2.2

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall - 2018
Program: B.Sc in Civil Engineering

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

(Answer all of the following questions.)

1. a. Explain the term Gross Domestic Production. Discuss in details the items (goods or services) that are not included in the calculation of GDP. (5)

   b. The data in the table apply to a hypothetical country, Itolia during 2017.

   Itolia's National Accounts (2017)

	($ billions)
Corporate Profits	55
Exports	68
Wages and Salaries	546
Gross Investment	157
Government Purchases	184
Indirect taxes	75
Personal Consumption	481
Interest Income	52
Imports	27
Depreciation	79
Proprietors' Income and rents	56

   Use the data to find GDP of Itolia using both the income based approach and expenditure-based approach. (15)

2. In a movie theatre, Movieplex, there are only 3 goods: popcorn, movie shows, and diet drinks. The following table shows the prices and quantities produced of these goods in 2010, 2015, and 2017:

	2010		2015		2017	
	Price (BDT)	Quantity	Price (BDT)	Quantity	Price (BDT)	Quantity
Pop Corn	80	500	90	600	100	800
Movie Shows	300	300	350	500	400	600
Diet Drinks	50	300	60	200	75	250

   a. Calculate the cost of the basket of goods at current prices for 2010, 2015 and 2017.

b. Calculate the cost of the basket of goods for 2010, 2015 and 2017 considering 2010 as the base year.

c. Calculate the Consumer Price Index (CPI) for 2010, 2015 and 2017

(10)

3. a. Briefly discuss about the functions of money. (5)

b. Explain what happens when money supply increases in the economy. (5)

4. Copy and complete the following table.

	Perfect Competition	Monopolistic Competition	Oligopoly	Monopoly
Number of firms				
Variety of goods				
Control over prices				
Barriers to entry and exit				
Examples				

(10)

University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination, Fall-2018
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) Suppose the salt was entering the tank at the rate $50\ lb/min$ and leaving the tank at the rate $\frac{A}{400}\ lb/min$, where $A(t)$ is the amount of salt in the tank at time t. If $80\ lb$ of salt was dissolved in the initially , how much salt would be in the tank after $2\ hour$ and after a long time. **15**

(b) Find the differential equation of $xy = ae^x + be^{-x} + x^2$ and also write down the order and degree of this differential equation. **10**

2. Solve the following differential equations using appropriate methods: **25**

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

(ii) $(x - y^3 + y^2 \sin x)dx = (3xy^2 + 2y\cos x)dy$

(iii) $(y^2 + yx)dx - x^2dy = 0$

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

(b) Solve: **15**

(i) $\frac{dy}{dx} + 3x^2y = x^2$

(ii) $\frac{dy}{dx} = (4x + y + 1)^2$

4. (a) Define Laplace transform. Find Laplace transformation of the following functions: **15**

(i) $e^{4t} + 4t^3 - 2sin3t + 3cosh5t + 4$

(ii) $e^{5t}(sinh4t + cos6t)$

(iii) t^2cos4t

(b) If $\mathcal{L}\{F(t)\} = f(s)$, then show that $\mathcal{L}\{F'''(t)\} = s^3f(s) - s^2F(0) - sF'(0) - F''(0)$ **10**

5. **(a)** Evaluate $\mathcal{L}^{-1}\left\{\frac{1}{s^2(s+1)^2}\right\}$ by using Convolution theorem. Verify the result by evaluating it by partial fraction method. **13**

(b) Evaluate **12**

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

(ii) $\mathcal{L}^{-1}\left\{\frac{5s-6}{s^2+9}-\frac{s-15}{s^2-25}\right\}$

6. **(a)** Use Heaviside's expansion formula to find , $\mathcal{L}^{-1}\left\{\frac{3s+1}{(s-1)(s^2+1)}\right\}$ **12**

(b) Solve using Laplace transformation: $Y''(t)+9Y(t)=cos2t,$ **13**

$$Y(0)=1, \qquad Y\left(\frac{\pi}{2}\right)=-1$$

7. **(a)** Find the (i) finite Fourier Sine transform, (ii) finite Fourier Cosine transform of the function **10**

$$F(x)=4x\ , \quad 0<x<6$$

(b) Find the Fourier Sine and Cosine transform of $e^{-2x}, x>0.$ **10**

(c) Find the Fourier transform of $f(x)=e^{-|x|}$,where x belongs to $(-\infty,\infty)$ **5**

8. **(a)** Define Fourier Series. Find the Fourier Series of the function $f(x)=x^2,$ **15**

$-\pi<x<\pi$ and show that $\frac{\pi^2}{6}=1+\frac{1}{2^2}+\frac{1}{3^2}+\frac{1}{4^2}+\cdots$

(b) Find the Fourier integral of the function $f(x)=e^{-kx}$ when $x>0$ and **10**

$f(-x)=f(x)$, for $k>0$ and hence prove that $\int_0^\infty \frac{cosux}{k^2+u^2}du=\frac{\pi}{2k}e^{-kx}$, $k>0.$

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2018
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) What is geomorphology? Express your understanding regarding physical and chemical weathering processes. **2+6 = 8**

(b) Draw a schematic diagram of the rock cycle and provide at least two examples of each types of rocks. **6**

(c) Mention (names only) the principal zones of the earth from geologic point of view and show thicknesses of different parts of lithosphere/geosphere. **6**

2. (a) Classify (mention names only) folds and discuss any two types showing neat sketches. **7**

