# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination, Spring-2010
## Program: B. Sc Engineering (Civil)

**Course Title: Principles of Accounting** **Course Code: ACN301**
**Time: 2 Hours** **Full Marks-50**

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**Answer All Questions**

**1.** X Ltd. is a manufacturing organization. The following information has been obtained from the ledger accounts of the company. **15**

| Accounts Title | Amount(Tk.) |
|---|---|
| Raw materials inventory, January1, 2008 | 10,000 |
| Raw materials inventory, December 31, 2008 | 5,000 |
| Purchase of raw materials | 50,000 |
| Return of raw materials | 2,500 |
| Carriage inward for raw materials | 1,000 |
| Factory utilities | 7,000 |
| Direct labor cost | 12,000 |
| Factory depreciation | 6,000 |
| Factory insurance | 2,500 |
| Factory supplies | 1,500 |
| Sales | 2,52,500 |
| Goods Return from the customer | 2,500 |
| Indirect labor | 10,000 |
| Factory maintenance | 8,000 |
| Administrative expenses | 15,000 |
| Work in process inventory, January 1, 2008 | 7,000 |
| Work in process inventory, December 31, 2008 | 16,000 |
| Finished goods Inventory, January 1, 2008 | 8,000 |
| Finished goods Inventory, December 31, 2008 | 12,000 |
| Selling Expenses | 10,000 |
| Factory Heat & lighting | 5,000 |

Required:

1. Prepare a schedule of cost of goods sold for X Ltd.
2. Prepare an income statement for the year ended 2008.

**2.** **10**

(a) What is cost accounting? Why is it important to study cost accounting for engineers?

(b)In case of long-term contract, how the amount of profit to be transferred to profit and loss account is determined?

(c) Write short notes on the following:
Bank Reconciliation Statement, Capital Budgeting, Job Order Costing Vs. Process Costing

**3.** X Ltd. has invited tender for manufacturing chairs for their training room. Your company, Y Ltd., has decided to take part in this bid. You are an accountant of your company. Management asked you to calculate the price that should be charged to X Ltd. for each of the chair. Your have estimated that raw materials will be required as follows: Direct materials (wood) 250cft. per chair @Tk.10 per cft., Indirect materials Tk.500.

Ten hours of direct labor will be required. Labors work forty hours per week. Each labor is paid Tk.1000 per week. Other overheads are charged @150% of the direct labor cost. Pricing of your company products is done in a way to ensure 20% margin on the selling price.

Required:

1. What is the total manufacturing cost per chair? 10
2. What should be the total selling price per chair?

**4.** The following amounts have been spent on a contract still unfinished on 31st December 2009:

| | Tk. |
|---|---|
| Materials sent to site | 85,349 |
| Laborer engaged on site | 74,375 |
| Plant installed at site at cost | 15,000 |
| Direct expenditure | 3,167 |
| Establishment charges | 4,126 |
| Materials returned to store | 549 |
| Work certified | 1,95,000 |
| Cost of work not yet certified | 4,500 |
| Materials in hand, 31st December | 1,883 |
| Wages accrued at 31st December | 2,400 |
| Direct expenditure accrued at 31st December | 240 |
| Value of plant at 31st December | 11,000 |

The contract price has been agreed at Tk. 2,50,000 and cash has been received from the contractee amounting to Tk. 1,80,000

Requirement: 10 + 5 =15

1. Prepare Contract Account
2. Show all supporting calculation

# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination Spring 2010
## Program: B. Sc. Engineering (Civil)

Course Title: Engineering Mechanics I | Credit Hours: 3.0 | Course Code: CE 101
Time: 3 hours | Full Marks: 100 (= 10 × 10)

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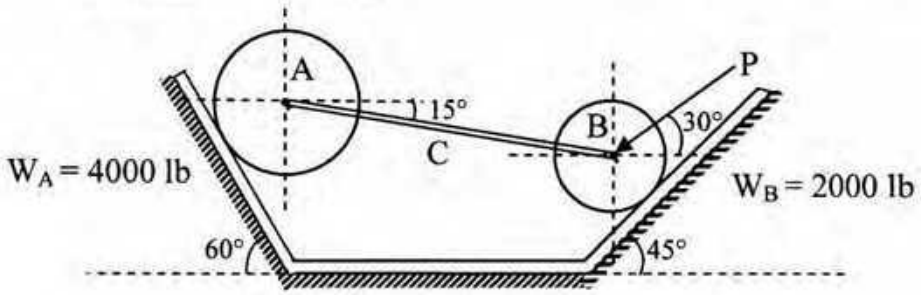
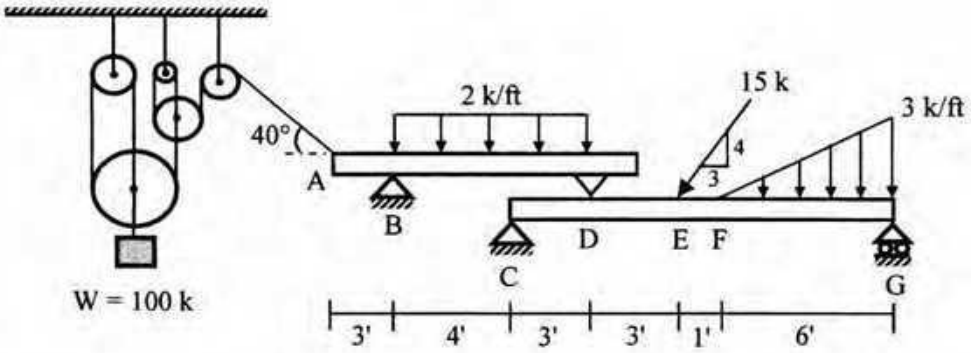
[Answer **any 10 (Ten)** of the following **14 (Fourteen)** questions]

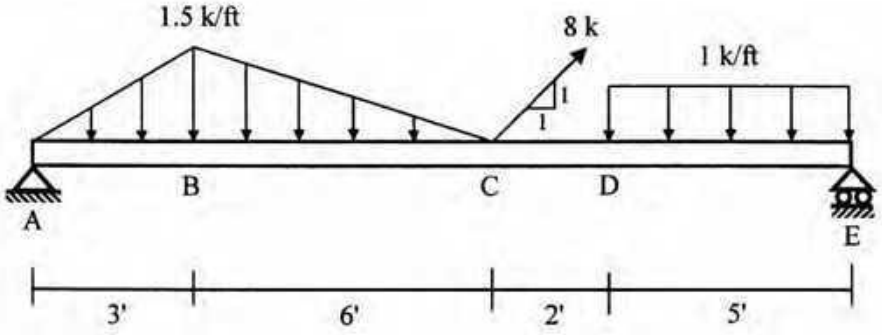
1. Two cylinders, **A** and **B** rest on smooth inclines. They are connected by a bar **C**. Find the force **P** to be applied to keep the system in equilibrium condition.



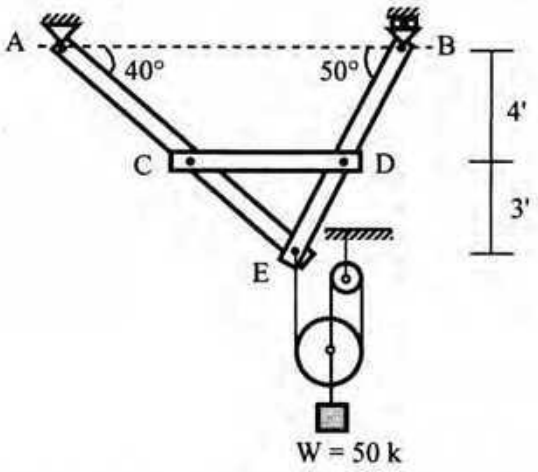

2. Refer to the following figure,
   i) Determine the support reactions at **B**, **C** and **G.**
   ii) Also calculate the shear force at right of point **E** and bending moment at point **E.**



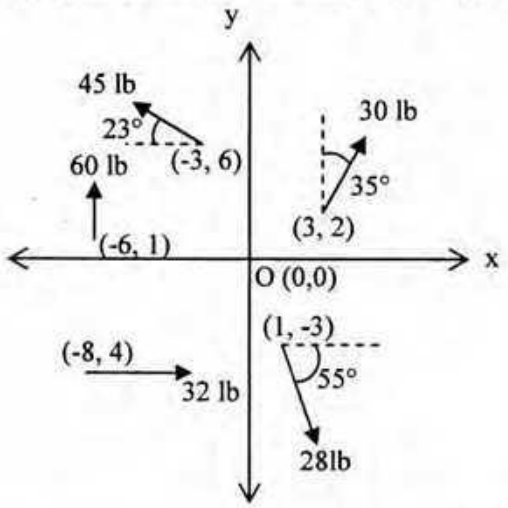

3. Determine the support reactions at **A** and **E** of the beam shown in the figure below. Also calculate the axial force, shear force and bending moment at point **D**.



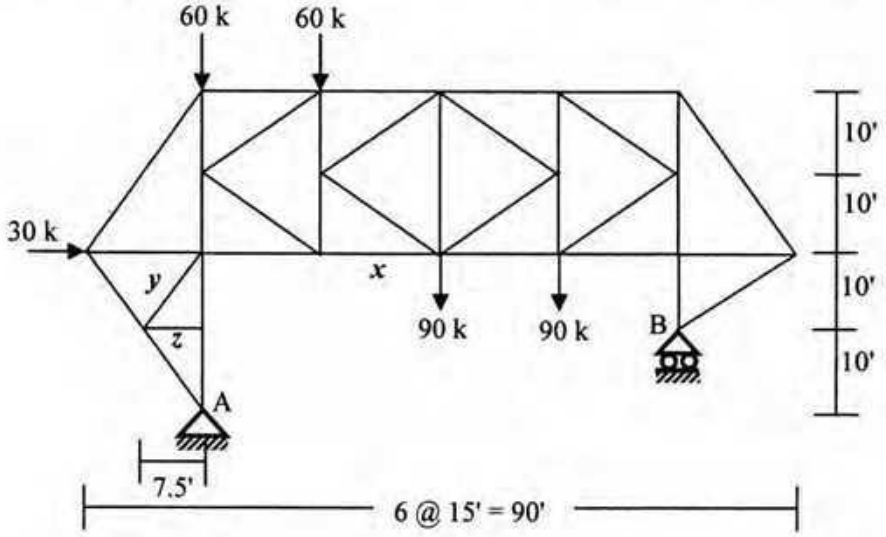
4. Determine the support reactions at **A** and **B** and force in the member **CD**.




5. Find the magnitude, direction and location of the resultant for the following force system.

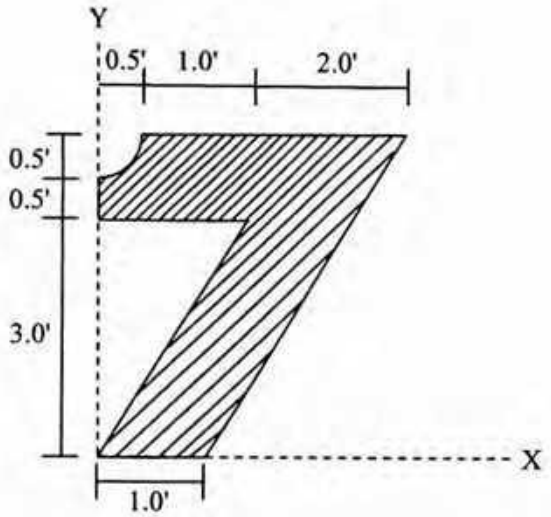



6. In the following figure, determine the support reactions at **A** and **B.** Also determine the forces in members ***x***, ***y*** and ***z***.

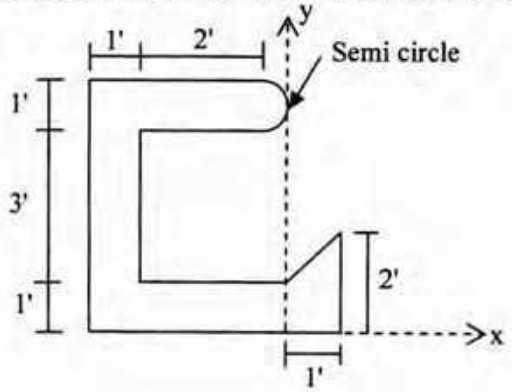


7. Derive the equation for the coordinates of centroid of a half circle having radius R.

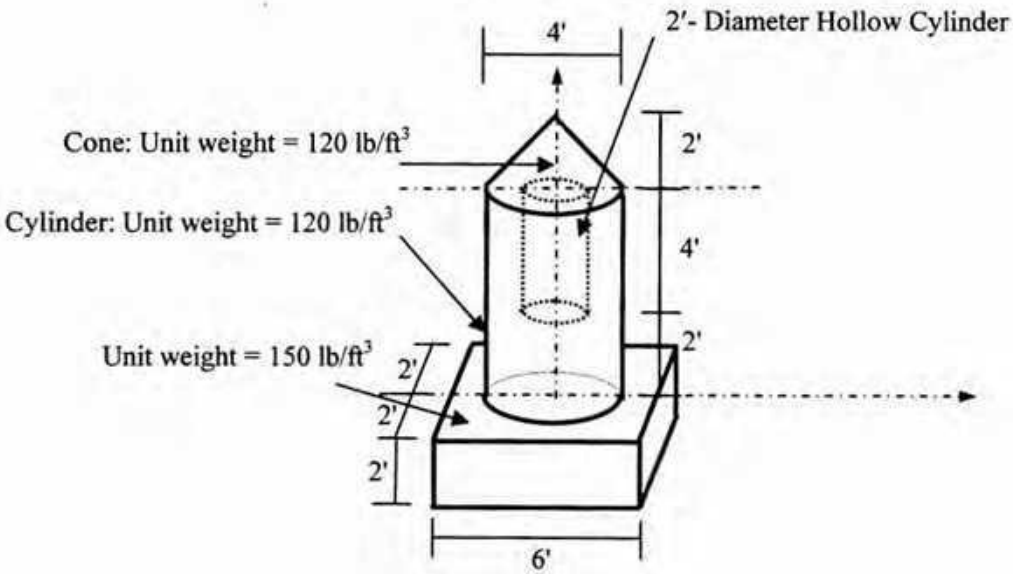
8. Locate the centroid of the shaded area shown below.



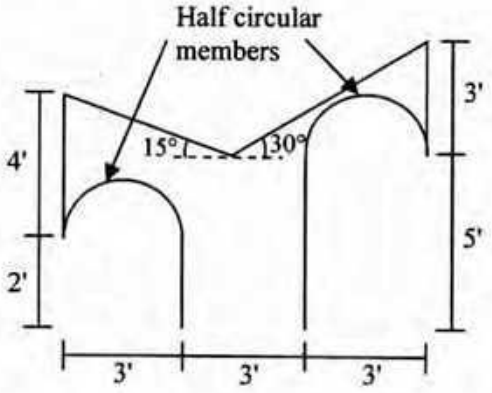

9. In the following figure, calculate the moments of inertia of the area about the *x*-axis and *y*-axis.



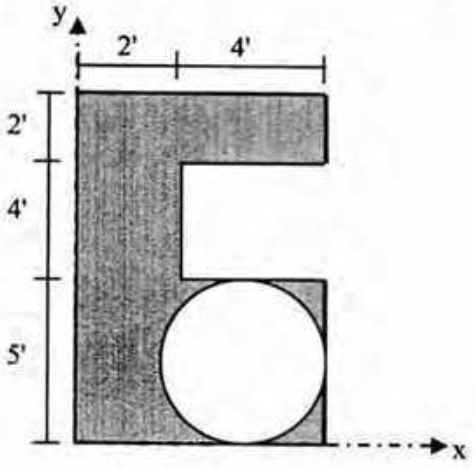

10. Locate the center of gravity of the composite body shown in the figure below.



11. Locate the centroid of the structure shown below by centerline dimensions. Half circular members weigh 50 lb/ft and other members weigh 30 lb/ft.




12. The centroid of the shaded area is $\bar{x} = 2.15'$, $\bar{y} = 6.65'$, while the centroidal moments of inertia are $\bar{I}_x = 360.73$ ft$^4$, $\bar{I}_y = 103.14$ ft$^4$. Calculate the minimum moment of inertia of the shaded area and show the corresponding principal axes.




13. A cable is suspended from two supports 200 ft horizontally apart and it carries 50 lb per ft uniformly distributed load horizontally. Left support is 20 ft lower than the right support and the sag appears 80 ft right from the lower support. Find the horizontal reactions at both of the supports.

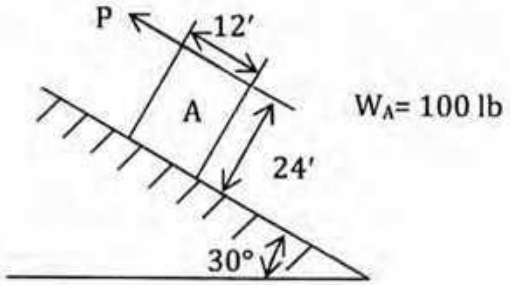
14. A cable which weighs 2 lb per ft is to have a sag of 7% of the span. The points of support are on the same level. If the maximum tension in the cable is 1485 lb, determine span length and length of the cable. Assume the cable to be parabolic.

# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination Spring 2010
## Program: B.Sc. Engineering (Civil)

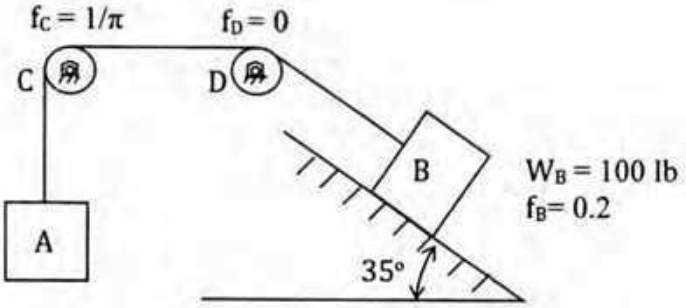
Course Title: Engineering Mechanics II | Credit: 3.00 | Course Code: CE 103
Time: 3.0 hours | Full Marks: 150 (=15 x 10)

[Answer **any 10 (Ten)** of the following **14 (Fourteen)** Questions]

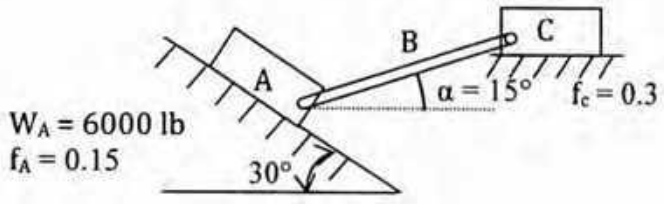
**1.** In the following figure, the force **P** acting parallel to the plane is such that the body **A** is about to tip over anti-clockwise. If tipping is to occur, the coefficient of friction must be greater than what value? **(15)**




**2.** As shown in the figure below, if the body **B** is to have motion impending down the plane, find the weight of **A**? **(15)**




**3.** In the following figure, the tendency of **A** is to move down the plane which results in a thrust on the body **C** through the member **AC**. If motion is impending, what is the weight of **C.** **(15)**



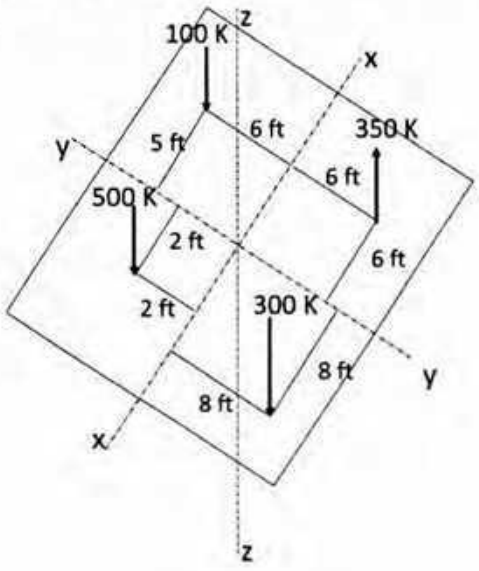
**4.(a)** Derive an expression for mass moment of inertia of a homogeneous right circular cylinder about its geometric axis. **(10)**

**(b)** If a cast-iron cylinder is 36" in diameter and 60" long, what is its mass moment of inertia about its geometric axis? Given cast-iron weights 450 lb per cu. ft. What is the corresponding radius of gyration? **(5)**

**5.** The linear acceleration of a particle is defined by the equation $a=t^3+3t^2$ fps$^2$. If it starts from rest, calculate the (i) Displacement, (ii)Velocity, (iii) Acceleration of the particle when t= 4 sec. (iv) What is its displacement in the 5$^{th}$ sec? **(15)**

**6.** The angular displacement of a rotating body follows the law $\theta = t - 0.1t^2$ rad, where t is in sec. Determine (i) Angular displacement, (ii) Angular velocity, (iii) Angular acceleration (iv)Tangential acceleration and (v) Normal acceleration after time interval t = 3 sec. Radius of the rotating body is 15" **(15)**

**7.** All forces in the following figure are in z direction. Determine the magnitude and location of the resultant force. **(15)**



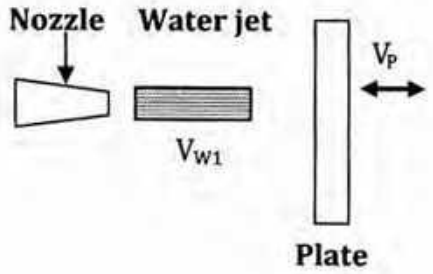

**8.** A 4-ft cylinder weighing 966 lb rolls down a 15° incline from rest. What is its speed after it has rolled 50 ft? Also calculate the work done by weight (ΔPE). **(15)**

9. A cylindrical jet of water from a nozzle 3" in diameter and moving with an absolute velocity of 30 fps, strikes a flat plate whose surface is at right angles to the jet as shown in the following figure. What is the force exerted by water on the plate: **(15)**

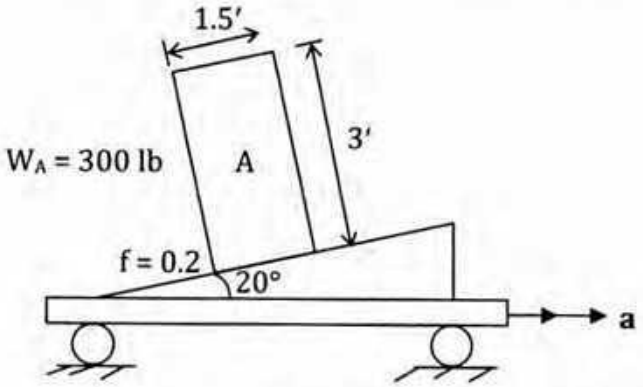
(i) If the plate is fixed, $\mathbf{V_p}$= 0 fps

(ii) If the plate is moving at $\mathbf{V_p}$= 8 fps in the same sense as the water.

