive a correlation between the velocities of two rivers. **3.5**

7. (a) Define river transportation, load, capacity and competence. Write short notes on various types of loads of a river. **5**

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



(c) What is stream order/rank? Mention the laws of stream order/rank with diagram. **4**

(d) Calculate Drainage Density (DD) of a catchment area (having SF = 1.067×10^{-3} /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	---	2.5		---	3.0	
2	8	2.667	2.722	30	1.667	2.222
3	---	---		---	---	
4	---			---		

8. (a) Mention the factors affecting drainage pattern. Classify and discuss, in brief with sketches, any two types of drainage patterns. **8**

(b) Sketch a typical cross-section of a river/stream valley. Classify (mention names only) valley according to the stage, genesis and controlling structures. **3**

(c) Discuss, in brief, the ways valleys are deepened and widened. **9**

University of Asia Pacific
Department of Basic Sciences & Humanities
Final Examination, Spring - 2015
Program: B.Sc. Engineering (Civil Engineering)
2^{nd} Year / 2^{nd} Semester

Course Title: Mathematics IV — Course Code: MTH 203
Time: 3 hr — Credit: 3.00 — Full Marks: 150

There are **EIGHT** questions. Answer any **SIX**

1. (a) Define a differential equation and order of a differential equation with an example of each. 7

   (b) Solve the differential equation 18

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

2. (a) Find the solution of the differential equation 10

$$\frac{d^2x}{dt^2} - 8\frac{dx}{dt} + 16x = 5\cos 3t$$

   (b) Define Cauchy-Euler equation. Hence solve the differential equation 15

$$x^2\frac{d^2y}{dx^2} - 6x\frac{dy}{dx} + 6y = 0$$

3. (a) State the necessary and sufficient condition that the differential equation to be exact. Hence solve the differential equation 10

$$\left(1+e^{\frac{x}{y}}\right)dx + e^{\frac{x}{y}}\left(1-\frac{x}{y}\right)dy = 0$$

   (b) Solve the differential equation: 5

$$\frac{d^4y}{dx^4} - 2\frac{d^3y}{dx^3} + 5\frac{d^2y}{dx^2} = 0$$

   (c) Solve the differential equation: 10

$$\frac{d^2y}{dx^2} + \frac{dy}{dx} - 2y = 2(1+x-x^2)$$

4. (a) Define Laplace transformation of a function. 3

(b) State and proof the Laplace transformation of a periodic function. 12

(c) Find $\mathcal{L}\{F(t)\}$, where 10

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

with period 2π.

5. (a) Define inverse Laplace transform. 3

(b) A particle P of mass 2 gram moves on the X-axis and is attracted toward origin O with a force numerically equal to 8X. if it initially at rest at X=10, find its position at any subsequent time assuming 22

(a) no other forces act
(b) a damping force numerically equal to 8 times of the velocity acts.

6. (a) State the convolution theorem. Hence evaluate $\mathcal{L}^{-1}\{1/s^2(s+1)^2\}$ by using this theorem. 10

(b) Prove that $\int_0^\infty te^{-st}\cos at\,dt=\frac{s^2-a^2}{(s^2+a^2)^2}$. 5

(c) Evaluate 10

i. $\mathcal{L}^{-1}\{\frac{8s+20}{s^2-12s+32}\}$
ii. $\mathcal{L}^{-1}\{\frac{s^2-4}{(s^2+4)^2}\}$

as a function of t.

7. (a) Define Fourier integral of an odd function. Hence show that $\int_0^\infty \frac{u\sin ux}{u^2+1}du=\frac{\pi}{2}e^{-x}$, $x>0$. When $f(x)=e^{-x}$ is an odd function. 12

(b) Define complex form of Fourier transform. Find the Fourier transform of $f(x)=e^{-|x|}$, where x belongs to $(-\infty,\infty)$. 13

8. (a) Define infinite Fourier sine and cosine transform. 6

(b) Find the Fourier sine and cosine transform of e^{-x}, $x\ge 0$. 12

(c) Derive relation between Laplace transform and Fourier transform. 7