(b) Differentiate faults and joints. **3**

(c) Compare Horst and Graben with the aid of sketch. **4**

(d) Mention a few major physical properties of mineral and distinguish between Ferro-Magnesian and Non-Ferro-Magnesian Silicates. **2+4 = 6**

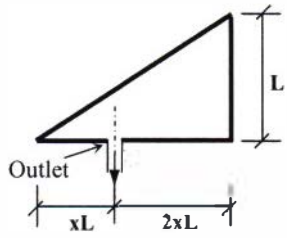
3. (a) What is earthquake? Write down the major causes of earthquake. **2+4 = 6**

(b) Discuss liquefaction phenomenon in the light of its basic mechanism and aftermaths. **8**

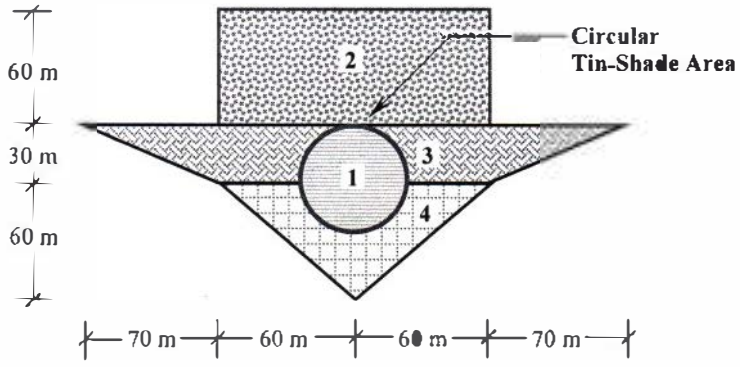
(c) Classify and discuss, in brief with sketch, any two types of drainage patterns. **6**

4. (a) Mention the factors affecting runoff. No description is required. **4**

(b) In the following basin, for what value of x, the flow rate (Q) will be the maximum? Also calculate the CC of the basin. **8**



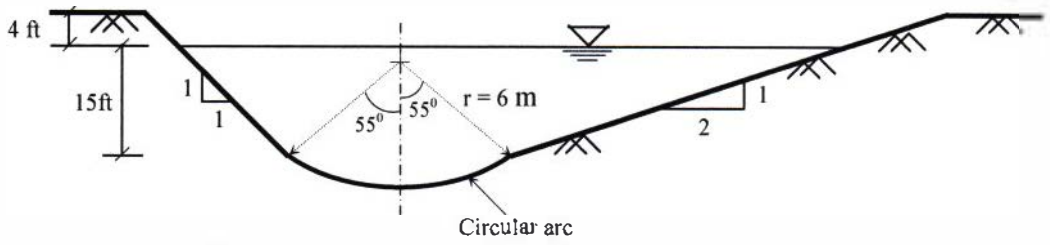
(c) For the drainage area as shown below, calculate peak runoff in ft3/s, Use $C_2 = (C_3 + C_4 - 0.3)$, $C_3 = (C_4 - 0.2)$ and $C_4 = 0.6$ and I = 0.04 in/min. **8**



5. (a) Prove that $\tau = \gamma_w R_H S$; where symbols carry their usual meanings. 5

(b) Velocity of flow of one river (R-1) is three times the velocity of flow of another river (R-2). If other features remain same, derive a correlation between the two rivers in terms of their ability of transporting maximum size of sediments. 4

(c) 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 in kPa and psf. 7

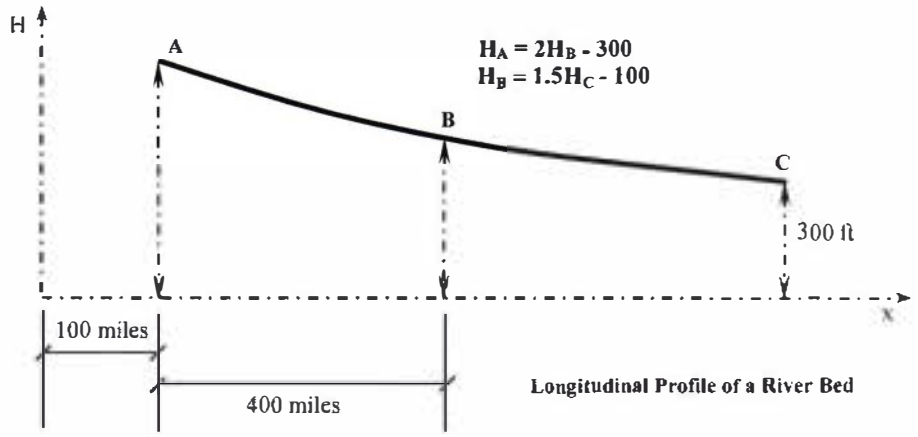


X-Sectional Profile of Channel Course

(d) Discuss, in brief, the ways valleys are widened. 4

6. (a) Prove that $H = ae^{-bx}$; where symbols carry their usual meanings. 6

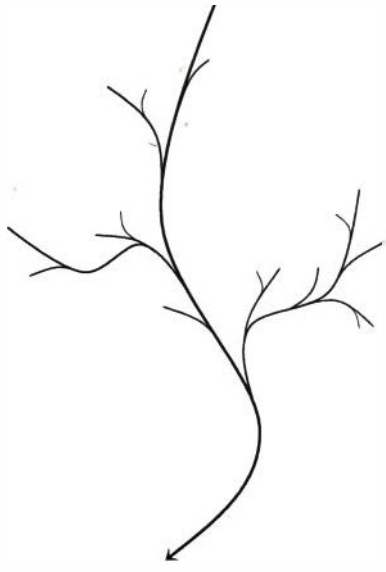
(b) Using the figure shown below, calculate the horizontal distance between B and C. 5