(iii) If the plate is moving at $\mathbf{V_p}$= 8 fps in the sense opposite to that of the water.



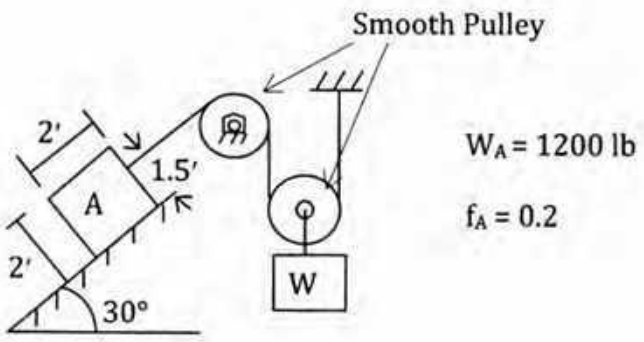

10. A homogeneous body **A**, is loaded on a truck on an inclined surface as shown in the figure below. **(15)**



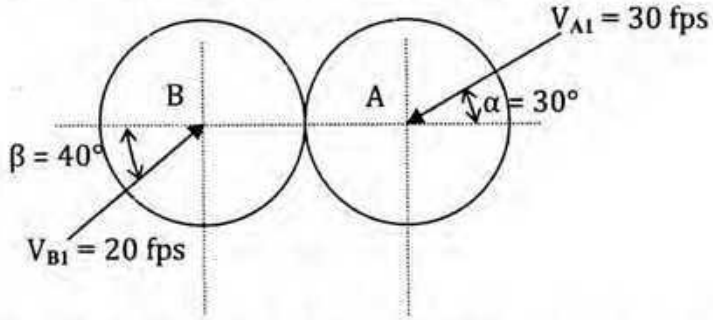

(a) Will the body tip over or slide if the acceleration of the truck, **a** is gradually increased?

(b) What is the maximum acceleration of the truck, if the body **A** is to maintain its equilibrium position on the inclined surface?

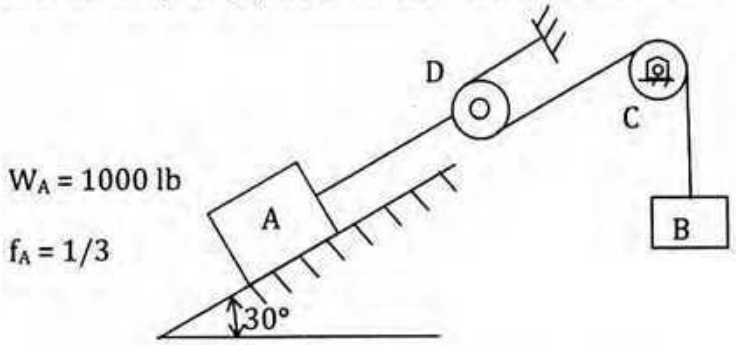
11. In the following figure; determine (a) the weight **W** when body **A** is on the point of turning over and (b) the corresponding tensions in the weightless cords. **(15)**



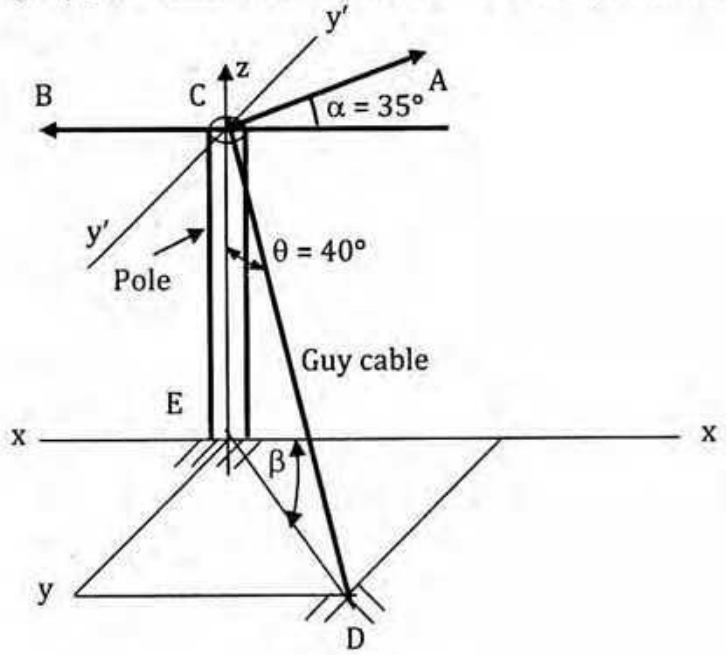
**12.** Two smooth spheres **A** and **B** of equal diameter collide with oblique central impact on a horizontal plane, as shown in the following figure. Each sphere weighs 8 lb. Coefficient of restitution is 0.75. What are the absolute velocities (including directions) of each sphere after impact? **(15)**




**13.** In the following figure, **C** and **D** are to be considered frictionless and weightless (a) If **A** moves 60 ft from rest up the inclined plane in 12 sec, what is the weight $\mathbf{W_B}$ of the body **B**? (b) What are the forces in the cables attached to **A** and **B**? **(15)**




**14.** Two cables **A** and **B** terminate on a pole as shown in the following figure and exert forces in the horizontal plane at **C**. The guy cable **CD** makes an angle θ = 40° with the pole and the anchor at **D** is to be so located that the pole will have only a compressive load. Let **A** = 5500 lb, **B** = 8000 lb and **CE** = 25′. Find the value of angle β, the tension in the cable **CD** and the compressive force acting on the pole. **(15)**



# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination Spring 2010
## Program: B.Sc. Engineering (Civil)

Course Title: Surveying | Course Code: CE 105
Time : 3 Hours | Full Marks: 150

*There are two sections in the question paper namely "**SECTION A**" and "**SECTION B**". You have to answer from both sections according to the instruction mentioned in each section.*

### SECTION A

There are **FOUR** questions in this section. Answer any **THREE.**

1. (a) What is Interpolation of contours? Discuss any method of Interpolation of contours. (2+7)
   (b) Differentiate between Plane and Geodetic surveying. (4)
   (c) Calculate the volume of earth work by Prisomoidal formula in a road embankment with the following data: (12)

| Chainage along the center line | 0 | 100 | 200 | 300 | 400 |
|---|---|---|---|---|---|
| Ground levels | 201.70 | 202.90 | 202.40 | 204.70 | 206.90 |

Formation level at chainage 0 is 202.30, top width is 2 ft side slopes are 2 to 1. The longitudinal gradient of the embankment is 1 in 100 rising. The ground is assumed to be level all across the longitudinal section.

2. (a) Explain the "closing error" of a compass survey. Show how you can adjust it by Graphical Method. (7)
   (b) ABCD is a closed traverse in which the bearing of AD has not been observed and the length of BC has been missed to be recorded. The rest of the field record is as follows: (15)

| Side | Bearing | Length (m) |
|---|---|---|
| AB | $181^0 18'$ | 335 |
| BC | $90^0 00'$ | ? |
| CD | $357^0 36'$ | 408 |
| DA | Roughly west | 828 |

   (c ) Differentiate between True and Magnetic Bearing. (3)

3. (a) What is Direct Levelling? (3)
   (b) What are the advantages and disadvantages of Plane Table Surveying? (6)
   (c) The following consecutive readings were taken with a level (16)
   6.31, 5.92, 6.12, 8.42, 9.81, 6.64, 7.92, 10.21,9.22,7.32,7.45
   The level was shifted after 3rd, 6th and 9th readings. The reduced level at first point was 150 ft. Calculate the reduced levels of the points by using Height of Instrument Method and apply usual arithmetic check.

4. (a) What is contour? What are the characteristics of contour? (2+5)
   (b) Prove, $C = 6/7 (D^2/2R)$, here the symbols have their usual meanings. (8)
   (c) The length of a line measured with a 20 m chain was found to be 250 m. Calculate the true length of the line if the chain was 10 cm too short. (3)
   (d) The following perpendicular offsets were taken from a property line to a chain line. Calculate the area between the survey line and property line by using Simpson's rule. (7)

| Chainage (ft) | 0 | 20 | 40 | 60 | 70 | 80 | 90 | 100 | 140 | 160 |
|---|---|---|---|---|---|---|---|---|---|---|
| Offsets (ft) | 6.5 | 9.9 | 10.5 | 12.5 | 10.7 | 9.5 | 8.1 | 7.9 | 6.8 | 5.7 |

## SECTION B

There are **FOUR** questions in this section. Answer any **THREE.**

5. (a) Derive the relation between the radius and degree of curvature for a simple circular curve using the arc definition and chord definition of curvature. (8)
   (b) Two tangents intersect at chainage 15+60, the deflection angle being 80° 52′. Calculate the necessary data of various chord lengths and tangential angles for setting out a curve of 20 chain radius to connect the two tangents, if it is intended to set out the curve by Rankin's method of tangential angles. Consider peg interval equals to 100 links, length of the chain being equal to 20 m (100 links). (17)

6. (a) Define (i) Vertical Photograph (ii) Oblique Photograph (iii) Tilted Photograph (iv) Flying height (v) Flight Line. What are the reasons for overlapping? (10)
   (b) An aircraft has been planned to fly over a defined territory to prepare a map of that area. The flying height has been adjusted to a height of 200 m from a terrain having an elevation of 400 m relative to a predefined datum. The territory covers an area of 13 km x 17 km. The scale of the photograph is 1 cm = 350 m. The photograph size is 15 cm x 15 cm. Determine the number of photographs to cover the area, if the desired overlap is 60% and the side lap is 35%. (15)

7. (a) Define (i) Celestial Poles and Celestial Equator (ii) Celestial Horizon (iii) Zenith and Nadir. Draw necessary sketches. (5)
   (b) Find the shortest distance between two places **S** and **T**, given that the latitude of **S** and **T** are 40° 10′ N and 30° 20′ N and their longitudes are 50° 20′ E and 55° 28′ E respectively. Find also the direction of **S** on the great circle route. (20)

8. (a) Find the zenith distance and altitude at the upper transit of the star having the declination of 63° 45′ N and the latitude of 25° 40′ N. (5)
   (b) A camera having focal length of 20 cm is used to take a vertical photograph to a terrain having an average elevation of 1500 m. What is the height above mean sea level at which an aircraft must fly in order to get the photograph at a scale of 1: 5000? (10)
   (c) A transition curve is required for a circular curve of 280 m radius, the gauge being 200 cm and maximum super-elevation restricted to 170 mm. The transition curve is to be designed for a velocity such that no lateral pressure is imposed on the rails and the rate of gain of radial acceleration is 20 $cm/sec^3$. Calculate the required length of the transition curve and the design speed. (10)

**Given formula:**

1. $\cos P = \dfrac{\cos p - \cos a * \cos b}{\sin a * \sin b}$

2. $\tan(A+B)/2 = \cot(P/2) * \dfrac{\cos(a-b)/2}{\cos(a+b)/2}$

3. $\tan(A-B)/2 = \cot(P/2) * \dfrac{\sin(a-b)/2}{\sin(a+b)/2}$

4. $z = \delta - \theta, \quad \alpha = 90^\circ - z$

5. $T = R\dfrac{\Delta}{2}, \quad l = \dfrac{\pi R \Delta}{180^\circ}, \quad \delta = 1718.9\dfrac{c}{R}$

6. $O_1 = \dfrac{c^2}{2R}, \quad O_2 = \dfrac{C}{2R}(c+C), \quad O_3 = ..... = O_{n-1} = \dfrac{C^2}{R}, \quad O_n = \dfrac{c'}{2R}(C+c')$

7. $L_{transition} = \dfrac{v^3}{\alpha R}, \quad \Delta_s = 1719\dfrac{L}{R}, \quad \Delta_c = \Delta - 2\Delta_s, \quad L_{circular} = \dfrac{\pi R \Delta_c}{180^\circ}, \quad s = \dfrac{L^2}{24R}, \quad \tan\theta = \dfrac{v^2}{gR}$

8. $T = (R+s)\tan\Delta + \dfrac{L}{2}$

9. $s_h = \dfrac{f}{H-h}, \quad L = (1-p_l)sl, \quad W = (1-p_w)sw$

10. $a = L \times W, \quad N = \dfrac{A}{a}$

11. $N_1 = \dfrac{L_1}{(1-p_l)sl} + 1, \quad N_2 = \dfrac{L_2}{(1-p_w)sw} + 1$

12. Level Section $A = (b + nh)\, h$
13. Two-Level Section $A = \{n\,(b/2)^2 + m^2\,(b+nh)h\}/(m^2-n^2)$
14. Three-Level Section $A = \{b\,(h_1+h_2)/4 + h\,(w_1+w_2)/2\}$

$w_i = m_i n/(m_i - n)\,(h + b/2n)$

$h_1 = m_1 n/(m_1 - n)\,(h + b/2m_1)$

$h_2 = m_2 n/(m_2 - n)\,(h - b/2m_2)$

**Note:** Here the symbols have their usual meanings.

# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination Spring- 2010
## Program: B.Sc. Engineering (Civil)

Course Title: Introduction to Civil & Environmental Engineering | Course Code: CE 107 | Credit: 2.00

Time: 1 hour | Full Marks: 40

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There are **TWO** sections in the question paper namely "SECTION A" and "SECTION B". You have to answer from the both sets according to the instruction mentioned on each section.

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### SECTION A
Marks: 15

Answer all questions

(1+2=3)

1. What are the rural environmental issues? How do you think we can adapt these issues?.

(2+2=4)

2. What is Global warning and how it occurs? "The trapping heat in the atmosphere is somewhat analogous to greenhouse"- explain.

(2+2=4)

3. What are the general effects of air pollution? Describe different sources of air pollution.

(1+3=4)

4. What is acid rain? Show with neat sketches how Sulfurous Smog and Photochemical Smog develop.

### SECTION B
Marks: 35

Answer all questions and follow the instructions.

(5+3+4=12)

1. a. Give the names in details of the following codes with their related fields,

   i. AASHTO ii. ACI iii. AREA iv. ASTM v. BNBC

   b. How can you ensure satisfactory quality of cement in the field?

   c. One foreign company proposes the implementation of an underground transportation system under build and transfer basis (BOT) to ease the traffic congestion in Dhaka city. Mention the various steps to be followed by the company during the implementation of the project.

   d. Define the following terms:

   i. Height of the Building ii. Floor Area Ratio (FAR)

   iii. High rise building iv. Road width

**Or,**

(3+3+3+3=12)

1. a. Define contract. Write down the name of various types of contract.
   b. What do you mean by planning and scheduling of a project?
   c. Write down the organogram of Bangladesh Roads & Highways Department (RHD).
   d. Describe the road transportation network in Bangladesh.

(10)

2. The University of Asia Pacific is planning to construct a seven storied building under its own supervision. As its fund is limited, the university wants to take loan from a financial institution. Financial institution provides maximum 70% loan of the total construction cost. Estimate the total construction cost and the amount of money to be borrowed as per the PWD schedule (enclosed). The particulars of the building are as follows:

| Sl No | Particulars | Specifications |
|---|---|---|
| 01 | Land Size | 50 m x 60 m |
| 02 | Road width | 20 m |
| 03 | Building type | Educational (Standard) |
| 04 | Allowable Bearing Capacity ($Q_a$) | 3.0 ksf |
| 05 | Floor Level | Seven |
| 06 | Plinth Area | 1500 Square meter (40 m x 37.5 m) |
| 07 | Type pf structure | RCC Frame Structure , Concrete with Stone Chips, fc=22-25 MPa |
| 08 | Ground Floor | 50% Car Parking and 50% Habitation |
| 09 | Lime terracing, RCC cornice and parapet | 0.92 m height |
| 10 | Roof top RCC water tank including beams and supports etc | 10,000 Gallons |
| 11 | For mosaic work in all rooms including stair, tiles in bathrooms and normal finishing | Tk.950 per square meter |
| 12 | Underground water reservoir, distribution line, water pump, pump house, WASA charge | 1,20,000 Gallons |
| 13 | Boundary wall | RCC frame |

(1+1+4+1+2+1+3=13)

3. Mr. Rahim purchased a 40 m wide (front side) and 50 m long plot. The adjacent road is 12 m wide. He wants to construct a five storied residential building (Type A2) on his plot. His architect wants to prepare a drawing sheet for RAJUK approval. Calculate the followings for the Architect:

   (i) Minimum front set back as per RAJUK rules?

   (ii) Back and side set backs as per RAJUK rules?

   (iii) If you keep front, back and side set back as per RAJUK minimum setback rules, then what will be the ground coverage of the building? Doest it complies with maximum ground coverage as per RAJUK rules, explain? If not, then what will be the back set back (take 0.25 m rounding) if, front setback 12.5 m and side setback 5 m in each side. Draw layout plan and find out the plinth area of the building as per RAJUK ground coverage rules?

(iv) What is the Floor Area ration (FAR) of the building for 50% ground coverage? Does it comply with RAJUK rules, explain? Do not consider ground floor area while calculating total floor area.

(v) What is the available and minimum required parking space? Assume, (a) Generator room 30 sqm (b) Guard room 5 sqm (c) Driver waiting room 5% of the plinth area (d) stair and lift area (total) 100 sqm (e) Apartment size 250 sqm (gross) and No of apartment in each floor is 4 (FOUR). (f) drive way 60% area of paring space. (g) 50 % ground coverage.

(vi) Find the maximum number of floor levels that can be constructed. Assume ground floor area is reserved for car paring and other purposes and do not consider ground floor area while calculating total floor area.

(vii) If he wants to construct fifteen storied building, then what will be the ground coverage? Assume ground floor area is reserved for parking and other purposes and do not consider ground floor area while calculating total floor area.

**Table:** FAR, Maximum Allowable Land Use and Minimum Width of Adjacent Road (Source: RAJUK)

| Building Occupancy Type | | 1300to≤2600 Sq. metre | | | ≥ 2600 Sq. metre | | |
|---|---|---|---|---|---|---|---|
| | | FAR | Max$^{m}$ Land Use (%) | Min$^{m}$ Road Width (m) | FAR | Max$^{m}$ Land Use (%) | Min$^{m}$ Road Width (m) |
| Type A : Residential | A1-A4 | 5.5 | 50 | 12 | 6.0 | 50 | 18 |
| | A5 | 5.0 | 50 | 12 | - | 50 | 18 |

*Table:* PARKING AND TRAFFIC REGULATION STANDARD

| Car Type | Parking width | Parking Length | Area |
|---|---|---|---|
| Car | 2.4 m | 4.8m | 11.52 sqm |
| Bus & Truck | 3.6 m | 10.0m | 360 sqm |

*Table:* MINIMUM PARKING REQUIREMENTS

| Occupancy Type | Building Type | Minimum Parking Requirements |
|---|---|---|
| **Residential buildings** | **Type A** | |
| Flats with gross floor area exceeding 200 sqm | | 1 Car parking for each unit |

*Table:* ***MINIMUM SETBACK***

**A. FRONT SETBACK:**

The minimum setback is the larger value of 4.5 metres from the centre of the road or 1.5 meter from the front property line.

**B. FOR SIDE SETBACK UPTO 10 STORIED OR 33.00 M HIGH BUILDING:**

| Size of the plot (sqm) | Minimum back setback (m) | Side setback(m) |
|---|---|---|
| 1301 and higher | 2.00 | 1.50 |

# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination Spring- 2010
## Program: B.Sc. Engineering (Civil)

Course Title: Introduction to Civil & Environmental Engineering | Course Code: CE 107 | Credit: 2.00

Time: 2 hours | Full Marks: 50

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There are **TWO** sections in the question paper namely "SECTION A" and "SECTION B". You have to answer from the both sections according to the instruction mentioned on each section.

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### SECTION A

Total Marks: 15

Answer any THREE

1. Define contract. Write down the name of various types of contract. (5)

2. a. Define planning and scheduling of a project with example?
   b. Write down the organogram of Bangladesh Roads & Highways Department (RHD). (5)

3. Write down the name of few types of equipment commonly used in construction works. The use of equipments in construction work has no benefits- Do you agree with this statement, explain. (5)

4. Describe the road transportation network in Bangladesh.

### SECTION B

Total Marks: 35

Answer all questions and follow the instructions.

1. Describe the followings (any three): (2x3=6)
   a) Meteorological and Hydrological Drought
   b) Age structure
   c) Water resources in Bangladesh
   d) Sustainability issues
   e) Environmental Engineering

(1+3=4)

2. Define water pollution. Briefly discuss any three water pollutants with their sources and their effects on human and nature.

(1+4=5)

3. What do you mean by ecosystem? Discuss different types of ecosystem and its different components.

(2)

4. In the year 2001 the population of Dhaka city was 55 lakh. When the population of Dhaka city will be doubled with a growth rate of 2.4%. Assume population follows exponential curve.

(3)

5. Flood water put raw sewage into Buriganga river. What will be the possible relationship between dissolve oxygen and biochemical oxygen demand (BOD) along the up and downstream from the point of pollution? Explain with diagram

(1+3=4)

6. Define the maximum sustainable yield. Find out the maximum sustainable yield as a function of carrying capacity, the current population size and current growth rate.

(4)

7. Suppose we stock a pond with 120 fish and note the population doubles every year for the first couple of years with no harvesting but after quite a number of years, the population stabilizes at its carrying 2020 fish. Growth seems to have followed a logistic curve. What would be the maximum sustainable fish yield from this pond?

(1+3=4)

8. What is acid rain? Show with neat sketches how Sulfurous Smog and Photochemical Smog develop.

(1+2=3)

9. What are the rural environmental issues? How do you think we can adapt these issues?

# The University of Asia Pacific
# Department of Civil Engineering
# Final Examination Spring 2010
# Program: B. Sc. Engineering (Civil)

Course Title: Engineering Materials | Course Code: CE 201
Time: 3 Hours | Full Marks: 150

There are EIGHT Questions. Answer **SIX QUESTIONS including Question No. 1 and Question No. 2. QUESTIONS 1 & 2 are COMPULSORY.**

**1** Concrete mix design is required for a residential building construction project based on the following data: (40)

Volume ratio of sand to total aggregate = 0.38
Air Content = 1 % (air-entraining admixture is not used)
Specific gravity of cement = 3.1
Specific gravity of sand (SSD) = 2.60
Specific gravity of coarse aggregate (SSD) = 2.65
Design compressive strength (28 days) = 4500 psi
Minimum required slump = 175 mm
Maximum aggregate size = ¾ inch, Aggregate type = stone chips

The following graphs are provided :

- Variation of compressive strength (28 days) with W/C.
- Variation of cement content with compressive strength (28 days) for different aggregate size and slump value

(i) Calculate the unit contents of cement, water, sand, and coarse aggregate.
(ii) Prepare a mixture proportion.
(iii) Calculate the volume ratio of the mix (assume unit weights of cement, sand (SSD), and coarse aggregate (SSD) with void are 1300 kg/m$^3$, 1350 kg/m$^3$ and 1450 kg/m$^3$, respectively).
(iv) Calculate the cost of concrete for one cubic meter. Assume the cost of 1 bag cement = Tk. 400, cost of 1 cft sand = Tk. 25, and cost of 1 cft stone chips = Tk. 100.
(v) Estimate the materials in weight and volume (cement, water, sand, and coarse aggregate) required to cast 15 beams of 12 inch width 20 inch depth and 20 feet span.
(vi) Assume 4% surplus water in sand over SSD condition and the amount of bulking of sand = 12%. What adjustments are necessary in mix design?
(vii) After making a trial mix of concrete using the mix design, it is found that the slump of concrete is significantly lower than the design slump of 175 mm. Explain the reasons related to this observation.
(viii) Explain the advantages and disadvantages of volumetric and weight based mix designs.

2 For a bridge construction project, the recommended FM was 2.6 for sand and 6.6 for stone chips. From a nearby market, sand and stone chip samples were collected and sent to the Concrete Laboratory of The University of Asia Pacific (UAP) for sieve analysis. The sieve analysis data are given below: (22)

| ASTM Sieve | Amount Retained (g) | |
|---|---|---|
| | Sand | Stone Chips |
| 3 inch | 0 | 0 |
| 1.5 inch | 0 | 0 |
| 1.06 inch | 0 | 0 |
| ¾ inch | 0 | 2000 |
| 5/8 inch | 0 | 2000 |
| 3/8 inch | 0 | 500 |
| #4 | 0 | 450 |
| #8 | 50 | 0 |
| #12 | 50 | 0 |
| #16 | 5 | 0 |
| #30 | 5 | 0 |
| #40 | 50 | 0 |
| #50 | 50 | 0 |
| #100 | 50 | 0 |
| #200 | 45 | 0 |
| Pan | 45 | 50 |

(i) Calculate the FM of the samples.
(ii) Draw the grading curve of the samples.
(iii) Discuss the possible ways to improve the FM of the samples to the recommended values.
(iv) Comment on the samples based on the sieve analysis data and grading curves.

Aperture/Sieve Openings are given in the attached sheet.

**3 (a)** Draw the typical stress-strain curves of concrete and steel. Make a brief comparison on the curves. (2.5)

**(b)** Explain how yield strength is determined for high-strength steel. (2.5)

**(c)** Define the following mechanical properties of a material: (3)
(i) Malleability
(ii) Creep
(iii) Relaxation

**(d)** Compare clamp burning and kiln burning process of brick. (3)

**(e)** Explain the strength development process of brick during burning. (3)

**(f)** How do you check the consistency of brick earth before moulding? (3)

**(g)** Explain how the brick industries are polluting the environment in Bangladesh. (3)

**(h)** Explain the relationship between the compressive strength and tensile strength of concrete. (2)

| | | |
|---|---|---|
| **4 (a)** | Explain the evolution of heat of hydration of cement with time. | (5) |
| **(b)** | Write the morphology of hydration products of cement. | (5) |
| **(c)** | Compare fly ash cement and ordinary Portland cement. | (4) |
| **(d)** | Write the ASTM specifications for normal consistency, initial setting time, and final setting time of OPC. | (3) |
| **(e)** | Explain how cement industries are polluting the global environment. Explain the ways to reduce the pollution from the cement industries. | (3) |
| **(f)** | Discuss the role of gypsum in cement. | (2) |
| **5 (a)** | Explain the seawater attack of concrete with chemical reactions. | (8) |
| **(b)** | Assume that you are in-charge of a hotel construction project at Cox's Bazar. List and discuss the important precautions that you will seriously consider to ensure the durability of the project. | (6) |
| **(c)** | Define workability of concrete. How is it measured? | (2) |
| **(d)** | "W/C ratio is a key parameter related to durability of concrete" – explain briefly. | (2) |
| **(e)** | Explain the variation of stress-strain curves of concrete with the variation of rate of loading. | (4) |
| **6 (a)** | Discuss the changes of strength and workability of concrete for the following situations:<br>(i) W/C is increased at site<br>(ii) Fine sand is used instead of coarse sand<br>(iii) More water reducing admixture is used<br>(iv) Shingles are used instead of brick chips<br>(v) Sand-to-aggregate volume ratio is reduced. | (5) |
| **(b)** | "Cube strength of concrete is higher than the cylinder strength of concrete" – why? | (3) |
| **(c)** | Write short notes on the followings:<br>(i) Bulking of sand<br>(ii) High performance concrete<br>(iii) Ferrocement<br>(iv) Mineral admixture<br>(v) Chemical admixture | (5) |
| **(d)** | Discuss five important factors related to the compressive strength of concrete. | (5) |
| **(e)** | How do you calculate the Young's modulus of concrete from the stress-strain curve of concrete? Discuss the relationship between the compressive strength and Young's modulus of concrete. | (4) |
| **7 (a)** | How are steel bars protected from corrosion in concrete? Explain briefly chloride-induced corrosion and carbonation-induced corrosion of steel bars in concrete. | (5) |
| **(b)** | Discuss the preventive measures necessary for concrete works in hot weather. | (4) |
| **(c)** | Discuss the water reducing mechanism of superplasticizer in concrete. | (3) |
| **(d)** | What is false setting of cement? How is it controlled? | (5) |
| **(e)** | Compare hydraulic cement and pozzolanic cement. | (2) |
| **(f)** | Write the properties of good quality sand sample. | (3) |

8 (a) Write the importance of seasoning timber. Compare sap wood and heart wood. (3)

(b) Explain three common defects of timber. (2)

(c) Explain the formation of annual rings of timber. (3)

(d) Write short notes on the followings: (6)

(i) Use of plastics in Civil Engineering works
(ii) Atomic packing factor
(iii) Metallic bond
(iv) Electroplating

(e) Draw the strength versus time curves for the following concrete with different curing conditions: (3)

(i) Continuous under water curing
(ii) 3-Day under water curing
(iii) No curing

(f) Discuss the functions of sand, cement, and water in concrete. (3)

(g) Compare plastic shrinkage and autogeneous shrinkage of concrete. (2)

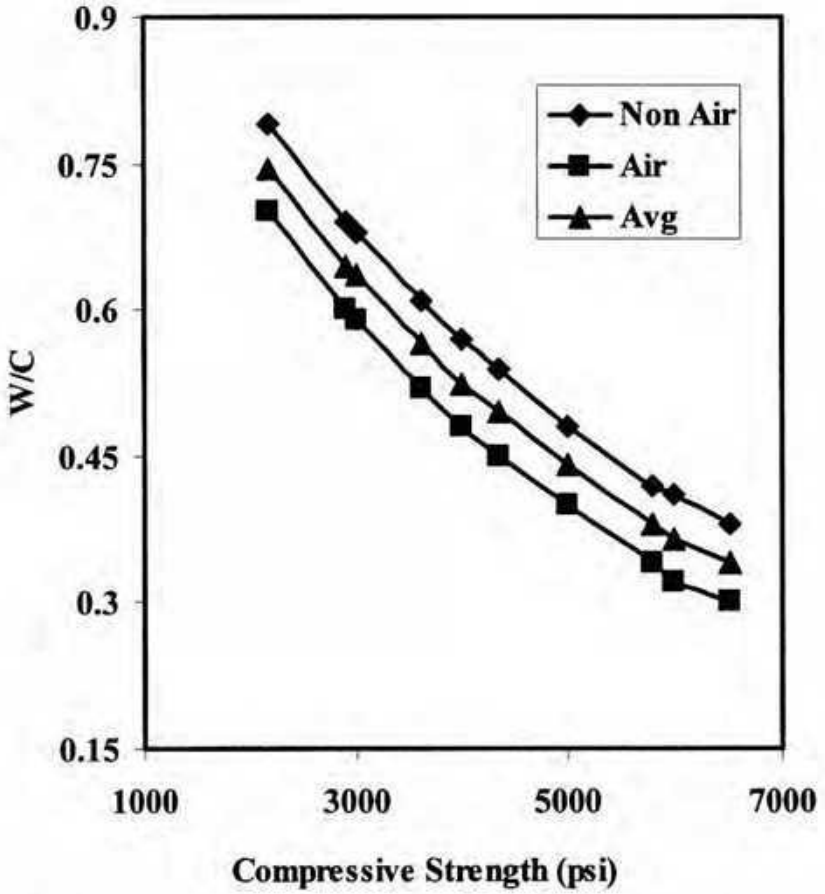



**Fig. W/C versus Compressive Strength (aggregate type = stone chips)**

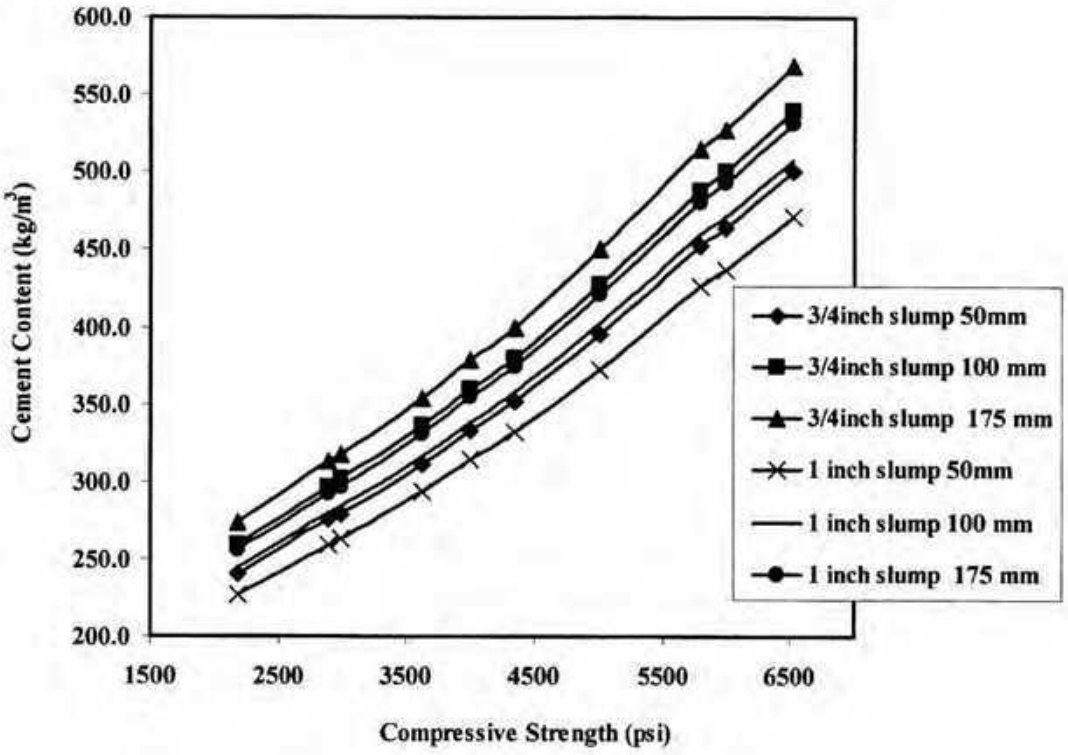



**Fig. Cement Content versus Compressive Strength (aggregate type = stone chips)**

**Table** Traditional American and British Sieve Sizes

| *Aperture mm or μm* | *Approximate Imperial equivalent in.* | *Previous designation of nearest size* | |
|---|---|---|---|
| | | *BS* | *ASTM* |
| 125 mm | 5 | — | 5 in. |
| 106 mm | 4.24 | 4 in. | 4.24 in. |
| 90 mm | 3.5 | $3\frac{1}{2}$ in. | $3\frac{1}{2}$ in. |
| 75 mm | 3 | 3 in. | 3 in. |
| 63 mm | 2.5 | $2\frac{1}{2}$ in. | $2\frac{1}{2}$ in. |
| 53 mm | 2.12 | 2 in. | 2.12 |
| 45 mm | 1.75 | $1\frac{3}{4}$ in. | $1\frac{3}{4}$ in. |
| 37.5 mm | 1.50 | $1\frac{1}{2}$ in. | $1\frac{1}{2}$ in. |
| 31.5 mm | 1.25 | $1\frac{1}{4}$ in. | $1\frac{1}{4}$ in. |
| 26.5 mm | 1.06 | 1 in. | 1.06 |
| 22.4 mm | 0.875 | $\frac{7}{8}$ in. | $\frac{7}{8}$ in. |
| 19.0 mm | 0.750 | $\frac{3}{4}$ in. | $\frac{3}{4}$ in. |
| 16.0 mm | 0.625 | $\frac{5}{8}$ in. | $\frac{5}{8}$ in. |
| 13.2 mm | 0.530 | $\frac{1}{2}$ in. | 0.530 in. |
| 11.2 mm | 0.438 | — | $\frac{7}{16}$ in. |
| 9.5 mm | 0.375 | $\frac{3}{8}$ in. | $\frac{3}{8}$ in. |
| 8.0 mm | 0.312 | $\frac{5}{16}$ in. | $\frac{5}{16}$ in. |
| 6.7 mm | 0.265 | $\frac{1}{4}$ in. | 0.265 in. |
| 5.6 mm | 0.223 | — | No. $3\frac{1}{2}$ |
| 4.75 mm | 0.187 | $\frac{3}{16}$ in. | No. 4 |
| 4.00 mm | 0.157 | — | No. 5 |
| 3.35 mm | 0.132 | No. 5 | No. 6 |
| 2.80 mm | 0.111 | No. 6 | No. 7 |
| 2.36 mm | 0.0937 | No. 7 | No. 8 |
| 2.00 mm | 0.0787 | No. 8 | No. 10 |
| 1.70 mm | 0.0661 | No. 10 | No. 12 |
| 1.40 mm | 0.0555 | No. 12 | No. 14 |
| 1.18 mm | 0.0469 | No. 14 | No. 16 |
| 1.00 mm | 0.0394 | No. 16 | No. 18 |
| 850 μm | 0.0331 | No. 18 | No. 20 |
| 710 μm | 0.0278 | No. 22 | No. 25 |
| 600 μm | 0.0234 | No. 25 | No. 30 |
| 500 μm | 0.0197 | No. 30 | No. 35 |
| 425 μm | 0.0165 | No. 36 | No. 40 |
| 355 μm | 0.0139 | No. 44 | No. 45 |
| 300 μm | 0.0117 | No. 52 | No. 50 |
| 250 μm | 0.0098 | No. 60 | No. 60 |
| 212 μm | 0.0083 | No. 72 | No. 70 |
| 180 μm | 0.0070 | No. 85 | No. 80 |
| 150 μm | 0.0059 | No. 100 | No. 100 |
| 125 μm | 0.0049 | No. 120 | No. 120 |
| 106 μm | 0.0041 | No. 150 | No. 140 |
| 90 μm | 0.0035 | No. 170 | No. 170 |
| 75 μm | 0.0029 | No. 200 | No. 200 |
| 63 μm | 0.0025 | No. 240 | No. 230 |
| 53 μm | 0.0021 | No. 300 | No. 270 |
| 45 μm | 0.0017 | No. 350 | No. 325 |
| 38 μm | 0.0015 | — | No. 400 |
| 32 μm | 0.0012 | — | No. 450 |

# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination Spring 2010
## Program: B.Sc. Engineering (Civil)

Course Title: Numerical Analysis & Computer Programming — Course No: CE 205
Time: 3.0 hours — Full Marks: 150

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

**1. (a)** Use Modified Euler method to evaluate the numerical solution of the following ordinary differential equation, for x = 0.1 **(15)**

$$\frac{dy}{dx} = \frac{y-x}{y+x}$$

Here, y = 1 at x = 0.
Desired accuracy, ε = 0.001.

**(b)** Using iteration method, find a real root of the equation $2x = \cos x + 3$. Desired accuracy is 0.0001. Start with x = 1. **(10)**

**2.** Fit a 2nd Degree Parabolic Curve using the following data, where x is an independent variable. Find the value of y corresponding to x = 3.85 from the fitted curve. **(25)**

| x | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| y | 2 | 6 | 7 | 8 | 10 |

**3.** For the following data, **(25)**

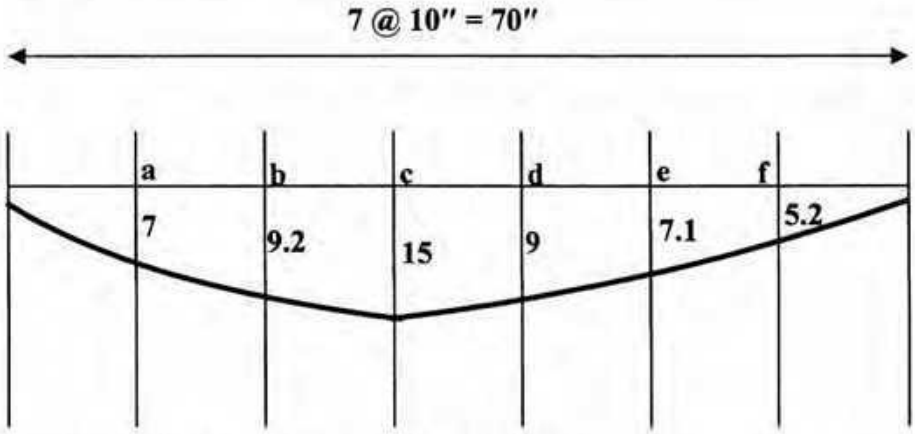
| Time (sec) | 0 | 20 | 40 | 60 |
|---|---|---|---|---|
| Speed (mps) | 0.000 | 0. 0745 | 0.249 | 0.561 |

(i) Derive the Gregory Newton Interpolation polynomial.
(ii) Calculate the speed at time, t = 53 sec.

**4. (a)** Using Bisection method, find a root of the following equation: **(15)**
$4x - \sqrt{1+\sin 2x} = 0$. Desired accuracy = 0.0001.

**(b)** Using the Simpson's rule, evaluate the following integral: **(10)**
$\int_0^8 \sqrt{1+x^3}\, dx$, consider eight equal subdivisions.

**5. (a)** Experimentally observed values of deflections of a beam are shown in the following figure. **(15)**




All deflections of the above figure are in ($\times 10^{-4}$) inch.
Using the Difference Table Calculate :

(i) The bending moments (M= $-EID^2y$) at points **c** and **f**.
(ii) The shear force at point **a**.
(iii) The slope at point **d.**

Given, E = 30,000 ksi, I = 1500 $in^4$.