Longitudinal Profile of a River Bed

(c) Rank the streams of the following drainage basin having a total catchment area of 6,000 square mile. The results of the survey are summarized in the table below. 9

Steam Rank	Average Length (km)
1	7.0
2	18.9
3	44.8
4	99.9



Calculate the following parameters:
(i) Average Bifurcation Ratio (ABR)
(ii) Average Length Ratio (ALR)
(iii) Stream Frequency (SF)

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2018
Program: B.Sc. Engineering (Civil)

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

Time- 3 hour — Full marks: 120

(Answer all the following questions)

Section A

1. Write a program that can read A(3x3) and B(3x3) matrices and multiply these two matrices. **(14)**
2. Write a program that can read two numbers and lists the numbers which are divisible by 7. **(06)**
3. Write a program in C++ to find the shear force and bending moment of the following cantilever beam shown in ***Figure 1***, with "L" ft length from the support and the applied uniformly distributed load is "w" kips/ft. **(10)**

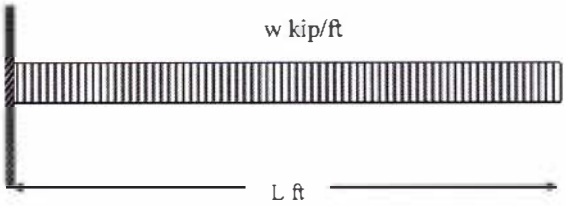


Figure 1

Section B

4. The costs of concrete mixes (by volume) at the ratios 1: 3: 6, 1: 2: 4 and 1: 2: 3 are 200, 225 and 240 Taka/ft^2 respectively. Calculate the cost per ft^2 of cement, sand and coarse aggregate using Gauss Elimination. **(10)**
5. Calculate $I = \int_2^7 \frac{2x^2 - x^2\sqrt{x}+1}{x^2}$ using both Trapezoidal and Simpson's rule. Assume, n=10 panels for both methods. **(12)**
6. Derive an equation to calculate a definite integral divided into an even number of equally spaced subintervals. Use the equation to calculate integral of the following function as plotted in ***Figure 2***. **(08)**

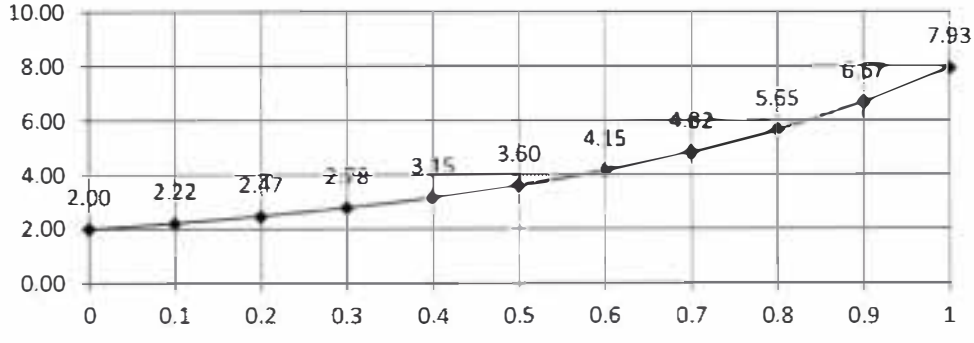


Figure 2

7. **(a)** Use the regula-falsi method to determine a real root of the equation $4e^{-x}sinx - 1 = 0$. Perform up to 5 iterations. **(07)**

(b) What is the condition for convergence in fixed-point iteration method? **(03)**

8. Using the least-square method, fit an equation of the form $\mathbf{Q = K\,H^n}$ **(9+1)**

for the data shown in Table–1. Using the best-fit equation, calculate the discharge Q for H = 3.0 ft.

Table–1

H (ft)	1.2	2.1	2.7	4.0
Q (cft/sec)	25	60	90	155

9. The strength (S) of concrete at different times (t) is shown in Table–2. **(8+2)**

Calculate the strength S for t = 28 days by interpolating the data. If the first data is missed, which method would you apply and why?

Table–2

t (days)	3	7	14	21
S (ksi)	1.3	1.8	2.3	2.5

(10)

10. Solve the following boundary value problem assuming $y(0) = y(1) = 0$. Use step length 0.25.

$$\frac{d^2y}{dx^2} - y = x$$

11. The acceleration of a body falling through air is given by a = dv/dt = 32–v. **(9+1)**

If v(0) = 0, calculate the velocity v for t = 0.2~ 0.6 @0.2 sec by Euler's method and second-order Runge-Kutta method. Which method gives more accurate results and why?

12. The differential equation $\frac{dy}{dx} = 1 + y^2$ satisfies the following data: **(10)**

x	y
0	0
0.2	0.2027
0.4	0.4228
0.6	0.6841

Use Milne's method to calculate y (0.8)

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2018 (Set 2)
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″ throughout].