**(b)** Using Trapezoidal rule, approximate the following integral taking 6 equal subdivision **(10)**

$$I = \int_{-1}^{1} e^{2x+1}\, dx$$

**6.** Fit a straight line to the following set of points. **(25)**

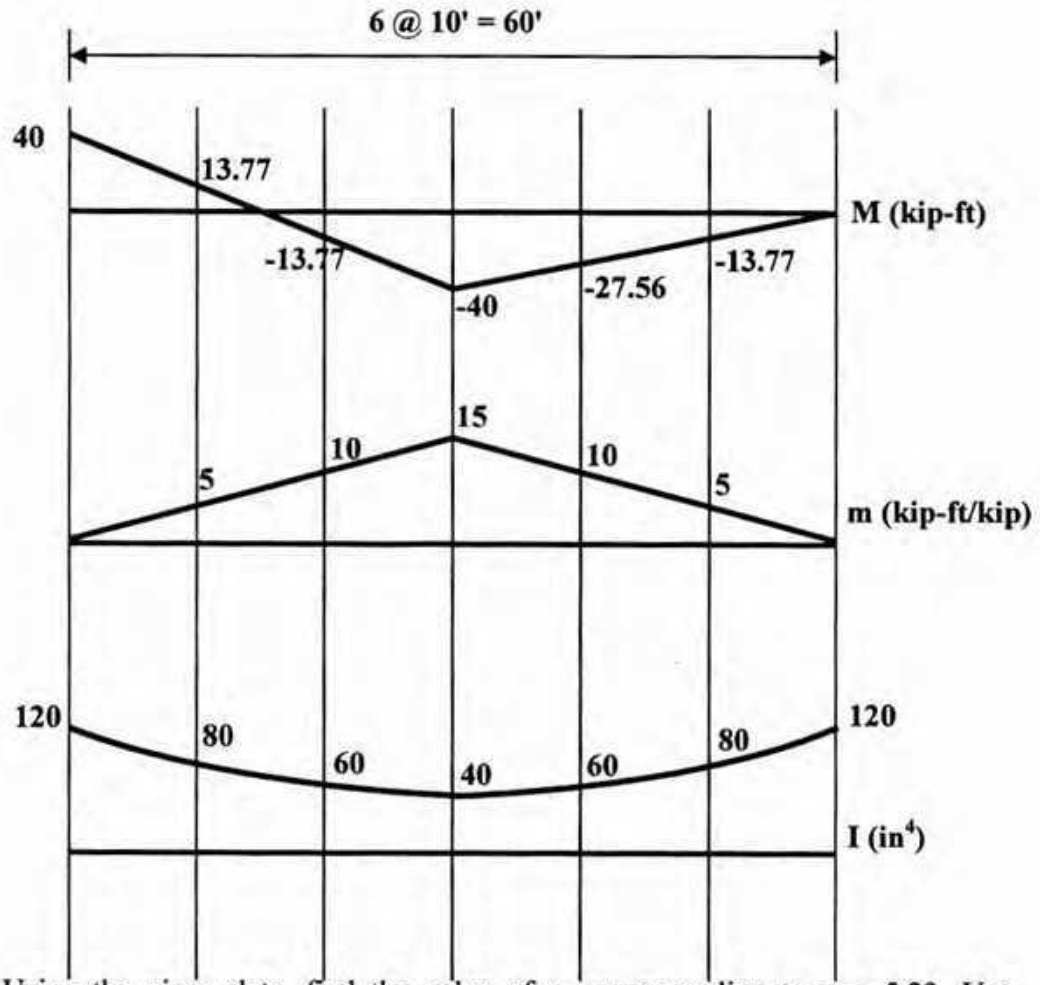
| x | 6 | 8 | 10 | 12 | 14 |
|---|---|---|---|---|---|
| y | 1000 | 750 | 400 | 150 | 80 |

**7. (a)** Use Gauss Elimination method to solve the following system of equations: **(15)**

$$2u + 3v + w = 9$$
$$u + 2v + 3w = 6$$
$$3u + v + 2w = 8$$

**(b)** Using Newton-Raphson method, find a real root of the following equation: **(10)**
$x \sin x + \cos x = 0$. Start with x = 0. Desired accuracy = 0.0001

**8.(a)** The following diagrams show the variation of Bending Moments M and m and Moments of Inertia I in a beam. Estimate $\int \frac{Mm}{I}\,dx$ and mid point deflection $\int \frac{Mm}{IE}\,dx$ of the beam, if E = 30,000 ksi. **(10)**




**(b)** Using the given data, find the value of y, corresponding to x = 5.23. Use Lagrangian Polynomial formula. **(15)**

| x | 1.9 | 3.8 | 6.1 | 7.3 |
|---|---|---|---|---|
| y | 39 | 52 | 56 | 67 |

**Formulae:**

**1.** $P(u) = f(x_1) + \{\Delta f(x_1)*u\}/1! + \{\Delta^2 f(x_1)*u*(u-1)\}/2! + \{\Delta^3 f(x_1)*u*(u-1)*(u-2)\}/3! + \ldots\ldots\ldots$

**2.** $\Delta^n f(x_1) = {}^nc_0\, f(x_1 + n*h) - {}^nc_1\, f\{x_1 + (n-1)*h\} + {}^nc_2\, f\{x_1 + (n-2)*h\} - \ldots\ldots + {}^nc_n\, f(x_1)$

**3.** $P(x) = L_1(x)\, y_1 + L_2(x)\, y_2 + \ldots\ldots\ldots\ldots + L_{n+1}(x)\, y_{n+1}$

# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination Spring 2010
## Program: B. Sc. Engineering (Civil)

Course Title: Mechanics of Solids I | Credit Hours: 3.0 | Course Code: CE 211

Time: 3 hours | Full Marks: 100 (= 10 × 10)

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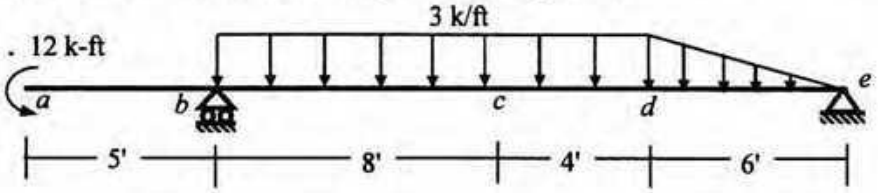
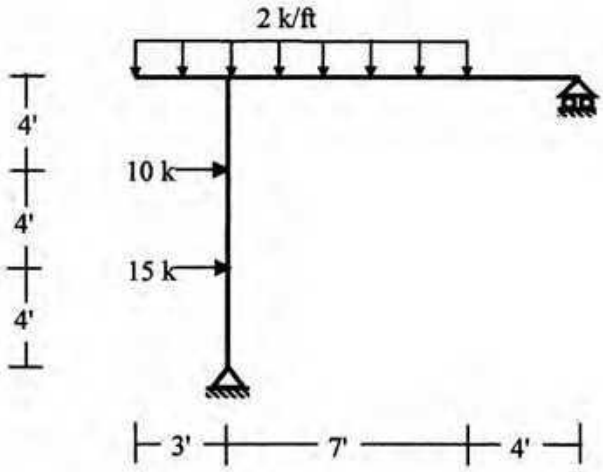
[Answer **any 10 (ten)** of the following 14 questions]

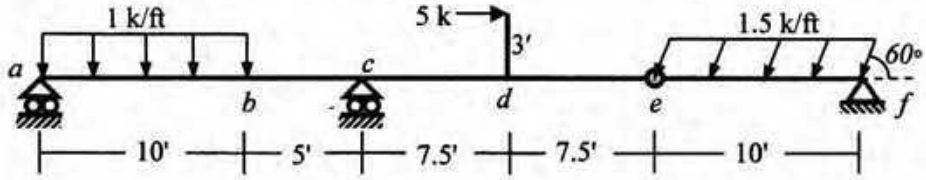
1. For the beam *abcde* loaded as shown in the figure below
   i) Derive the equation of shear force and bending moment using Singularity Functions.
   ii) Also calculate the shear force and bending moment at point *c*.




2. Draw the shear force and bending moment diagram for the frame shown below.

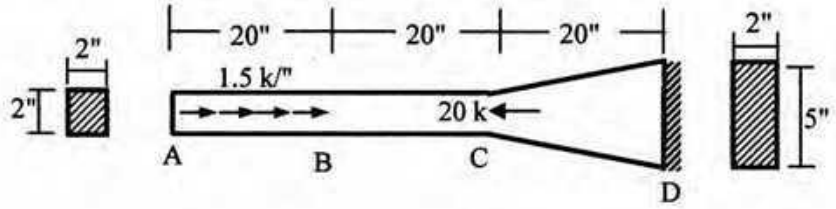



3. Draw the axial force, shear force and bending moment diagram for the beam shown below.

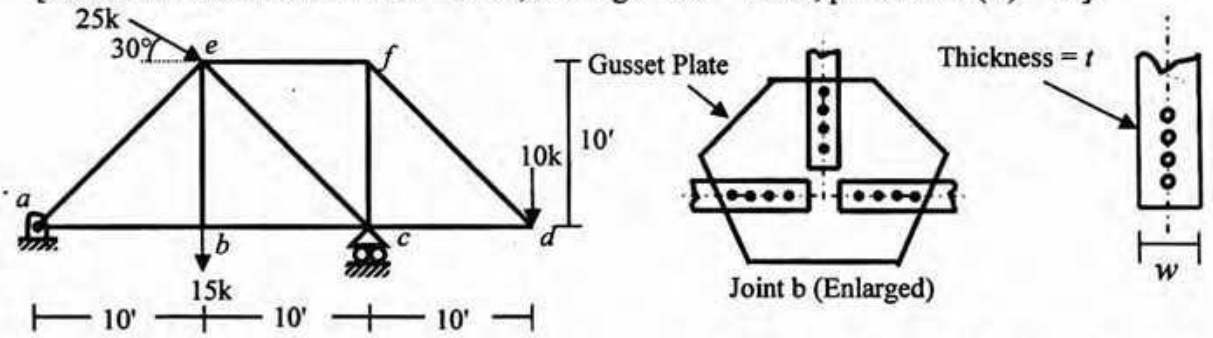



*e* is an internal hinge

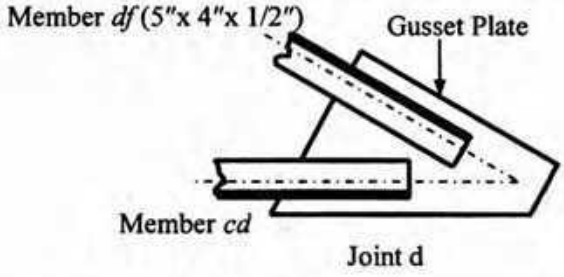
4. For the axial member ABCD shown below (with rectangular cross-section of variable depth but constant width), calculate the axial deformations at point B and C [E = 20,000 ksi].



5. For member *be* of the truss loaded as shown below, calculate the required
   (i) Bolt diameter ($d$), (ii) Thickness ($t$) of member *be*, (iii) axial stress of member *be*.
   [Given: Allowable shear stress = 9 ksi, bearing stress = 10 ksi, plate width ($w$) = 5"].




6. For the truss shown above, design the weld for member *df* with Gusset plate at joint *d*. Given that, allowable shear stress in weld = 16 ksi and 5" leg of the 'L' section is attached to the Gusset plate.




7. (i) Calculate the axial deformations ($\Delta_{xx}$, $\Delta_{yy}$, $\Delta_{zz}$) if the rectangular prism in Fig. a is subjected to triaxial normal forces $P_x$ (= 60 k), $P_y$ (= 80 k) and $P_z$ (= 50 k).

   (ii) In Fig. b, calculate the uniaxial force $F_x$ needed to cause the same deformation ($\Delta_{xx}$) along the x-axis.
   [Given: Modulus of Elasticity = 4000 ksi, Poisson's ratio = 0.30].

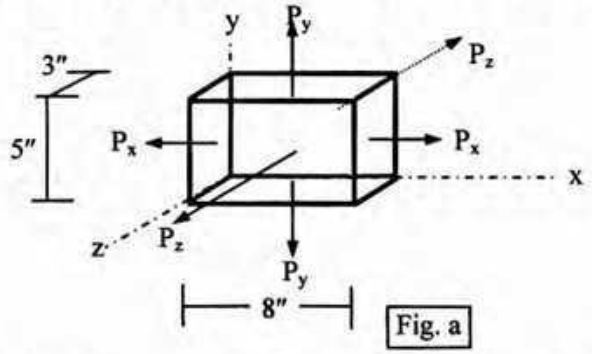



Fig. a

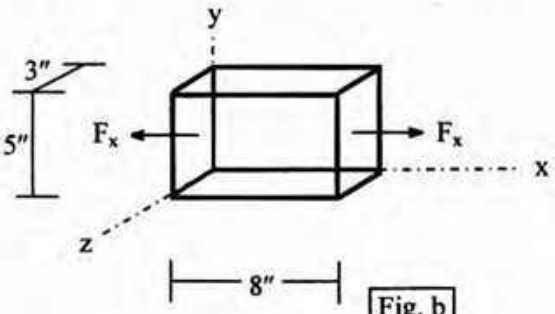
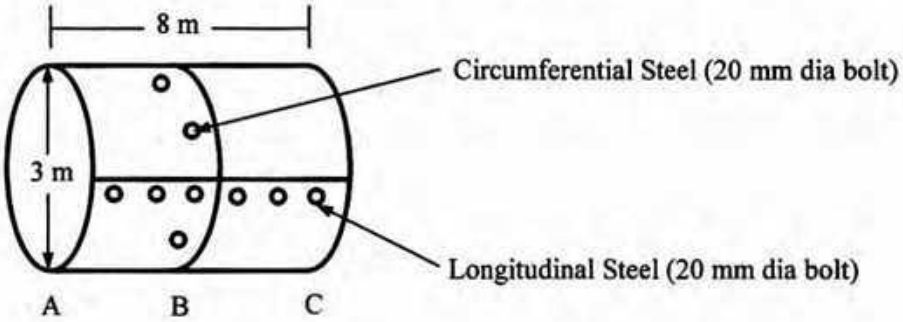
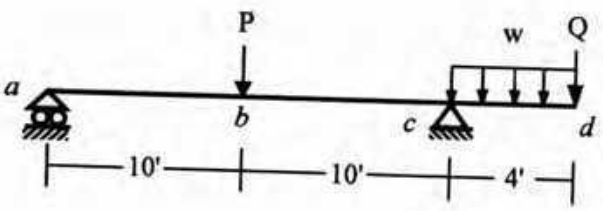


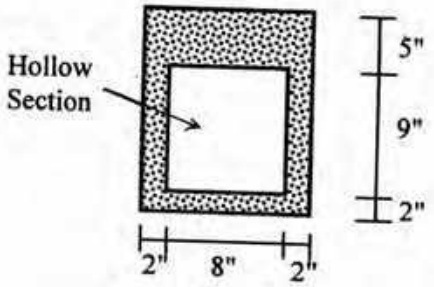

Fig. b

8. For a gas cylinder of 3 m diameter and 10 mm wall thickness, calculate the
   (i) maximum internal pressure that the cylinder can be subjected to
   (ii) corresponding tangential and longitudinal stresses and strains in the wall of the cylinder
   (iii) required spacing of 20 mm diameter bolts to resist the wall stresses
   [Given: Allowable tensile stress in the wall = 130 MPa, Allowable shear stress in bolts and welds = 100 MPa, Modulus of elasticity of steel = 20 GPa, Poisson's ratio = 0.25].



9. Calculate the maximum tensile and compressive flexural stresses in the cross-section of the beam loaded as shown below, if P = 6 k, Q = 0 k and w = 2 k/ft.

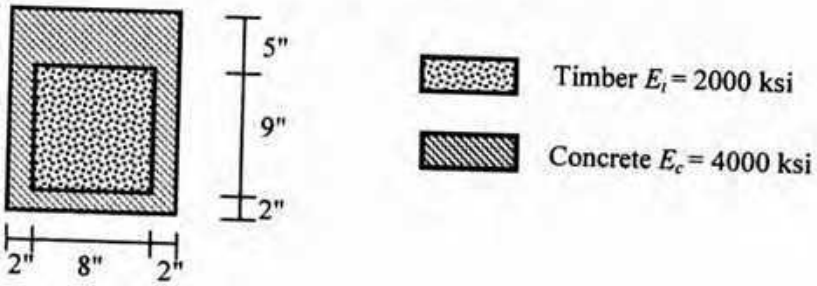


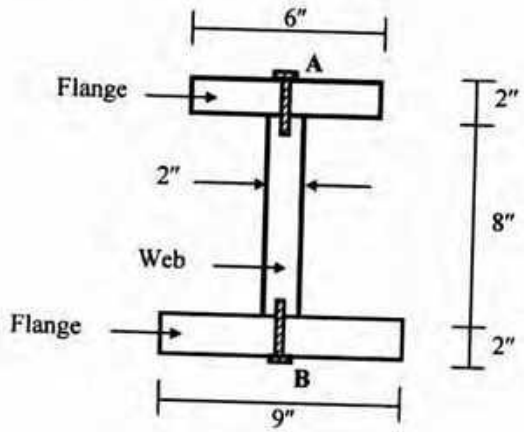

Beam Cross Section

10. Calculate the plastic section modulus and plastic moment of the section shown in Question 9 [Given: Yield Strength of material, $\sigma_{yp}$ = 3 ksi].

11. For the beam *abcd* shown in Question 9, draw the flexural strain diagram over the composite cross-sectional area (shown below) at section *c*, if $P$ = Q = 0 kips, $w$ = 3 k/ft.
Also calculate the maximum flexural stresses in timber and concrete.



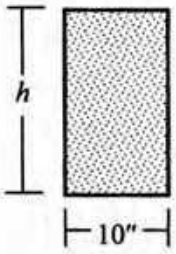

12. Three unequal dimension wooden planks form an "I section" beam (cross section) as shown in the figure below. For the beam *abcd* loaded as shown in Question 9, if P = 10 k, Q = 20 k and w = 0 k/ft, find the necessary spacing of the nails (both A and B) to hold the top and bottom flanges with the web. [Given: Allowable shearing force per nail is 3 kips].




Cross Section

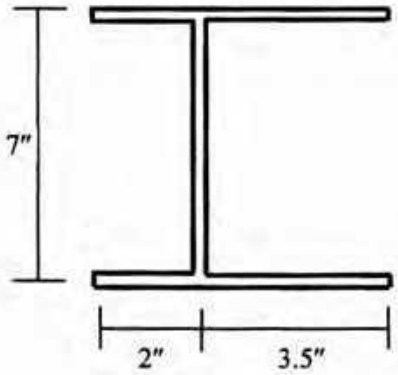
13. For the beam *abcd* shown in Question 9, if P = 20 k, Q = 10 k and w = 0 k/ft, calculate the maximum shear stress induced in the rectangular section shown below.

[Given: Maximum bending (both compressive and tensile) stress is 2.4 ksi].




Cross Section of beam

14. Determine the location of shear center of the cross-section shown below. Thickness is 0.1″ throughout.



# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination Spring 2010
## Program: B.Sc. Engineering Civil

Course Title: Fluid Mechanics | Course No : CE 221 | Credit: 3.00
Time : 3.0 hours | Full Marks : 150

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Answer any 6 (SIX) questions. Figures in the right margin indicate full marks.

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1 a. Distinguish between, (i) Lagrangian and Eulerian Method *6*
(ii) Pathlines and Streamlines
(iii) Uniform and Non-Uniform Flow

b. Two parallel plates are held apart and the space between them is filled with crude oil (Figure 1). A force of 1.962 N is required to drag the upper plate of 90 $m^2$ area at a velocity (V). The viscosity of oil is 0.05 N-s/$m^2$. What is the size of the space (d) between the plates? Assume velocity distribution $V = \frac{y}{3} + y^2$ *9*

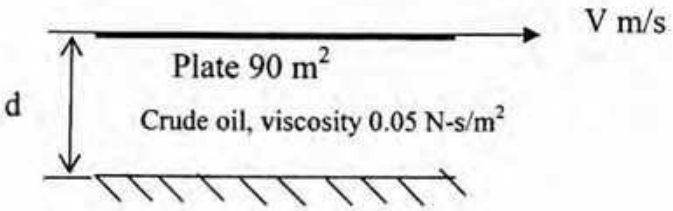



Figure 1

c. A capillary tube having an inside diameter 5 mm is dipped in water at $20^0$c. Determine the height of water which will rise in the tube. Take surface tension 0.0735 N/m, angle of contact $60^0$ and specific weight of water at $20^0$ c 9.69 kN/$m^2$. *5*

d. By how much does the pressure in a cylindrical jet of water 5 mm in diameter exceed the pressure of the surrounding atmosphere if the surface tension of water is 0.080 N/m. *5*

2 a. A gauge indicates a pressure of 24.53 kN/$m^2$ vacuum. Compute the corresponding absolute pressure in kN/$m^2$. The local barometreic pressure is 700 mm of mercury (S=13.60) *4*

b. What is a piezometer? Can a piezometer be used for measuring pressure in the pipe in which a gas is flowing? *4*

c. State Pascal's Law. *4*

d Compute "y" in Figure 2 if the pressure difference between points A and B is 150.00 kN/m$^2$. ($P_A > P_B$) 7

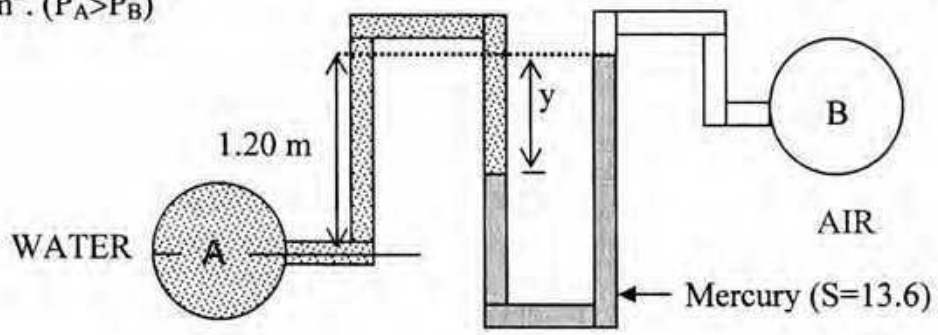



Figure 2

e. Determine the reading of gauge A in Figure 3. 6

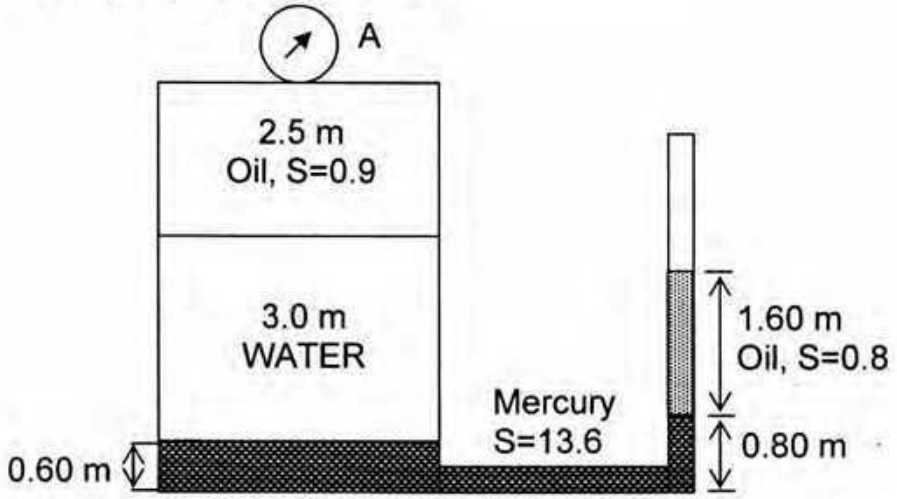



Figure 3

3 a. State Bernoulli equation and explain each term with neat figure. Mention clearly the assumptions made in the equation. 6

b. What do you understand by the term 'centre of pressure'? 6

c. The following Figure 4 shows a gate AB hinged at the end A. If the gate is 1.5 m wide, calculate the horizontal force (F) required at B to keep the gate in equilibrium. 13