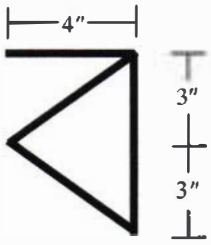


Fig. 1(a)

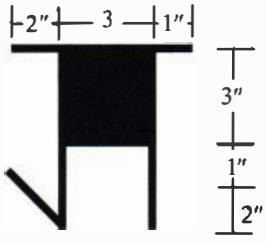


Fig. 1(b)

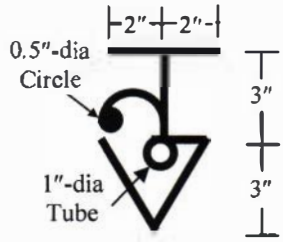


Fig. 1(c)

2. Fig. 2(a) shows a singing Cuckoo bird [weighing W = 0.2 + (Roll No./100)] sitting on the 1″-dia branch of a tree, while Fig. 2(b) shows schematic diagram of the frame *abc*.

   At the center of the section *a*

   (i) Calculate the normal stress and shear stress

   (ii) Draw the Mohr's circle of stresses.


Fig. 2(a)

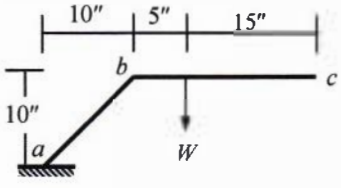


Fig. 2(b)

3. Fig. 3 shows a closed thin-walled section (wall thickness 0.10′) subjected to eccentric shear forces F_1 [= (100 + Roll No.) kips] and F_2 (= $0.5F_1$).

   Calculate the compound shear stress on the section, including Direct Shear and Torsional Shear.

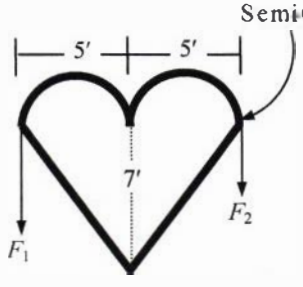


Fig. 3

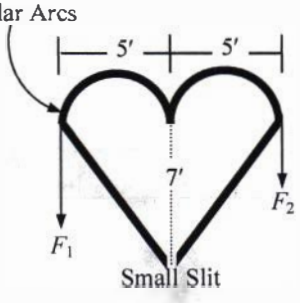


Fig. 4

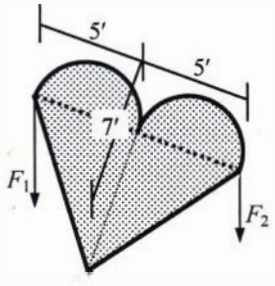


Fig. 5

4. Fig. 4 shows an open thin-walled section (wall thickness 0.10′) subjected to eccentric shear forces F_1 [= (100 + Roll No.) kips] and F_2 (= $0.5F_1$). Calculate the

   (i) Maximum shear stress (τ_{xy}) on the section, including Direct Shear and Torsional Shear.

   (ii) Yield strength of material required to avoid yielding (according to Tresca).

5. Fig. 5 shows two forces F_1 and F_2 acting perpendicular to the shaded footing area.

   If F_1 [= (100 + Roll No.) kips], calculate the

   (i) Minimum force F_2 required to avoid overturning of the footing area

   (ii) Maximum compound normal stress on the footing area (for the forces F_1 and F_2).

6. The frame *abc* shown in Fig. 2(b) is repeated here, with $W = 0.2 + (\text{Roll No.}/100)$.

Given: Modulus of elasticity $E = 2 \times 10^6$ psi, and members *ab* and *bc* are both 1"-dia branches of a tree.

Calculate the deflection and rotation at nodes *b* and *c*.

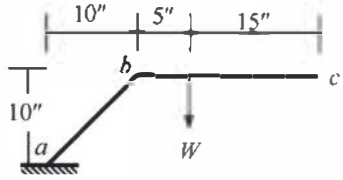


Fig. 2(b) (Repeated)

7. Fig. 6 shows a 'kneeling man' holding flower for the skeleton of St. Valentine (who was killed about 1750 years back) on the beam *abc*, which is supported at *a* and *c*, with an internal hinge at *b*.

The figure also shows the distribution of the man's total weight over his two feet.

Use *Singularity Functions* to calculate the

(i) Vertical deflection at *b*.

(ii) Rotation just at left of *b*.

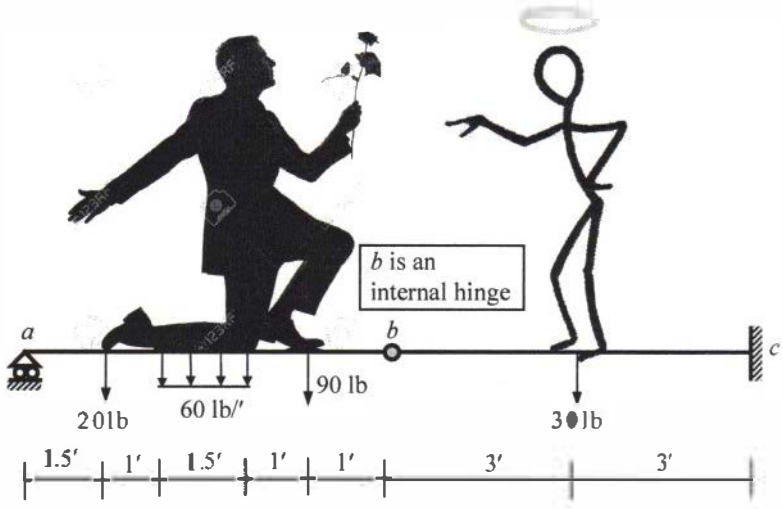


Fig. 6

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

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

10. (i) For the flower (weighing 2 lb) supported on water shown in Fig. 7
- Write the equation for the load *w(x)* using singularity functions
- Write boundary conditions
- Draw the qualitative deflected shape.