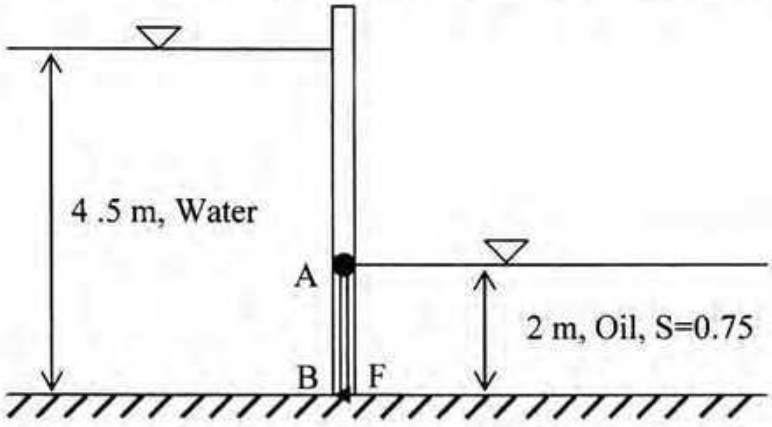



Figure 4

4 a. Find the magnitude and the line of action of the resultant force exerted upon the vertical wall AB shown in Figure 5. Assume length of AB is 0.6 m. *6*

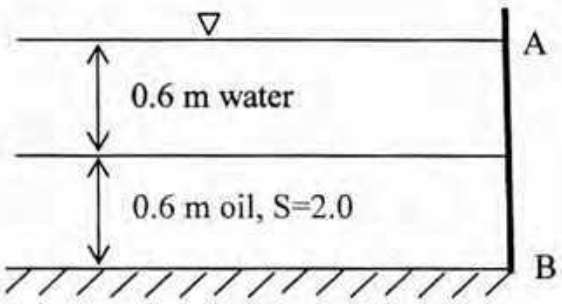



Figure 5

b. Determine the horizontal and vertical forces acting on the curve surface AB on the cylinder in Figure 6. The cylinder is 1 m long. The diameter of the cylinder is 2.0 m. *7*

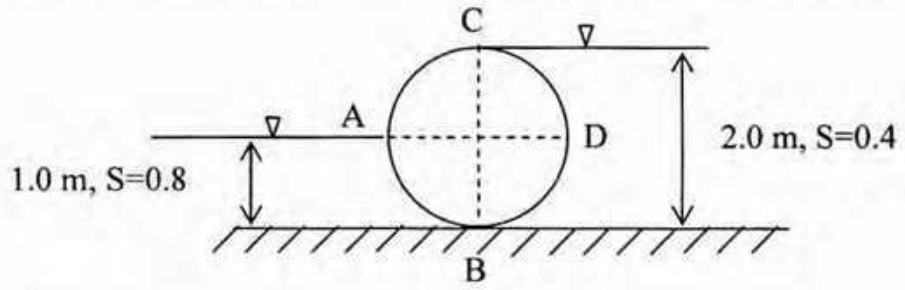



Figure 6

c. Determine the horizontal and vertical forces acting on the curve surface CD on the cylinder in Figure 6. *7*

d. What is the net vertical force acting on the cylinder shown in Figure 6, if it weighs 25.0 kN. Neglect friction. *5*

5 a. Define, (i) coefficient of contraction (ii) coefficient of velocity, and (iii) coefficient of discharge *6*

b. Water enters in a $150^0$ horizontal reducing pipe with a velocity of 5 m/sec and a pressure of 50 $kN/m^2$ as shown in Figure 7. If the diameters at the entrance and exit sections are 40 cm and 20 cm, respectively, calculate the components of the reaction e.g. $R_X$ and $R_Y$ acting on the pipe. *14*

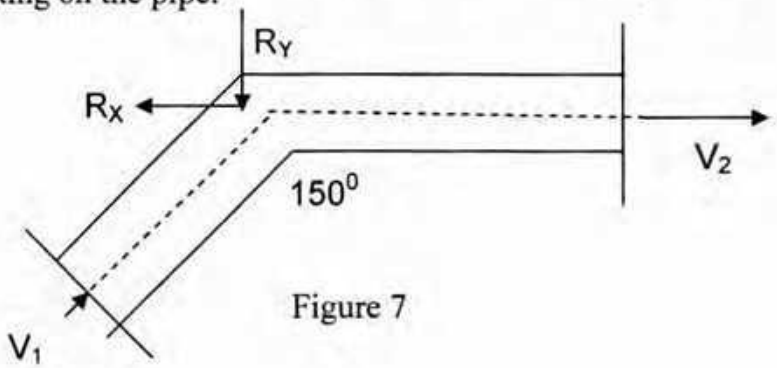



Figure 7

c. A circular orifice, 4.0 cm diameter, is made in the vertical wall of a tank. The jet falls vertically through 0.6 m while moving horizontally through a distance of 1.6 m. Calculate the coefficient of velocity if the head causing flow is 1.2 meters. If the discharge is $1.70 \times 10^{-3}$ $m^3/s$, Calculate $C_c$ and $C_d$. 5

6 a. What is the difference between a weir and an orifice? How are the weirs classified? 7

b. A rectangular channel 10 m wide has a broad crested rectangular weir at the end throughout its length. A discharge of 10 $m^3/s$ passes over it. Determine the height to which the weir be built if the depth of water behind the weir is not to exceed 2 m. Take $C_d$=0.60. 8

c. Water is discharging through an external mouthpiece of 40 $cm^2$ area, under a head of 4.0 m. Find the discharge through the mouthpiece. Take $C_c$=0.62. 4

d. Show that the flow over a triangular notch can be expressed as, $Q = \frac{8}{15} C_d \sqrt{2g} \tan\frac{\theta}{2} H^{\frac{5}{2}}$ 6

7 a. What is Dimensional analysis? What are the different applications of the principles of Dimensional homogeneity in fluid mechanics? 6

b. Check whether the following equations are dimensionally homogenous: 6

a. $\tau = \gamma RS$ b. $Q = C_d a\sqrt{2gH}$ c. $h_f = f\frac{L}{D}\frac{V^2}{2g}$

c. Find Q in the pipe AB shown in Figure 8. Take f=0.04 and assume reasonable values for 13

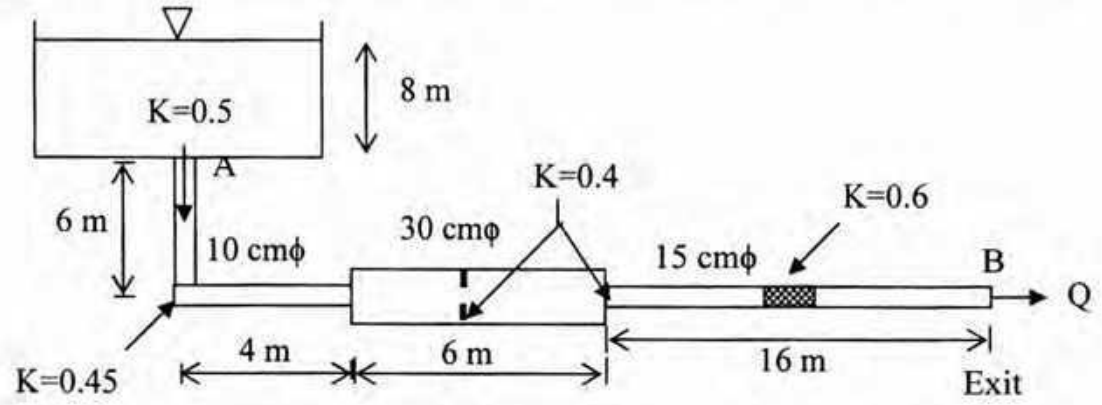



Figure 8

8 a. What do you understand by 'minor losses' in pipes? Mention the places with neat sketches where minor losses may occur. *5*

b. Calculate pressure at point A and B shown in Figure 9. Take f= 0.04, pipe diameter 0.25 m and K=0.5 for entry, K= 0.6 for bent and K=0.8 at exit. *20*

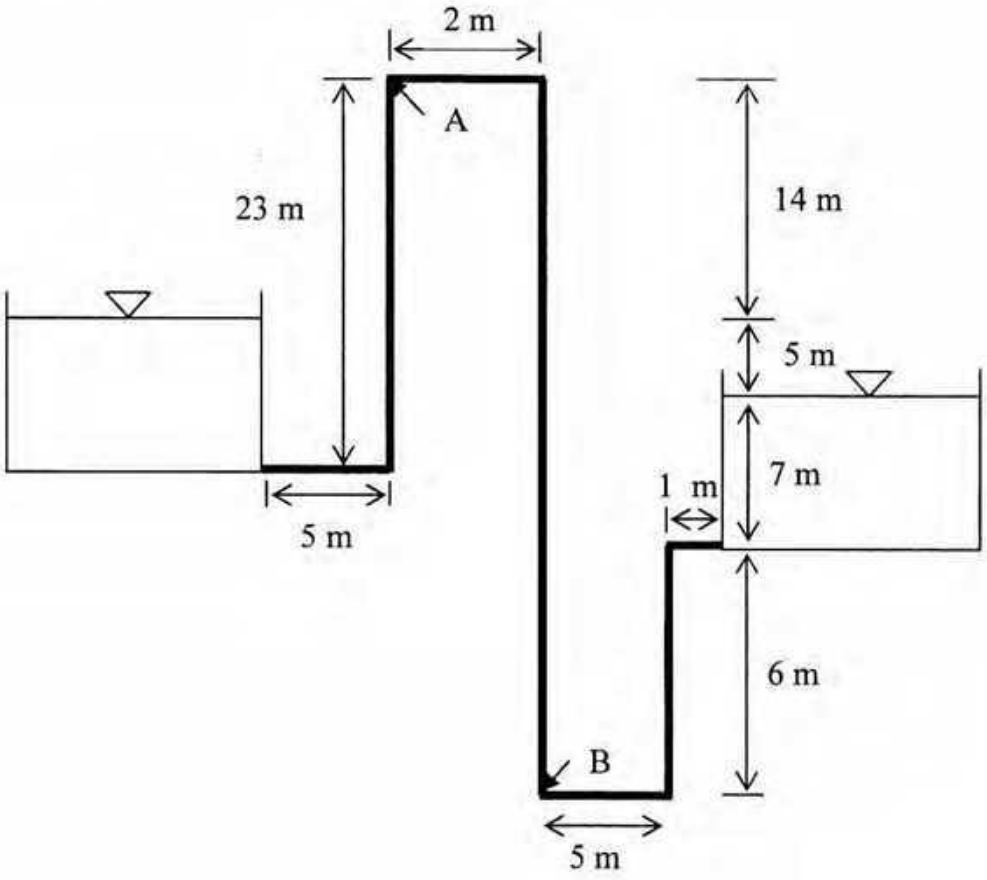



Figure 9

**Formulae**

$$\tau = \mu \frac{dv}{dy}$$

$$P_i - P_o = \sigma\left(\frac{1}{R_1} + \frac{1}{R_2}\right) = \frac{2\sigma}{R} = \frac{4\sigma}{R} = \frac{\sigma}{R}$$

$$h = \frac{4\sigma\cos\theta}{\gamma d}$$

$$P = \gamma h$$

$$P = \lambda A\bar{h}$$

$$h' = \frac{I_G}{A\bar{h}} + \bar{h}$$

$$h' = \frac{I_G Sin^2\theta}{A\bar{h}} + \bar{h}$$

$$P_H = \gamma \bar{h} A_V$$

$$P_V = \gamma V = W$$

$$P = \sqrt{P_H{}^2 + P_V{}^2}$$

$$\sum M_o = \rho Q(\Delta V)$$

$$V_0 = \sqrt{2gh}$$

$$Q = C_d a\sqrt{2gH}$$

$$C_d = C_C \times C_V$$

$$C_V = \sqrt{\frac{x^2}{4yH}}$$

$$Q = 0.855a\sqrt{2gH}$$

$$Q = 0.707a\sqrt{2gH}$$

$$Q = \frac{2}{3} C_d b\sqrt{2g} H^{\frac{3}{2}}$$

$$b' = b - 0.1 \times n \times H$$

$$H_a = \frac{V_a{}^2}{2g}$$

$$Q = \frac{2}{3} C_d\left[b - 0.1n(H + H_a)\right]\sqrt{2g}\left[(H + H_a)^{\frac{3}{2}} - H_a{}^{\frac{3}{2}}\right]$$

$$Q = 1.705 C_d b H^{\frac{3}{2}}$$

$$Q = CbH_s{}^{\frac{2}{3}}$$

$$Q = C_d A\sqrt{2gy_1}$$

$$Q = \frac{8}{15} C_d\sqrt{2g}\tan\frac{\theta}{2} H^{\frac{5}{2}}$$

$$Q = CbH^n$$

$$h_f = f\frac{L}{D}\frac{V^2}{2g}$$

$$V = C\sqrt{RS}$$

$$C = \sqrt{\frac{8g}{f}}$$

$$V = \frac{1}{n} R^{\frac{2}{3}}\sqrt{S}$$

$$C = \frac{1}{n} R^{\frac{1}{6}}$$

$$H_L = \frac{(V_1 - V_2)^2}{2g}$$

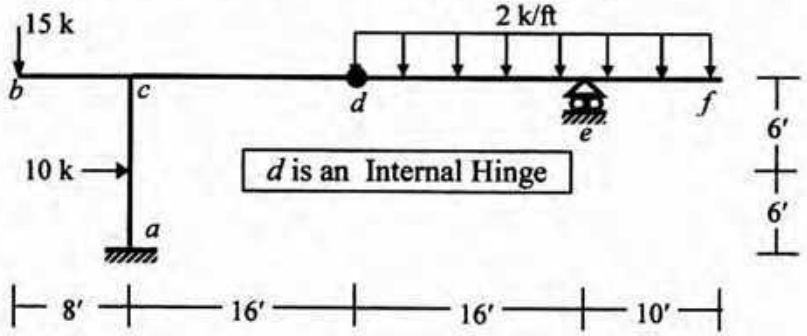
$$H_L = K\frac{V^2}{2g}$$

# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination Spring 2010
## Program: B. Sc. Engineering (Civil)

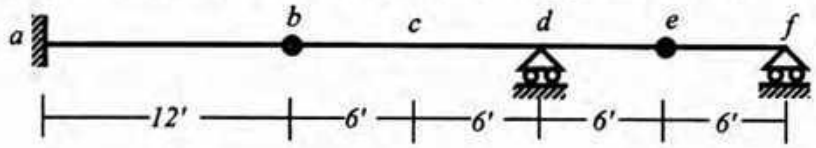
Course Title: Structural Engineering I  Credit Hours: 3.0  Course Code: CE 311
Time: 3 hours  Full Marks: 100 (= 10 × 10)

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

1. Determine the degree of statical indeterminacy (dosi) of the frame *abcdef* shown below and also draw the Axial Force, Shear Force and Bending Moment diagrams of the frame.

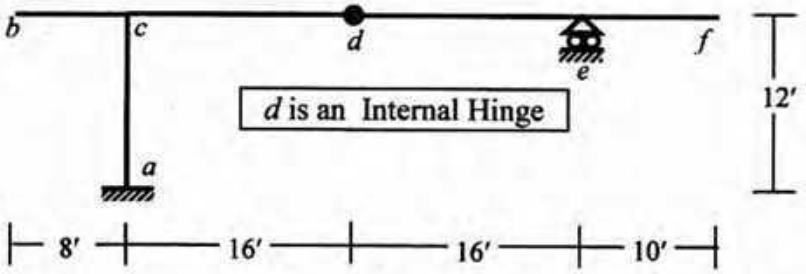



2. Determine the degree of statical indeterminacy (dosi) of the beam *abcdef* shown below and draw the influence lines of (i) $R_d$, $R_f$, (ii) $V_c$, $V_{d(Right)}$, (iii) $M_a$, $M_d$.

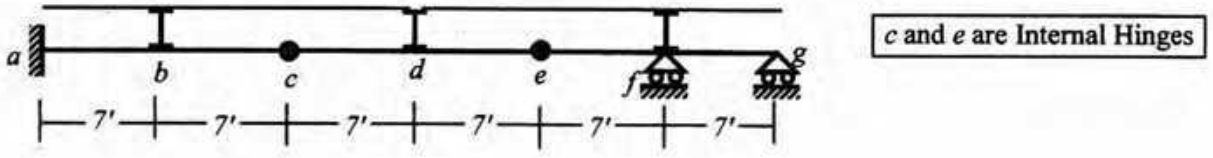



3. Calculate the maximum positive and negative values of both $R_a$ (reaction at support *a*) and $M_c$ (bending moment at *c*) for the beam *abcdef* in Question 2, for a uniformly distributed dead load of 1 k/ft, a moving uniformly distributed live load of 0.5 k/ft and a moving concentrated live load of 15 k.

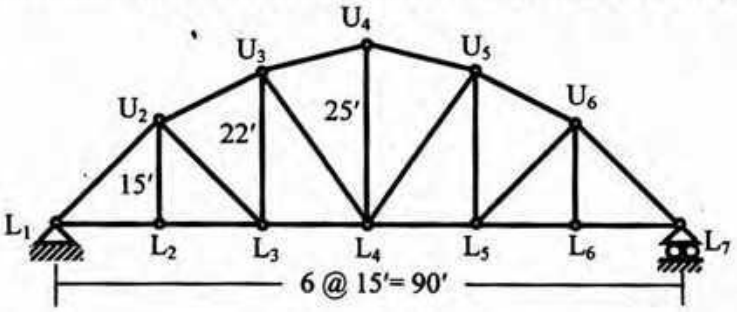
4. Draw the influence lines of support reactions $X_a$, $Y_a$ and bending moment $M_a$, if the unit load moves over (i) column *ac*, (ii) beam *bf*.




5. For the plate girder *abcdefg* shown below, draw the influence lines for $R_a$, $R_f$, $V_{d(Left)}$ and $M_a$.

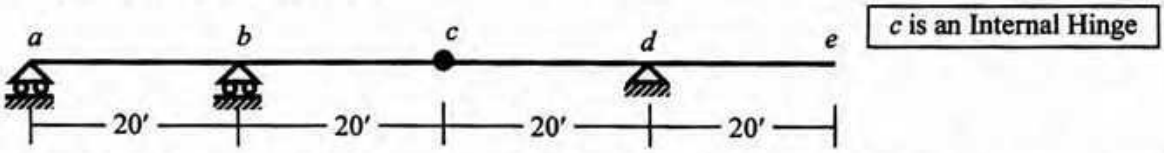


6. Draw the influence lines for the forces in members $U_3U_4$, $U_3L_4$ and $L_3L_4$ of the following truss.

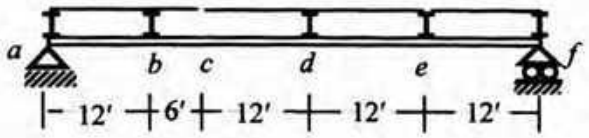


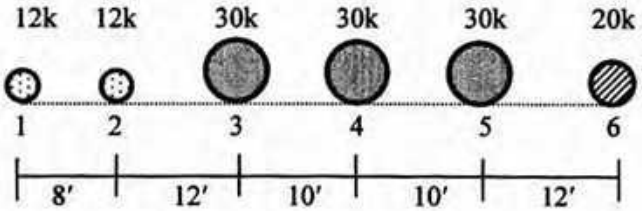

7. Calculate the maximum tensile and compressive forces in the members $U_3L_4$ and $U_3L_3$ for the truss described in Question 6, for a uniformly distributed dead load of 1 k/ft, a moving uniformly distributed load of 2 k/ft and a moving concentrated load of 10 k.

8. Draw the design bending moment diagram of the beam *abcde* shown below [based on influence lines of moment at midpoint of *ab*] for a uniformly distributed dead load of 2 k/ft and moving uniformly distributed load of 1 k/ft.




9. For the plate girder shown below, calculate the maximum value of $FBR_d$ for the given wheel arrangement.

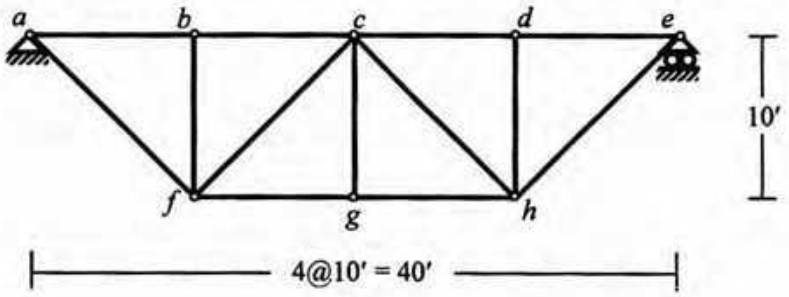



10. Calculate the maximum $V_{b\text{-}c}$ for the plate girder and wheel arrangement shown in Question 9.

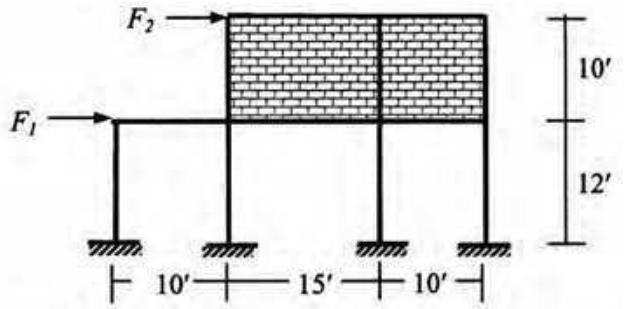
11. Calculate the greatest maximum moment of a 60′ simply supported beam for the wheel arrangement shown in Question 9.

12. Calculate maximum compressive force in member *fc* of the truss shown below,due to wheel arrangement shown in Question 9. Load moves along the top cord of the truss.



13. The figure below shows a two-storied RCC hospital building frame situated on a flat terrain in Dhaka (Exposure A), carrying brick walls at the upper floor.

If the areas of beams and columns are negligible compared to the walls, and first storey force due to wind is $F_1 = 15$ kips, calculate the forces $F_1$, and $F_2$ due to wind for a similar structure to be designed as a residential building at a hilly terrain ($H$ = 40 ft, $L_u$ = 100 ft) in Chittagong (Exposure C).




14. The two-storied RCC hospital building in Dhaka (Zone 2) described in Question 13, designed as an Intermediate Moment Resisting Frame (IMRF) is supported on soil $S_3$ and carries slabs (weighing *1.5* k/ft) at all two floors and brick walls (weighing *1* k/ft) on the first floor only, as shown in the figure.

If the weight of the beams and columns are negligible compared to the slabs and walls, and the first storey force due to earthquake is $F_1 = 15$ kips, calculate the forces $F_1$, $F_2$ and base shear due to earthquake for a similar structure to be designed as an Ordinary Moment Resisting Frame (OMRF) for a residential building on very soft soil ($S_4$) in Chittagong (Zone 2).

## *List of Useful Formulae for CE 313*

*$\Delta R = \{(\sum P)\, d_1 + P'\, e\} i/L - P_1 \times i$

*$\Delta V = (\sum P)\, d_1 /L + P'\, e/L + P_0\, e_0/L - P_1$

* $(W_1/P) \times (s + a)/s \geq W/L$

* $(W_1/P) \times (s + a + P)/(s + L) \geq W/L$

*$W_1/P \geq W/L$

*$W_1/a \geq W/L$

* The design wind pressure at a height z is $p_z = 0.00256\, C_I\, C_z\, C_G\, C_t\, C_p\, V_b^2$, design wind force $F_z = B\, h_{eff}\, p_z$

* The total design base shear is $V = (ZIC/R)\, W$ where $C = 1.25\, S/T^{2/3}$

* $F_t = 0.07\, TV \leq 0.25V$ when $T > 0.7$ second, and $= 0$, when $T \leq 0.7$ second

* $F_j = (V - F_t)\, [w_j\, h_j / \sum w_i\, h_i]$

* Structural Period $T = C_t(h_n)^{3/4}$, where, $C_t = 0.083$ for steel moment resisting frames, 0.073 for RC moment resisting frames and eccentric braced steel frames, 0.049 for all other structural systems

The basic wind speeds at different important locations of Bangladesh :

| Location | $V_b$ (mph) |
|---|---|
| Dhaka | 130 |
| Chittagong | 160 |
| Rajshahi | 95 |
| Khulna | 150 |

| Category | $C_I$ |
|---|---|
| Essential facilities | 1.25 |
| Hazardous facilities | 1.25 |
| Special occupancy | 1.00 |
| Standard occupancy | 1.00 |
| Low-risk structure | 0.80 |

| Height z (ft) | $C_z$ | | |
|---|---|---|---|
| | Exp A | Exp B | Exp C |
| 0~15 | 0.368 | 0.801 | 1.196 |
| 50 | 0.624 | 1.125 | 1.517 |
| 100 | 0.849 | 1.371 | 1.743 |
| 150 | 1.017 | 1.539 | 1.890 |
| 200 | 1.155 | 1.671 | 2.002 |
| 300 | 1.383 | 1.876 | 2.171 |
| 400 | 1.572 | 2.037 | 2.299 |
| 500 | 1.736 | 2.171 | 2.404 |
| 650 | 1.973 | 2.357 | 2.547 |
| 1000 | 2.362 | 2.595 | 2.724 |

| Height z (ft) | $C_G$ (for non-slender structures) | | |
|---|---|---|---|
| | Exp A | Exp B | Exp C |
| 0~15 | 1.654 | 1.321 | 1.154 |
| 50 | 1.418 | 1.215 | 1.097 |
| 100 | 1.309 | 1.162 | 1.067 |
| 150 | 1.252 | 1.133 | 1.051 |
| 200 | 1.215 | 1.114 | 1.039 |
| 300 | 1.166 | 1.087 | 1.024 |
| 400 | 1.134 | 1.070 | 1.013 |
| 500 | 1.111 | 1.057 | 1.005 |
| 650 | 1.082 | 1.040 | 1.000 |
| 1000 | 1.045 | 1.018 | 1.000 |

| $H/2L_u$ | $C_t$ |
|---|---|
| 0.05 | 1.19 |
| 0.10 | 1.39 |
| 0.20 | 1.85 |
| 0.30 | 2.37 |

**Table 1: Response Modification Coefficient, R for Structural Systems**

| Basic Structural System | Description Of Lateral Force Resisting System | R |
|---|---|---|
| (a) Bearing Wall System | Light framed walls with shear panels | 6~8 |
| | Shear walls | 6 |
| | Light steel framed bearing walls with tension only bracing | 4 |
| | Braced frames where bracing carries gravity loads | 4~6 |
| (b) Building Frame System | Steel eccentric braced frame (EBF) | 10 |
| | Light framed walls with shear panels | 7~9 |
| | Shear walls | 8 |
| | Concentric braced frames (CBF) | 8 |
| (c) Moment Resisting Frame System | Special moment resisting frames (SMRF) | |
| | (i) Steel | 12 |
| | (ii) Concrete | 12 |
| | Intermediate moment resisting frames (IMRF), concrete | 8 |
| | Ordinary moment resisting frames (OMRF) | |
| | (i) Steel | 6 |
| | (ii) Concrete | 5 |
| (d) Dual System | Shear walls | 7~12 |
| | Steel EBF | 6~12 |
| | Concentric braced frame (CBF) | 6~10 |
| (e) Special Structural Systems | According to Sec 1.3.2, 1.3.3, 1.3.5 of BNBC | |

**Table 2: Site Coefficient, S for Seismic Lateral Forces**

| Site Soil Characteristics | | Coefficient, S |
|---|---|---|
| Type | Description | |
| $S_1$ | A soil profile with either:<br>A rock–like material characterized by a shear–wave velocity greater than 762 m/s or by other suitable means of classification, or<br>Stiff or dense soil condition where the soil depth exceeds 61 meters | 1.0 |
| $S_2$ | A soil profile with dense or stiff soil conditions, where the soil depth exceeds 61 meters | 1.2 |
| $S_3$ | A soil profile 21 meters or more in depth and containing more than 6 meters of soft to medium stiff clay but not more than 12 meters of soft clay | 1.5 |
| $S_4$ | A soil profile containing more than 12 meters of soft clay characterized by a shear wave velocity less than 152 m/s | 2.0 |

# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination Spring 2010 (Set B)
## Program: B. Sc. Engineering (Civil)

Course Title: Structural Engineering II | Credit Hours: 3.0 | Course Code: CE 313
Time: 3 hours | Full Marks: 100 (= 10 × 10)

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

1. For the frame loaded as shown in Fig. 1, approximately calculate the column shear forces using the
   (i) Portal Method (making reasonable assumptions to account for column lengths and supports),
   (ii) Cantilever Method (assuming equal cross-sectional areas for all columns).

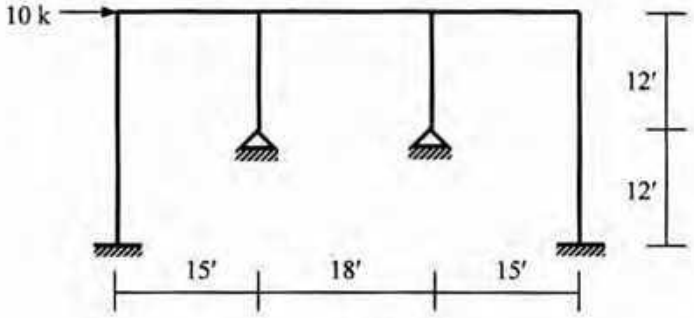



Fig. 1

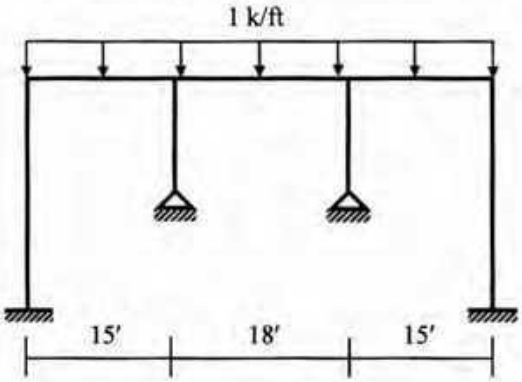



Fig. 2

2. Draw the bending moment diagram for the frame loaded as shown in Fig. 2, using
   (i) ACI coefficients, (ii) approximate locations of inflection points [Given: EI = constant].

3. For the Bridge Portal loaded as shown in Fig. 3, use Portal Method (making reasonable assumptions to account for column support conditions) to draw the SFD and BMD of columns *abc* and *def*.

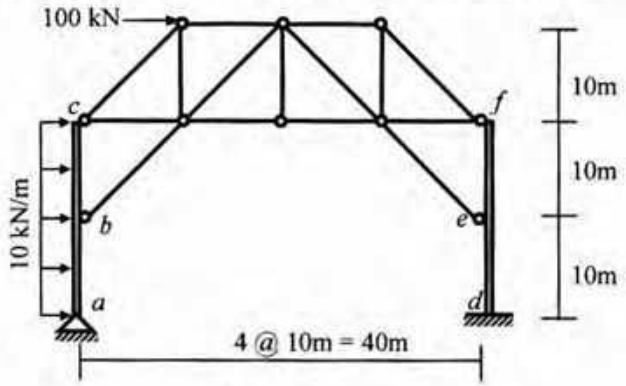



Fig. 3

4. Use the Method of Virtual Work to calculate the vertical deflection at joint *a* of the truss loaded as shown in Fig. 4, assuming diagonal members to take equal share of the sectional shear
   [Given: EA/L = constant = 7500 kN/m].

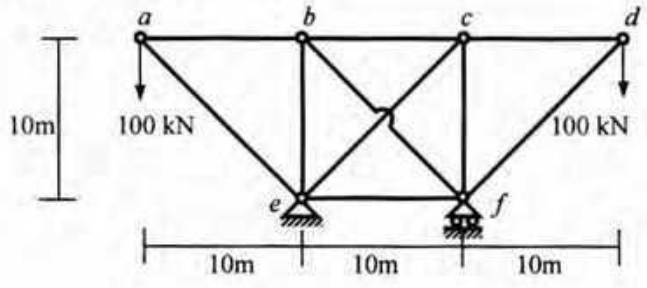



Fig. 4

5. Use the Method of Virtual Work (considering flexural and shear deformations only) to calculate the vertical deflection at joint *c* of the frame *abcd* loaded as shown in Fig. 5
[Given: EI = constant = $20 \times 10^3$ k-ft$^2$, GA* = constant = $2 \times 10^5$ k].

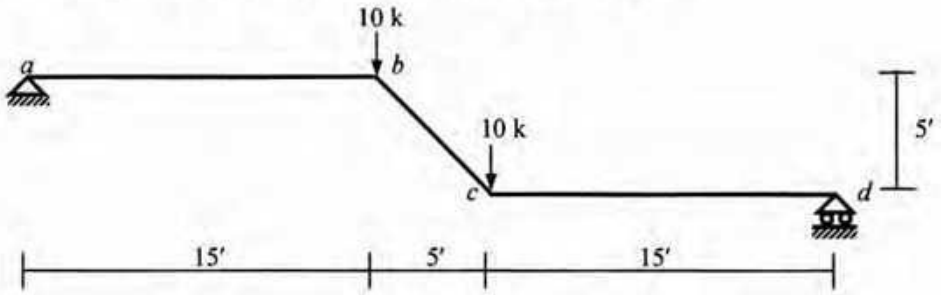



Fig. 5

6. Use the Flexibility Method to calculate the forces in all the members of the truss *abcdef* shown in Fig. 6, if support *e* moves 0.03-m rightward [Given: EA/L = constant = 7500 kN/m].

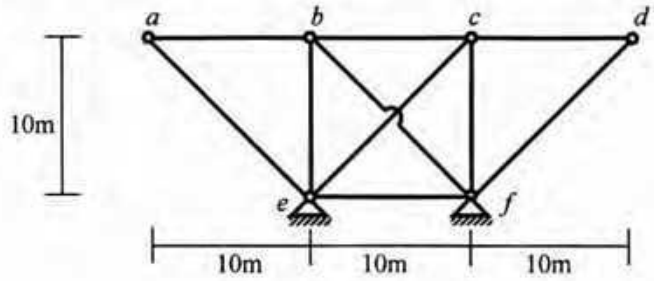



Fig. 6

7. Use the Flexibility Method (considering flexural deformations only) to draw the bending moment diagram of the beam loaded as shown in Fig. 7 [Given: $EI_{DE} = 2\ EI_{ABCD} = 80 \times 10^3$ kN-m$^2$].

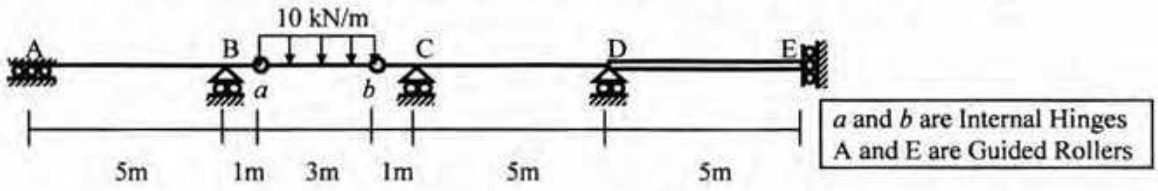



Fig. 7

8. Use the Flexibility Method (considering flexural and axial deformations only) to draw the Bending Moment Diagram of the frame shown in Fig. 8, if in addition to the applied loads, support *a* moves 10-mm rightward [Given: EI = constant = $20 \times 10^3$ k-ft$^2$, EA = constant = $4 \times 10^5$ k].

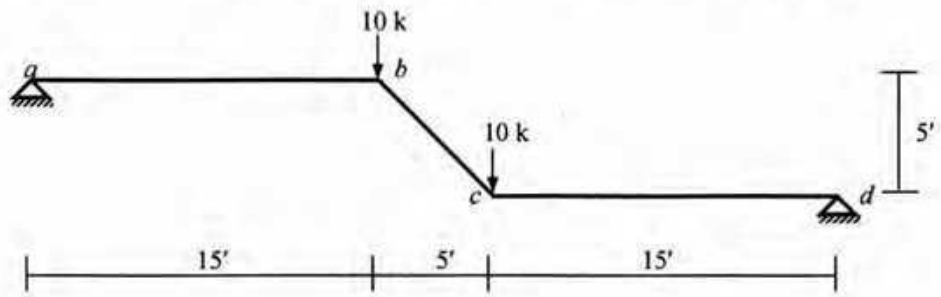



Fig. 8

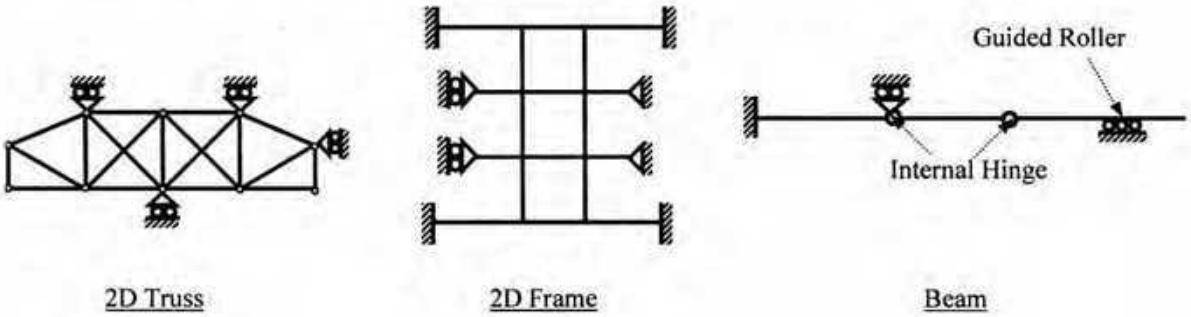
9. Use the Moment Distribution Method to calculate the joint moments and draw the bending moment diagram of beam ABCDE shown in Fig. 7.

10. Use the Moment Distribution Method to calculate the joint moments and draw the bending moment diagram of the frame shown in Fig. 2.

11. For the beam ABCDE shown in Fig. 7, draw the qualitative influence lines of support reactions $R_B$, $R_C$, shear forces $V_{C(Left)}$, $V_{C(Right)}$ and bending moments $M_A$, $M_D$, $M_E$.

12. For the beam ABCDE shown in Fig. 7, calculate the maximum value of $R_D$ (reaction at support D) for a uniformly distributed dead load of 10 kN/m, a moving uniformly distributed load of 5 kN/m and a moving concentrated load of 20 kN.

13. Determine the size of flexibility matrix for the structures shown in Fig. 9.
    Also convert them to statically determinate structures to be used in 'Case 0' of Flexibility Method.




2D Truss  2D Frame  Beam

Fig. 9

14. (i) Explain when it becomes necessary to draw quantitative influence line of statically indeterminate structures.
    (ii) Narrate two differences between the Flexibility Method and Moment Distribution Method of structural analysis (in terms of basic methodology and applicability).
    (iii) Mention two differences between the Flexibility Method for 3D Trusses vs. 2D Frames (in terms of *dosi* and the forces/moments calculated).
    (iv) Differentiate between the two approximate Methods for Truss Analysis (in terms of basic assumption and applicability).
    (v) Distinguish briefly between the Portal Method and Cantilever Method for the approximate lateral load analysis of statically indeterminate frames (in terms of basic assumption and applicability).

# List of Useful Formulae for CE 313

* Portal Method for multi-storied frames assumes
  - The shear force in an interior column is twice the shear force in an exterior column.
  - There is a point of inflection at the center of each column, and at the center of each beam.
* Cantilever Method is based on three assumptions
  - The axial force in each column of a story is proportional to its horizontal distance from the center of gravity of all the columns of the story.
  - There is a point of inflection at the center of each column, and at the center of each beam.