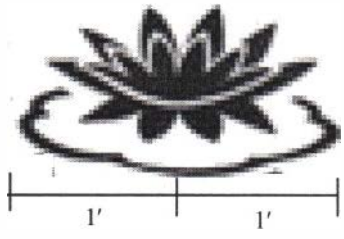


Fig. 7

(ii) Briefly answer the following questions
- Explain the difference between 'Braced' and 'Unbraced' column, and the difference between their range of 'Effective length factor' (*k*).
- Why did you decide (in lab tests) the column buckled when they reached plastic condition?

11. Fig. 8(a) and Fig. 8(b) show a 0.20m-long 'cantilever' flower-branch (with 2mm-diameter and initial imperfection 0.01m) deflecting 0.03m. Calculate the
    (i) Weight W of the flower
    (ii) *Moment Magnification Factor* and maximum bending moment for the flower-branch, using the (a) Equation for end moments, (b) AISC equation

    [Given: Modulus of elasticity $E = 7{,}000$ MPa].

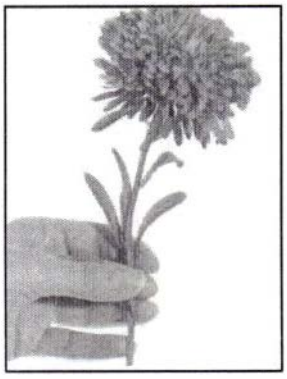


Fig. 8(a)

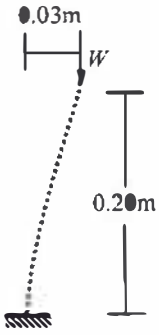


Fig. 8(b)

Fig. 9(a)

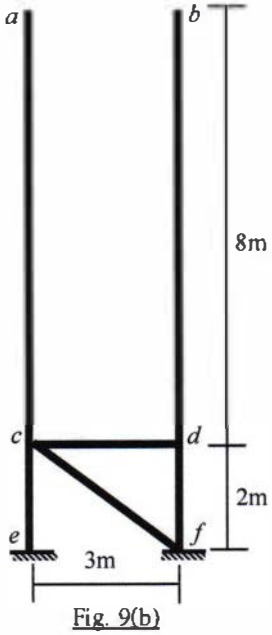


Fig. 9(b)

12. Fig. 9(a) shows the famous Nellie's Tree (also known as the 'Love Tree'), while Fig. 9(b) shows its schematic diagram. If the tree has 0.80m-diameter columns and 0.60m-diameter beams, calculate the buckling loads of
    (i) Column ac, (ii) Column ce

    [Given: Modulus of elasticity $E = 12{,}000$ MPa].

13. Use the AISC-ASD method to calculate the allowable
    (i) Compressive force for member ef
    (ii) Force F that can be applied on the truss shown in Fig. 10

    [Given: Circular section with Diameter = 0.1m,
    Yield strength $f_y = 400$ MPa,
    Modulus of elasticity $E = 210{,}000$ MPa].

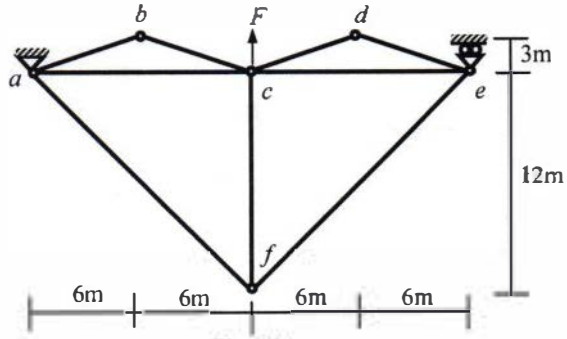


Fig. 10

14. The truss shown in Fig. 10 is made of a nonlinear material with stress-strain relationship given by $\sigma = 400\ \mathrm{Sin}(1000\varepsilon)$, where σ is the compressive stress (MPa) and ε is the strain.

    Calculate the critical force for the member ef.

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2018
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) Discuss the relationship between viscosity and temperature in case of fluid. **[3]**
   (b) A cubical block weighing 25 kg and having a 25 cm edge is allowed to slide down on an inclined plane surface making an angle 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? **[11]**
   (c) At a certain point in an oil the shear stress is 0.2 N/m^2 and the velocity gradient is 0.21 s^{-1}, if the mass density of the oil is 972 kg/m^3.Find the kinematic viscosity. **[6]**

2. (a) Convert a pressure head of 10 m of water column to a carbon-tetra-chloride of specific gravity of 1.62. **[5]**
   (b) For the inclined-tube manometer in Figure 01, the pressure in pipe A is 130 KN/m^2. The fluid in both A and B is water and the gage fluid in the manometer has a specific gravity of 3.6. What is the pressure in the pipe B corresponding to the differential reading shown? **[8]**

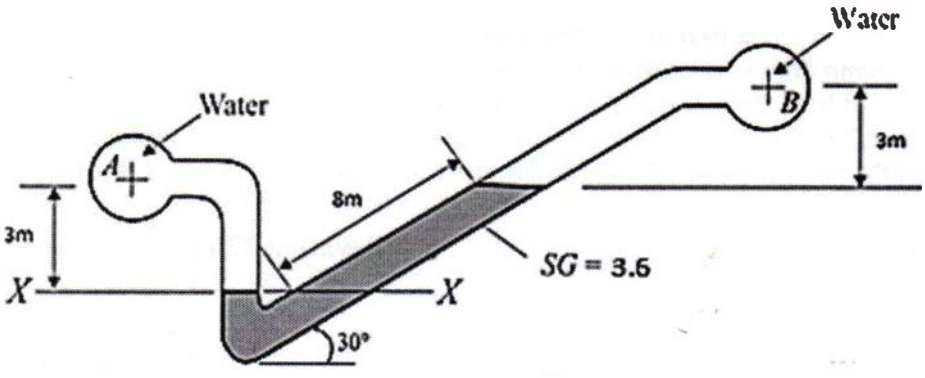


Figure: 01

(c) A circular gate having 16 m diameter shown in Figure 02 is located in the inclined wall of a large reservoir containing a liquid having specific gravity 0.79. The gate is mounted on a shaft along its horizontal diameter, and the liquid depth is 19 m above the shaft. Determine the magnitude and location of the resultant force exerted by the liquid on the gate. Equation of center of gravity and moment of inertia in case of circular body is given in the list of necessary equation list. [7]

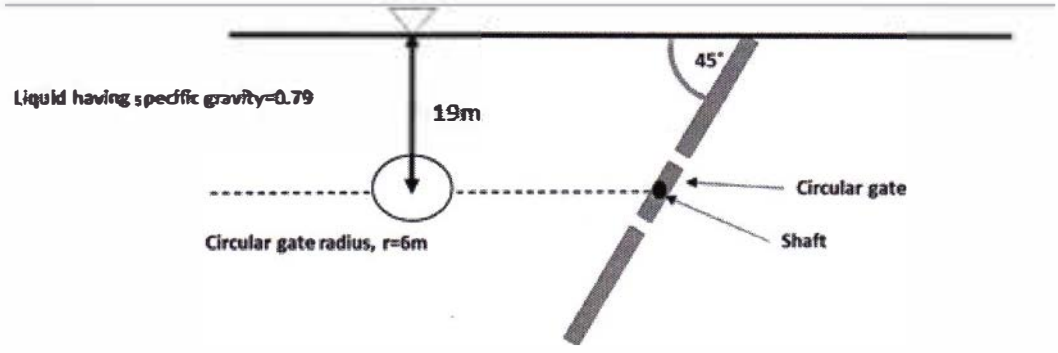


Figure: 02

3. (a) What is flow net? Write down the uses and limitations of flow net. [4]
   (b) Velocity field is defined by $u = 2y^2$, $v = 3x$, $w = 0$. At point (1,2,0), compute a) velocity, b) local acceleration and c) convective acceleration. [2+3+5]
   (c) In a flow the velocity vector is given by $V = 2.5xi + 3yj - 9zk$. Determine the equation of the streamline passing through a point $M(2,3,4)$. [6]

4. (a) State and prove Bernoulli's Theorem. [1+7]
   (b) A pump draws water from reservoir A and lifts it to reservoir B as shown in Figure 03. The loss of head from A to 1 is 3 times the velocity head in the 150 mm pipe and the loss of head from 2 to B is 20 times the velocity head in the 100 mm pipe. Compute the horsepower output of the pump and the pressure heads at 1 and 2 when the discharge is (a)12 L/s; (b) 36 L/s [6+3+3]