* Vertical Analysis based on approximate location of hinges
  $M_{(+)} = 0.08\ wL^2$, $M_{(-)} = 0.045\ wL^2$, $V_{(+)} = wL/2$, and $V_{(-)} = -wL/2$
* Vertical Analysis using ACI Coefficients
  $M_{(+)}$ (i) For end spans, if discontinuous end is (a) unrestrained = $wL^2/11$, (b) restrained = $wL^2/14$
  (ii) For interior spans = $wL^2/16$
  $M_{(-)}$ (i) At the exterior face of first interior supports for (a) Two spans = $wL^2/9$, (b) More spans = $wL^2/10$
  (ii) At the other faces of interior supports = $wL^2/11$
  (iii) For spans not exceeding 10′, of where columns are much stiffer than beams = $wL^2/12$
  (iv) At the interior faces of exterior supports, if the support is (a) a beam = $wL^2/24$, (b) a column = $wL^2/16$
  V (i) In end members at first interior support = $\pm$ 1.15wL/2, (ii) At all other supports = $\pm$ wL/2

* Deflection of truss due to load, temperature change and misfit, $\Delta = \Sigma N_1\, dL = \Sigma N_1 (N_0 L/EA + \alpha \Delta T\, L + \Delta L)$
* Deflection of beams/frames due to axial, shear and flexural deformation,
  $\Delta = \int (x_1 x_0/EA)\, dS + \int (v_1 v_0/GA^*)\, dS + \int (m_1 m_0/EI) dS$

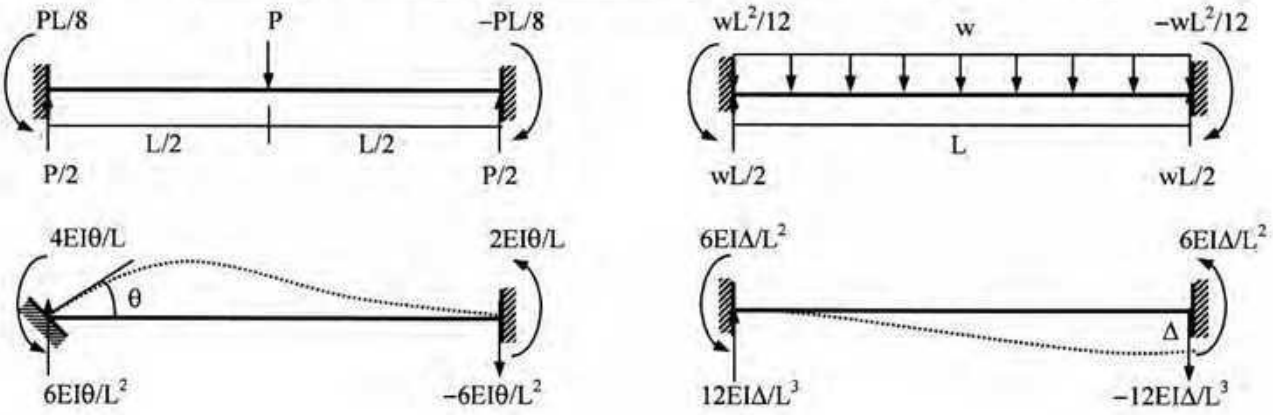
Integration of Product of Functions ($I = \int f_1 f_2\, dS$)

| $f_2$ \ $f_1$ | A, L | B, L | A, L | A, B, L | A, C, B, L |
|---|---|---|---|---|---|
| a, L | AaL | BaL/2 | AaL/2 | (A+B)aL/2 | [A+4C+B]aL/6 |
| b, L | AbL/2 | BbL/3 | AbL/6 | [A+2B]bL/6 | [2C+B]bL/6 |
| a, L | AaL/2 | BaL/6 | AaL/3 | [2A+B]aL/6 | [A+2C]aL/6 |
| a, b, L | A(a+b)L/2 | B(a+2b)L/6 | A(2a+b)L/6 | [A(2a+b)+B(a+2b)]L/6 | [Aa+Bb+ 2C(a+b)]L/6 |

* dosi for 2D trusses = m + r – 2j, for 3D trusses = m + r – 3j
* dosi for 2D frames = 3m + r – h – 3j, for 3D frames = 6m + r – 3h – 6j
* Deflection of beams/frames due to axial, shear and flexural deformation,
  $\Delta_{i,j} = \int (x_i x_j/EA)\, dS + \int (v_i v_j/GA^*)\, dS + \int (m_i m_j/EI) dS$; $M = m_0 + F_1 m_1 + F_2 m_2 + \ldots\ldots$, etc.
* Compatibility of deflection $\Rightarrow \Delta_{i,0} + F_1 \Delta_{i,1} + F_2 \Delta_{i,2} + \ldots\ldots F_n \Delta_{i,n} = \Delta_i$; etc

* For member with fixed far end, Rotational stiffness = 4EI/L, Carry over factor = 0.5
* For member with hinged/roller/discontinuous far end, Rotational stiffness = 3EI/L, Carry over factor = 0
* The moment distribution factors of members OA, OB,..... are $[K_{OA}/K_O]$, $[K_{OB}/K_O]$,.....respectively

Fixed End Reactions for One-dimensional Prismatic Members under Typical Loadings



**University of Asia Pacific**
Department of Civil Engineering
CE 315: Design of Concrete Structures
Time: 3 hrs. Term Final Examination Marks: 100

**Section-A: Answer any Four out of Five questions (Marks: 4×5=20)**

1. Explain with sketches the behaviour of under reinforced beam and over reinforced beam.
2. What is meant by temperature and shrinkage reinforcement? Discuss their importance mentioning the limitations for minimum amount and spacing of such reinforcements as per ACI Code.
3. Draw sketches for strain and stress distribution diagrams of a reinforced concrete beam section when subjected to bending for uncracked, cracked but elastic and ultimate condition.
4. (i) Write down the recommendation to fix the effective flange width of T-beams according to ACI.

   (ii) What are the factors to be considered to fix the depth of a T-beam.
5. (i) Give reasons for the minimum cover for reinforcements in ACI Code.

   (ii) Mention the recommended minimum cover for reinforcements in different structural elements in different conditions.

**Section-B: Answer any Three out of Four questions (Marks: 3×8=24)**

6. Calculate the allowable moment capacity of the beam section shown in Fig. 1.

   $f'_c = 3$ ksi; $f_y = 60$ ksi; $f_s = 24$ ksi; $n = 9$.
7. Calculate the ultimate design moment capacity of the same beam section in Fig. 1.

   $f'_c = 3$ ksi; $f_y = 60$ ksi; $n = 9$.
8. Calculate the stresses in concrete fibres at top and bottom, and also in embedded steel for the beam section in Fig. 2 for a bending moment of 50 kft. Given $f'_c = 3$ ksi; $f_y = 60$ ksi; $f_s = 24$ ksi; $n = 9$. If $f_t' = 350$ psi what is the cracking moment for the section.
9. Calculate the allowable moment capacity of the beam section shown in Fig. 3.

   $f'_c = 3$ ksi; $f_s = 20$ ksi; $n = 9$.

**Section-C: Answer any Four out of Six questions (Marks: 4×14=56)**

10. A 30 ft span beam (Fig. 4) supports a DL = 2 k/ft <u>including</u> self weight of the beam and a LL = 1.3 k/ft. The section of the beam is limited to 12"×28". Given $f'_c = 3.5$ ksi, $f_y = 60$ ksi, $f_s = 24$ ksi, $n = 9$.

    (i) Design the beam by WSD

    (ii) Design the beam by USD

    (iii) Give your comments on your designs.

11. A slab with beams is shown in Fig. 5. The beams are simply supported with a span of 28 ft. The slab is subjected to loads as following

    DL (self weight to be calculated, FF = 30 psf, wall = 30 psf), LL = 80 psf.

    Given $f'_c = 3$ ksi; $f_y = 60$ ksi; $f_s = 24$ ksi, $n = 9$

    (i) Design the beam by WSD

    (ii) Design the beam by USD.

12. A 30 ft span simply supported and simply reinforced beam by subjected to DL of 2 k/ft **excluding** self weight of the beam and LL of 1.4 k/ft.

    Given $f'_c = 3.5$ ksi; $f_y = 60$ ksi; $f_s = 24$ ksi, $n = 9$

    (i) Design the beam by WSD

    (ii) Design the beam by USD.

13. (a) Mention the amount of minimum reinforcements and spacing of stirrups for shear stress equal to very small to very large such as more than $8\sqrt{f'_c}$.

    (b) A simply supported beam carries the factored load as shown in Fig. 6. Design the stirrups and make neat sketch showing stirrups. Given $f'_c = 3$ ksi; $f_y = 60$ ksi.

14. A 2-span beam with the bending moment diagram is shown in Fig. 7. The moments in brackets correspond to factored moments at ultimate condition. If $f'_c = 3$ ksi; $f_y = 60$ ksi; $f_s = 24$ ksi, $n = 9$ design the beam by WSD and USD.

15. A floor slab, 5 inch thick, supported by simply supported T-beams having span of 30 ft. and spaced 12 ft. c/c is shown in Fig. 8. The beams are reinforced with 8 – #8 bars as shown. Compute ultimate design moment for the beam and then determine the allowable live load per square foot of the floor slab. Given:

    $f'_c = 3$ ksi; $f_y = 60$ ksi; $n = 9$

    Floor finish = 30 psf & partition wall = 30 psf.

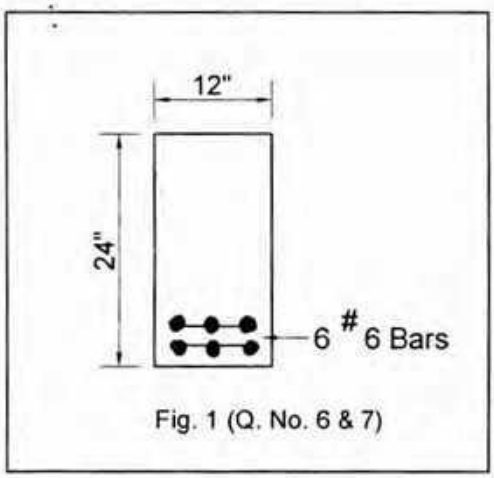


Fig. 1 (Q. No. 6 & 7)

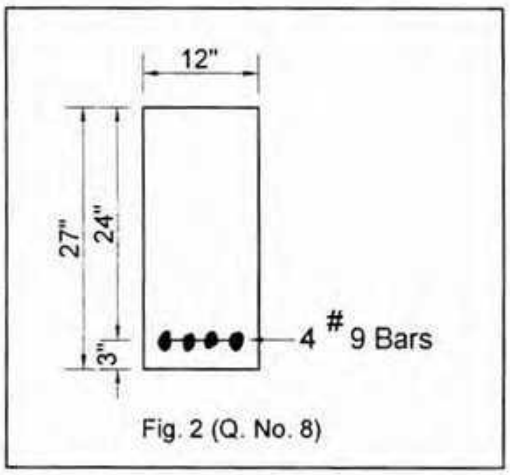


Fig. 2 (Q. No. 8)

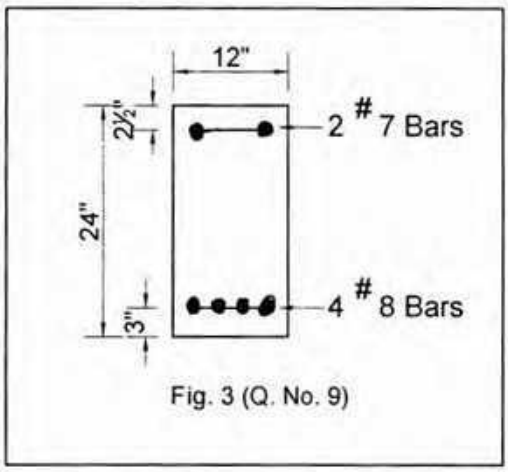


Fig. 3 (Q. No. 9)

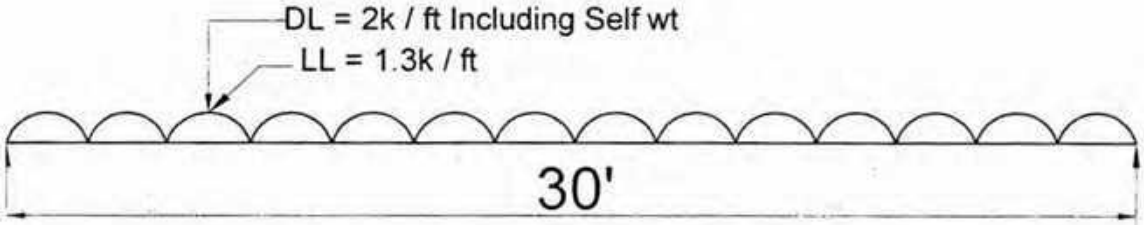
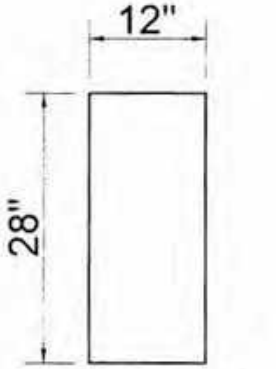


Fig. 4 (Q. No. 10)



SECTION

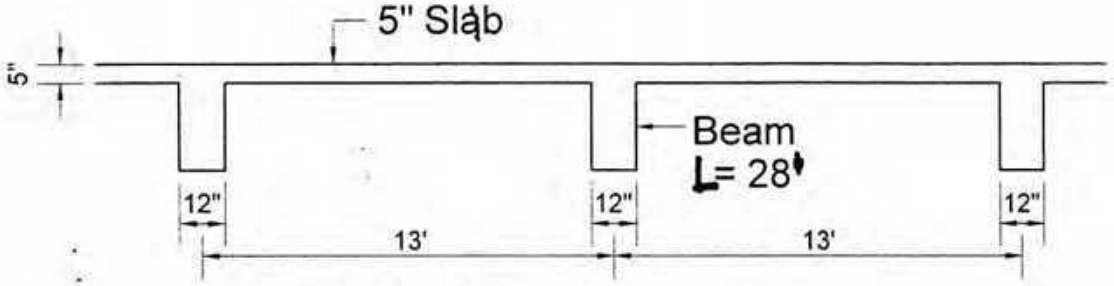
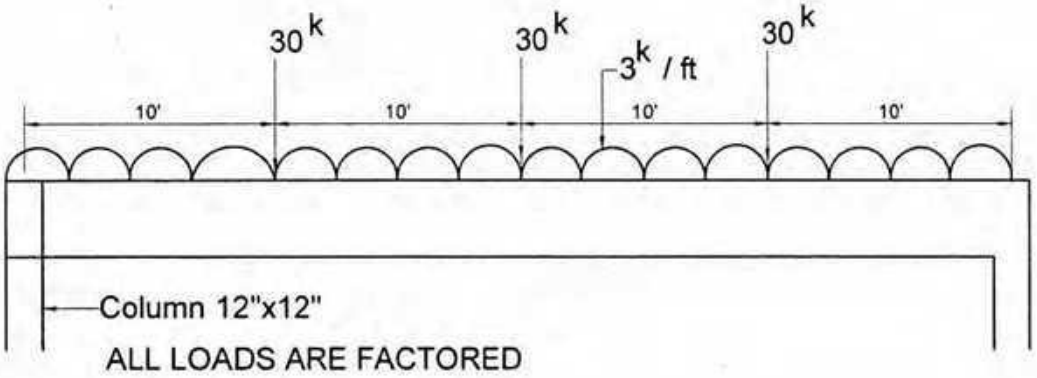



Fig. 5 (Q. No.11 )



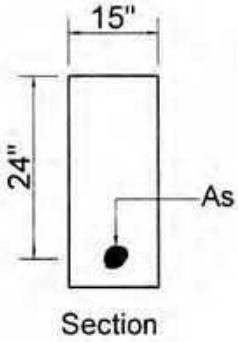




Fig. 6 (Q. No. 13b)

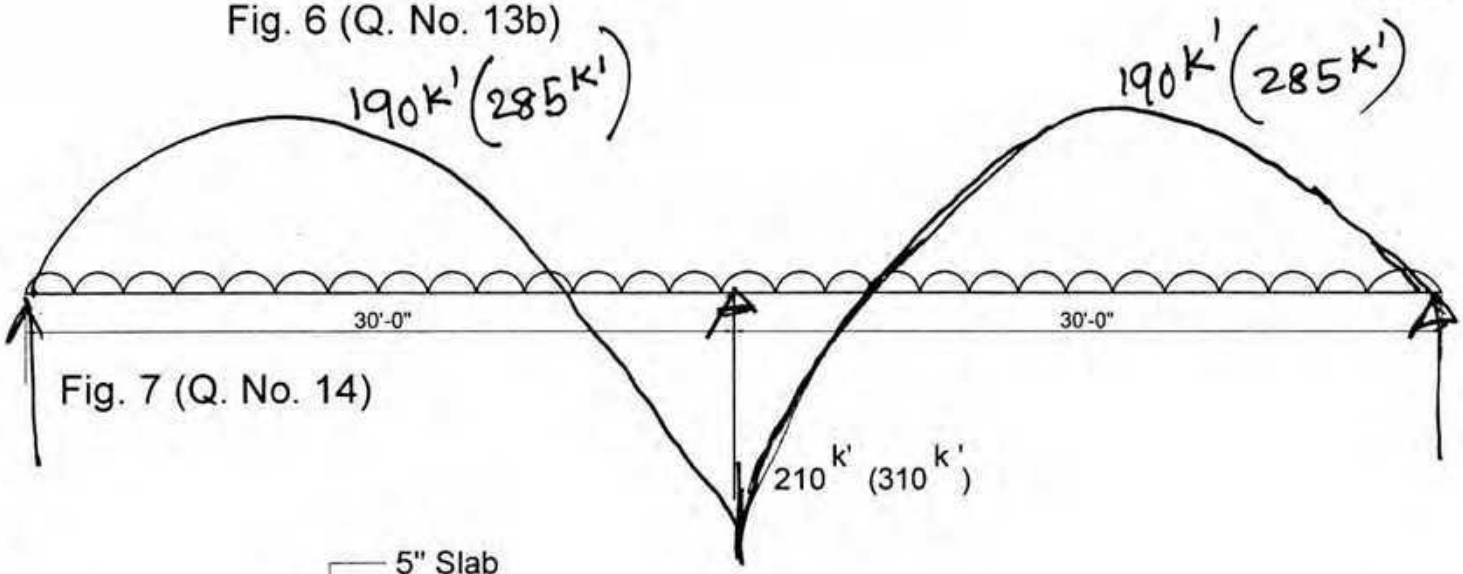



Fig. 7 (Q. No. 14)

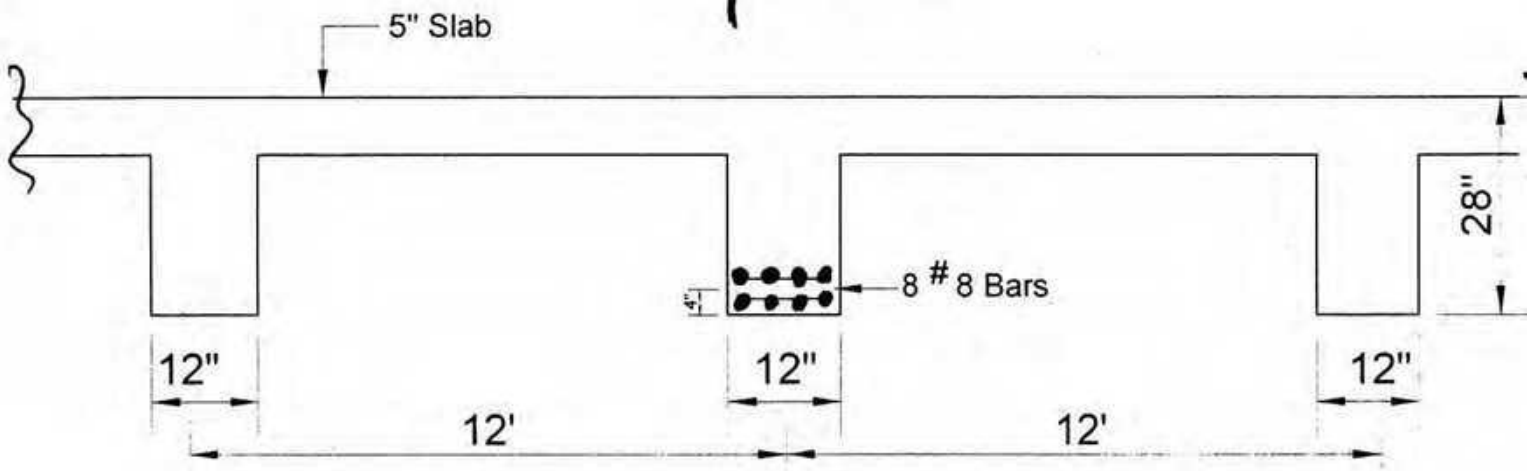



Fig. 8 (Q. No. 15 )

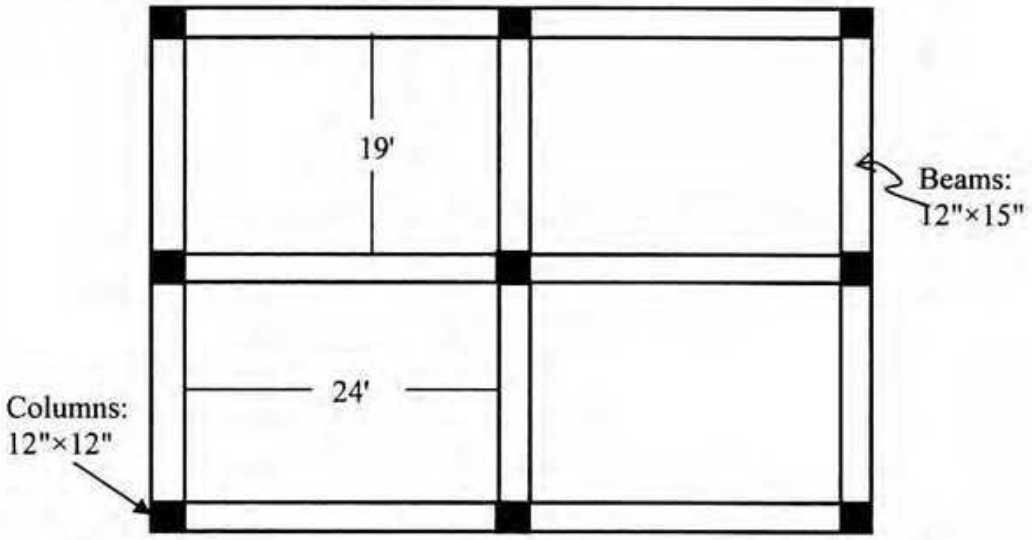
# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination Spring 2010
## Program: B. Sc. Engineering (Civil)

Course Title: Design of Concrete Structures II  Credit Hours: 3.0  Course Code: CE 317
Time: 3 hours  Full Marks: 150

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

1.(a) For the two way edge supported slabs shown below the middle strip mid span and support moments are given. Calculate the required reinforcements and show them in neat sketches. Show corner reinforcements also. Draw plan and sections showing the reinforcements. (12)

Use **WSD** method.