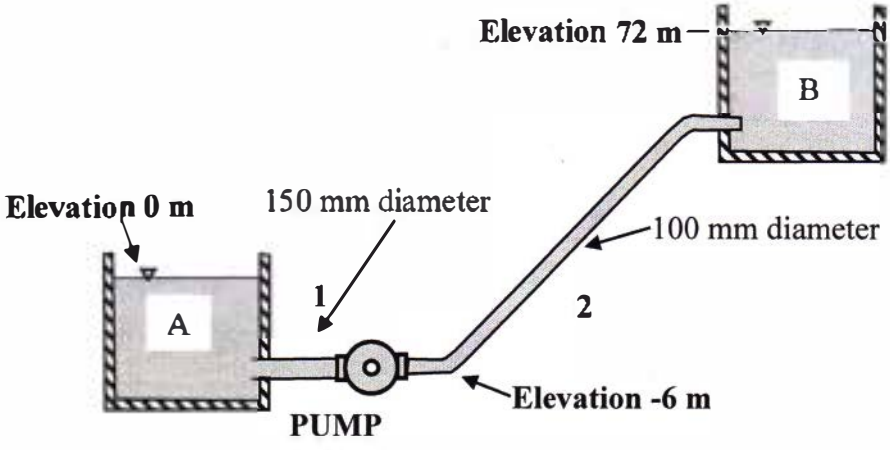


Figure: 03

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

(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. **[12]**

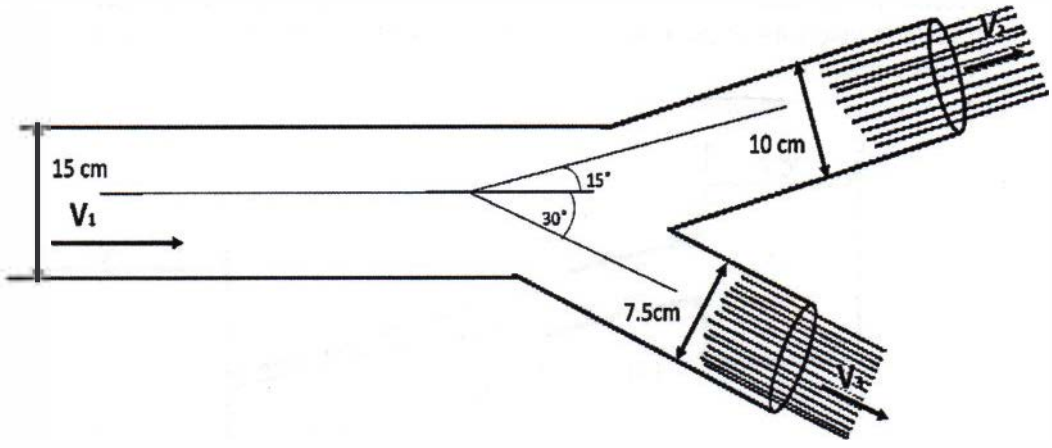


Figure: 04

6. (a) Briefly explain Reynolds experiment regarding finding out fluid flow types. **[6]**

(b) Compute the hydraulic radius for a trapezoidal channel given in Figure 05. The depth of flow is 5m, the bottom width is 15 m, and the slope is 2(horizontal):1 (vertical). **[5]**

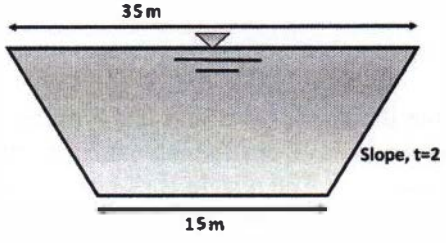


Figure: 05

(c) Derive the Darcy-Weisbach formula for pipe friction. [Equation for shear stress is given in the list of necessary equation list. You do not need to prove that part.] **[9]**

7. (a) Find head loss in 250 m of 1.5m diameter smooth concrete pipe carrying 7.50 m^3/s of water at 10°C using Mannings formula, Chezy's equation and Darcy weisbach equation.(Manning coefficient =0.013,Chezy's C=45,Kinematic viscosity of water at 10°C is 1×10^{-6} m^2/s) **[9]**

(b) A fluid is flowing through a series of pipes which is shown in the following Figure 06. 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. [11]

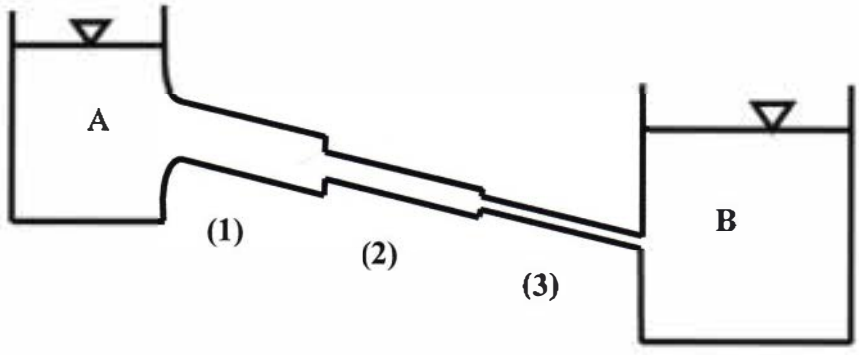


Figure: 06

Pipe properties are given in the following table.

Pipe No.	Diameter (mm)	Length (m)	Equivalent Roughness, e (mm)
1	400	1000	0.25
2	200	1100	0.3
3	100	1200	0.275

8. (a) A pump is 13 m above the water level and has a pressure of -4 m of water at suction side (Figure: 07).The suction pipe is 20 cm diameter and the delivery pipe is 25 cm diameter ending in a nozzle of 10 cm diameter. The nozzle is directed vertically upward at an elevation of 15 m from water level. Determine the discharge . [5]

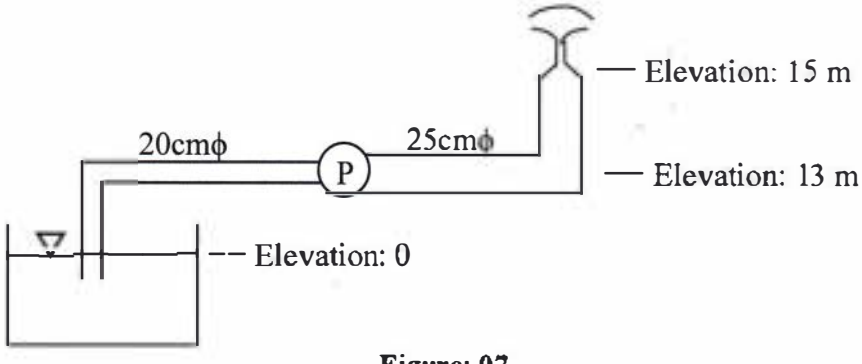


Figure: 07

(b) Establish the equivalent length equation in case of pipes in series connection. **[8]**

(c) Sketch the HGL and EGL for Figure 08 given below and mention the name of the losses. **[7]**

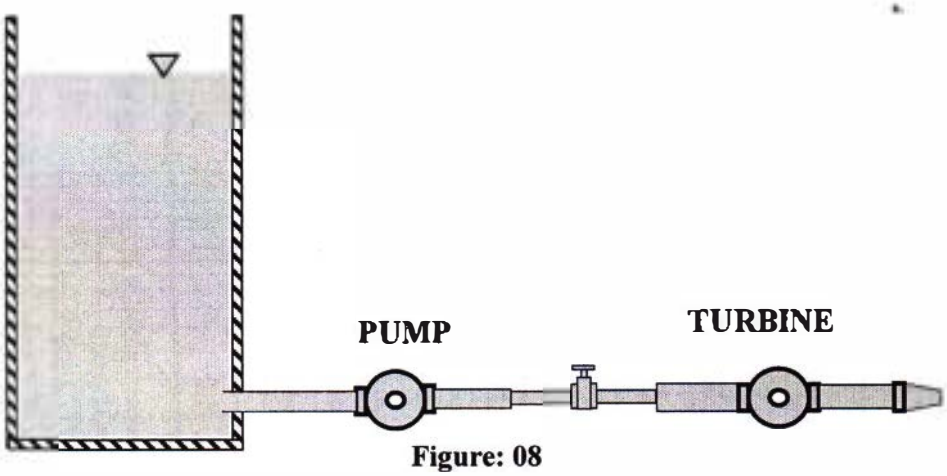


Figure: 08

List of Necessary equation chart

$$Shear\ stress = c_f\left(\frac{\rho V^2}{2}\right)$$

$$Moment\ of\ Inertia\ of\ Circle,\ I_0 = \frac{\pi d^4}{64}$$

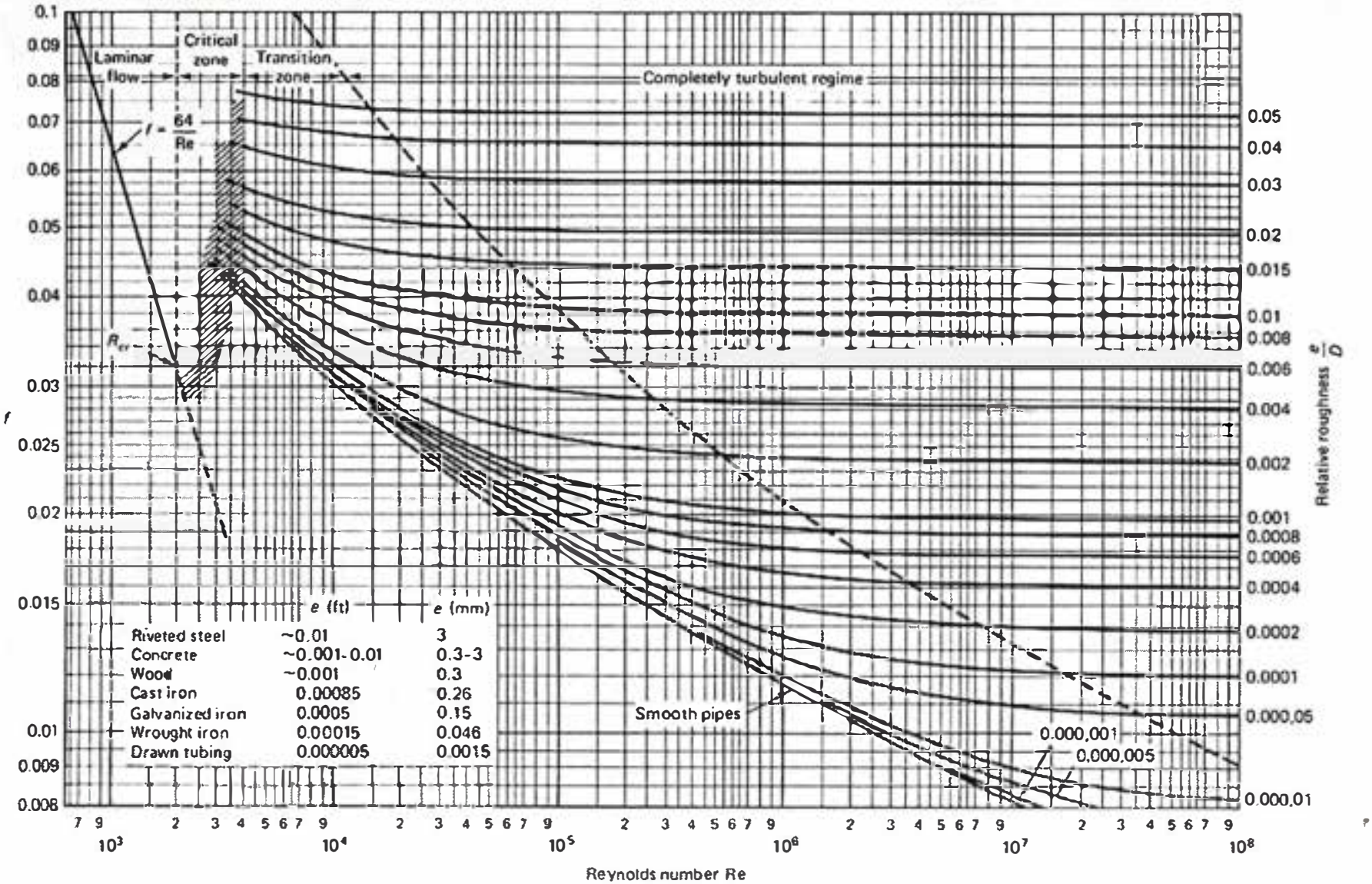


Figure 7.13 Moody diagram. (From L. F. Moody, *Trans. ASME*, Vol. 66, 1944.)