Given: t=6″  n=9

$f'_c$ = 3 ksi, $f_y$=50 ksi, $f_s$ = 20 ksi, $k$=0.378, $j$=0.874

$+M_A$= 2.9 k-ft/ft

$-M_A$= 4.0 k-ft/ft

$+M_B$= 1.9 k-ft/ft

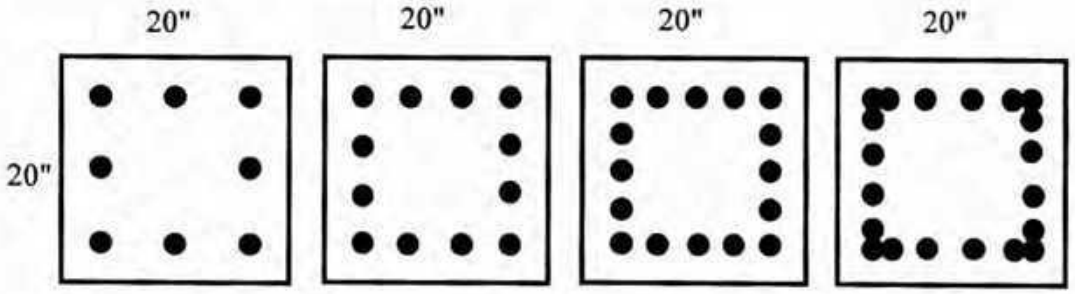
$-M_B$= 2.7 k-ft/ft

(b) Why is special arrangement of reinforcement needed at the exterior corners of a two way slab system? Discuss the possible special arrangements? [04]

(c) What are the limitations in ACI Code for using semi-empirical direct design method (DDM) to determine moments in two-way slabs? [04]

(d) Write down the ACI code specifications regarding column reinforcement ratio, bar sizes to be used, minimum bars (number) and minimum area or dimension. [05]

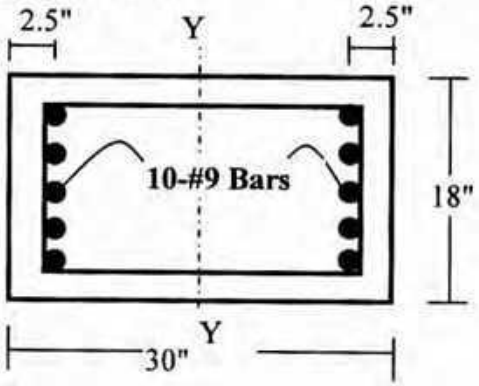
2.(a) Why are ties provided in column? Draw the tie arrangements of the following column sections as per ACI Code. (all bars #9 i.e. 1-1/8" dia) (07)




(i) 8 bars (ii) 12 bars (iii) 16 bars (ii) 20 bars

(b) In reviewing the capability of a building, a particular column of the same existing framed building is found to be reinforced with bars as shown below. The service loads calculated for different load combinations are found as follows: (12)

(i) P= 500 k and M= 150 k-ft
or (ii) P=400 k and M=200 k-ft
or (iii) P=275k and M= 300 k-ft

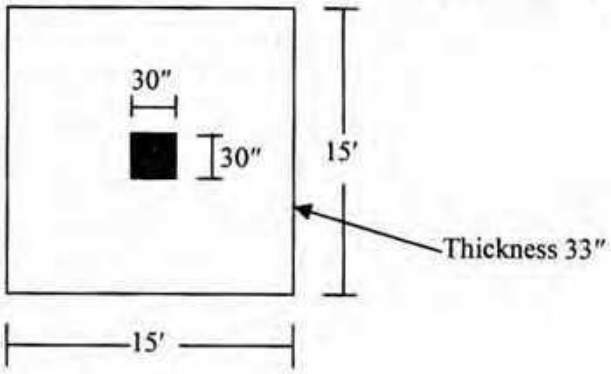



Check the adequacy of the column section by **WSD** method.
**Given:** $f'_c$ = 3 ksi, $f_y$=50 ksi, $f_s$ = 20 ksi, $S_{ut}$=4470 in$^3$

(c) Compare flat plate with flat slab. What are the functions of a drop panel in a column supported floor? Give the specifications for the size of drop panel in flat slabs. (06)

3. (a) Design a tied column supporting a DL=250 k and LL=150 k assuming a moderate % of steel by WSD. Given: $f'_c$ = 3 ksi, $f_y$= 50 ksi, $f_s$=20 ksi. (05)
(b) Keeping the same cross-section as in 3(a) design the same column by USD. (05)
(c) Keeping the actual % of steel as in 3(a) design the column by USD. (05)
(d) Give your comments on the above designs. (03)
(e) For the same loads as in 3(a), design a spirally reinforced column (spirals also) by WSD. (07)

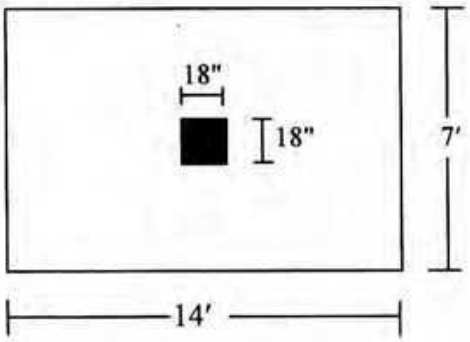
4.(a) The plan of a square footing of 33" thickness is shown in the following figure. The net upward pressure is 3.7 ksf. Check the adequacy of the thickness of the footing. Use **WSD.** [Given: Column size 30"×30", $f'_c$ = 3 ksi, $f_y$=50 ksi, $f_s$ = 20 ksi, k=0.378, j=0.874, R= 200 psi]. (12)



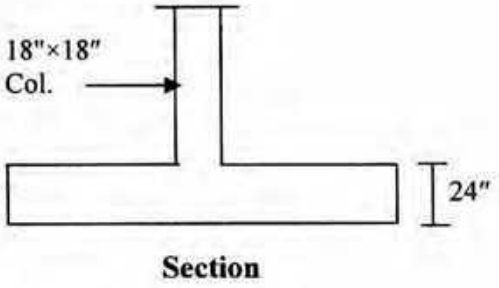

(b)

**Footing Plan**

A rectangular footing supporting a 18″×18″ column with working loads of $P_{DL}=185^k$ and $P_{LL}=150^k$ is shown in figure below. The total thickness of the footing is 24″ which is adequate for all shears. Calculate only the necessary reinforcements for the footing and show them with necessary details in neat sketches. Use either **WSD** or **USD** (13)



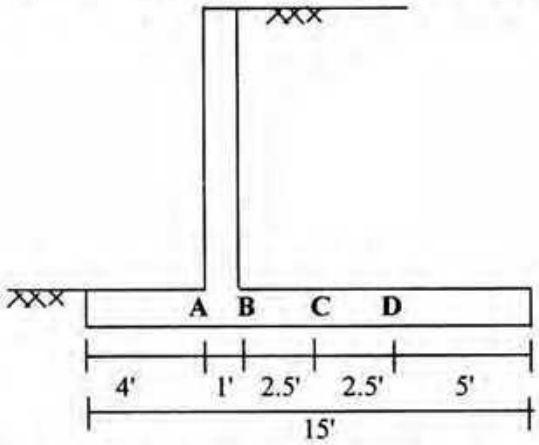

**Plan**




**Section**

Given: $f_c'=3$ ksi, $f_y=50$ ksi, $f_s=20$ ksi, k=0.378, j=0.874

5.(a) A cross section of a cantilever type retaining wall with 4 (four) possible locations through which the resultant may pass (either A, B, C or D) is shown in the following figure. Draw the qualitative soil pressure diagrams for the footing for each case. (10)

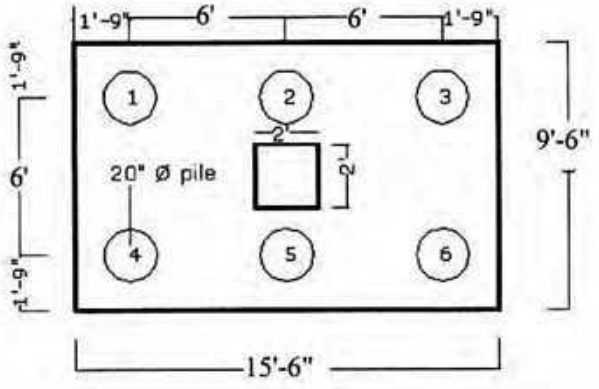



(b) The plan of a pile cap with 6 nos. 20" dia piles and the column (24"x24") is shown in the following figure. Net reaction of a single pile is $110^k$. The total thickness of the pile cap is 48" having average d=39" (15)

[Given: $f_c'=3$ ksi, $f_y=50$ ksi, $f_s=20$ ksi, k=0.378, j=0.874, R= 200 psi].

i) Calculate the punching and beam shear stresses.
ii) Calculate the design moment and reinforcement in the pile cap.
iii) Comment on the adequacy of the thickness.

Use **WSD** method.



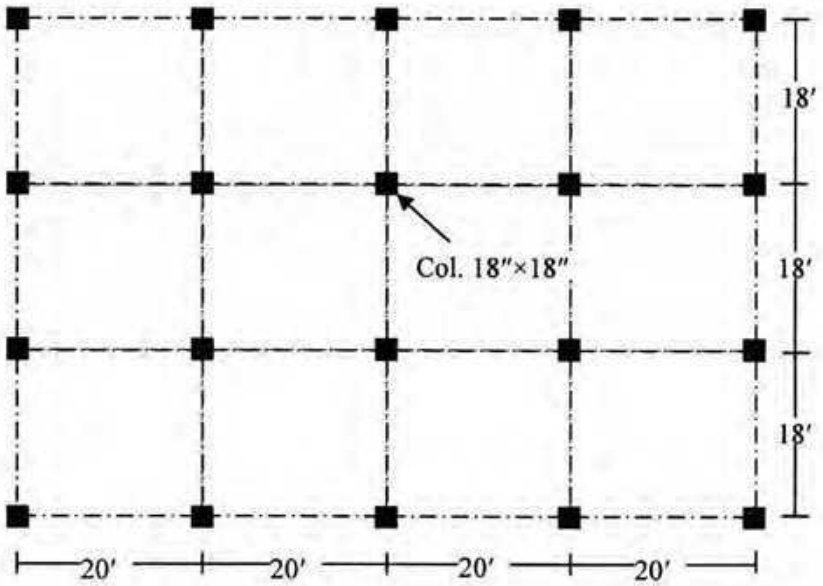
6. A building is to be designed as a flat plate structure. A plan of the building is shown below. The columns are 18"×18" in size and are on 18'×20' grid. The building will have no beams on column lines. Other design conditions and material properties are given below: (25)

FF=25 psf, Random wall load = 40 psf and LL=50 psf, $f_c' = 4$ ksi, $f_y = 60$ ksi,

Design an interior panel by **USD**.

Follow the steps mentioned below:

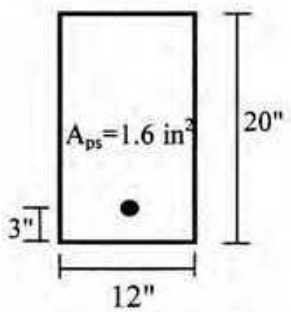
(i) Calculation for minimum slab thickness
(ii) Check for punching shear – around interior column
(iii) Calculation for design moments
(iv) Check for slab thickness – moment consideration
(v) Calculation for flexural reinforcements
(vi) Neat sketches for reinforcements




7.(a) Define i) Pretensioning and ii) Post tensioning. Describe different stages of Pre-tensioning system with sketches (06)

(b) A simply supported pretensioned rectangular beam shown below will be be used on a 40 ft simple span. Calculate the concrete and steel stresses at the mid-section of the beam for the following conditions: (12)
i) at initial condition with full prestress and no live load
ii) at working condition with effective prestress and full live loads.
Compare stresses with ACI allowable streses.

Given: $n$=7, $f_c'$=5 ksi, $f_{ci}'$=4 ksi , $f_{si}$=150 ksi, $f_{se}$=115 ksi
Self wt. beam= 300 lb/ft
Superimposed live load= 400 lb/ft



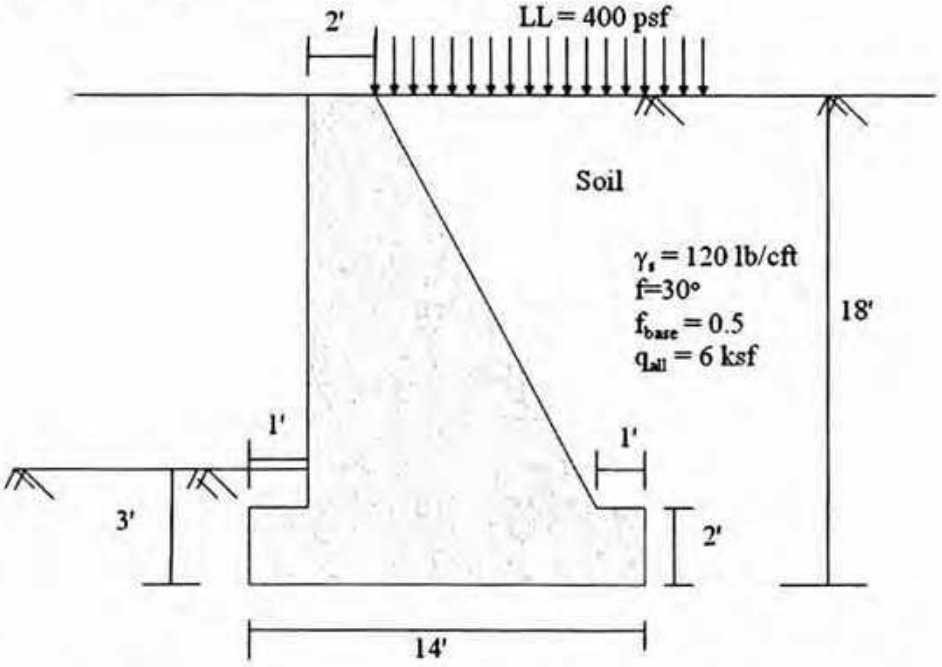

Mid span section

(c) For the beam defined as in Question 7(b), calculate cracking moment [Given: $f_r$=*600 psi*]. (07)

8.(a) A trial section of a gravity retaining wall as shown in the following figure was made to support the soil behind the wall and the surcharge on the ground surface. (12)

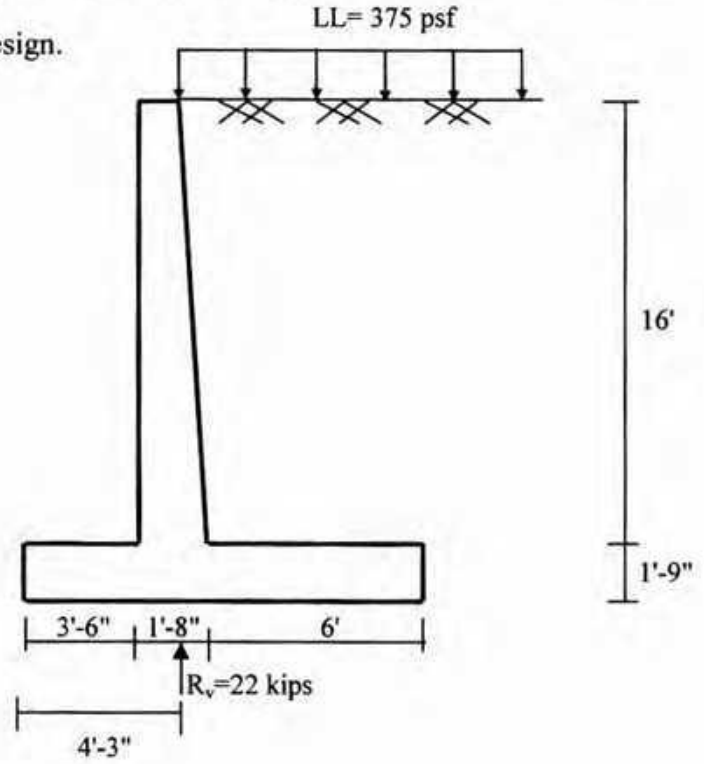
i) Check the external stability of the section against sliding and overturning.
ii) Also check the soil pressure under the base.

[Consider only the critical position of surcharge LL.]




(b) A cross section of a retaining wall is shown in the following figure. If $R_v$, the vertical component of the reaction is equal to 22 kips and acts at a distance 4.25 ft from the toe as shown, Design the footing (heel slab and toe slab) of the retaining wall[ Given: $\gamma_s$=120 lb/ft$^3$, $f_c'$ = 3 ksi, $f_s$=20 ksi, $n$=9, $R$=200 psi]. (13)

Use **WSD** method of Design.



# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination Spring 2010
## Program: B. Sc. Engineering (Civil)

Course Title: Environmental Engineering I — Course Code: CE 331
Time: 3 Hours — Full Marks: 150

Answer any **six** out of **eight** questions. The figures in the right margin indicate full marks.

1.a) Enumerate the factors to be considered in planning a municipal water supply system? (08)

b) What are the objectives of water supply system? (03)

c) Estimate the future population of a city by the incremental increase method for the year 2030 and 2050 from the following data: (14)

| Year | 1940 | 1950 | 1960 | 1970 | 1980 | 1990 | 2000 |
|---|---|---|---|---|---|---|---|
| Population | 25000 | 27600 | 34300 | 41800 | 47860 | 54800 | 62000 |

Also calculate the fire demand for the population in 2050 by Kuichling's method.

2.a) What is meant by 'fire demand' and how is it computed? (05)

b) Briefly explain the problems in ground water development in Bangladesh. (10)

c) A 30 cm diameter well penetrates 26 m below the static water table. After 24 hours of pumping at 5400 litres/minute, the water level in a test well at 80 m is lowered by 0.51 m, and in a well 35 m away, the drawdown is 1.13 m. What is the transmissibility of the aquifer? (10)

3.a) Design a tubewell to deliver 34000 gallons per hour at a depression head of 5 m. The average water level is 10 m below the ground in September and 15 m in March. The geological investigations have yielded the following results at the site of boring: (22)

| Depth (m) | Type of Strata |
|---|---|
| 0 to 5 | Surface clay |
| 5 to 20 | Very fine sand |
| 20 to 30 | Clay with Kankar |
| 30 to 50 | Coarse sand |
| 50 to 60 | Clay |
| 60 to 80 | Medium sand |
| Below 80 | Clay with sand stone |

Assume coefficient of permeability for coarse and medium sand = 0.04 cm/sec.

b) What are the reasons for failure of tubewells? (03)

4.a) What is water-hammer? How can you reduce the water-hammer effect in water works practices? (08)

b) State various methods of detection and prevention of wastage of water. (10)

c) How will you test the soundness of your construction before bringing a pipeline into commission? (07)

5.a) What are the sanitary significance, WHO guideline values and Bangladesh standards of the following impurities in water: Arsenic, Chloride, Sulfate, Manganese. (10)

b) Explain the process of arsenic removal by the method of co-precipitation and adsorption indicating the possible chemical reactions involved. (08)

c) Design a rectangular settling basin for a flow of 3.5 MLD. The over-flow rate is 0.024 cm/s and the detention period is 2.5 h. Calculate the weir length required if the weir loading is 125 $m^3/d/m^2$. (07)

6.a) Explain the operating difficulties of rapid sand filtration. How can these difficulties be removed? (11)

b) What are the factors influencing disinfection of water? (07)

c) It is required to supply water to a population of 50,000 at a per capita demand of 150 litres per day. The disinfectant used for chlorination is bleaching powder which contains 30% available chlorine. Determine how much of bleaching powder is required annually at the water works if 0.4 ppm of chlorine dose is required for disinfection. (07)

7.a) Derive the correction made in the Hardy-Cross method of computing flow distribution in a network of pipes. (07)

b) State systematically the process of design of branched network of distribution system. (06)

c) Water has to be supplied to a town with 1,20,000 population at the rate of 150 lpcd from a river 2500 m away. The difference in elevation between the L.W.L. in the sump and reservoir is 35 m. if the demand has to be supplied in 8 hours, determine the size of the main and the B.H.P of the pumps required. Assume maximum demand as 1.5 times the average demand, f = 0.008, velocity in the pipe 2.5 m/sec and efficiency of pump 75 percent. (12)

8.a) What are the basic requirements for community management? (06)

b) Calculate the per capita water available and the capacity of the storage tank required for a family of 8 persons having a roof area of 25 $m^2$ with a runoff coefficient of 0.7. The family lives in part of Bangladesh having a yearly rainfall of 2.6 m. The distribution demands 40% storage requirement for full utilization of rainwater. (06)

c) Why is the Tara hand pump tube well developed and being prompted in Bangladesh? (03)

d) Write short notes on any two of the following: (10)

i) Ethics of water
ii) Water use and re-use
iii) Water pricing

# The University of Asia Pacific
# Department of Civil Engineering
# Final Examination Spring 2010
# Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering II | Course Code: CE 333
Time: 3.0 hrs | Full Marks: 150

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There are EIGHT questions. Answer question 1 and any **FIVE** from the rest. **QUESTION 1 is COMPULSORY.**

*[Assume reasonable value for missing data (if any)]*

**1.a)** Residential area shown in figure 1 is severed by sewer P1. At present it has a total of 200 nos 5 storied building with two flats on each floor. The average occupancy is 6 persons per flat. The per capita water demand is 200 liter per day. The segment of sewer (P1) between man holes MH1 and MH2 servicing the area was designed using the following data: (20)
i) pipe diameter = 300 mm; ii) pipe length = 300m;
iii) peak infiltration rate = 0.25 $m^3$/ha/day
iv) invert level at MH1 = 1.75 m;
v) invert level at MH2 = 0.85 m;
vi) per capita waste water generation rate is 70% of water use
vii) Area = 200 ha [Assume reasonable value for missing data.]
viii) Manning's roughness coefficient for old sewer is 0.015. The nomograph is attached with this question paper.
Using the above information determine whether the sewer is adequate or not. Comment on your finding.

**b)** Write down the conditions where combine sewer system is suitable. (5)

**2.a)** Is ROEC a hygienic latrine? Justify your answer. Also briefly explain the advantages and disadvantages of ROEC over simple pit latrine. (10)

**b)** In an effort to discourage people from open defecation the local authority in a village offers pre-cast concrete rings of 1.0m dia and concrete slabs to cover the pits at a very subsidized rate. Design a simple pit latrine for an average family of 8 persons who uses water for cleansing. The ground water table is below 5.0m. The latrine has to serve at least 4 years. (15)

**3.a)** Describe the measures or design modifications taken to prevent or reduce ground water contamination from pour-flush pit latrine in high water table area. (10)

**b)** If the soil is sandy loam with a long-term infiltration rate of about 30 l/$m^2$/day. Design a soakage pit for as septic tank discharging 900 l effluent every day. Assume pit dia = 1.25 m. (15)

**4.a)** Draw the bacteria-algae symbiosis in waste stabilization pond. Show that maximum efficiency in a series of waste stabilization ponds is achieved when the detention times of all ponds are the same. (10)

**b)** What do you mean by the following terms: (15)
i) Grit Chamber
ii) Sludge Volume Index
iii) Invert level of sewer
iv) Self-cleansing velocity
v) Difference between aerobic and anaerobic process

**5.a)** Show the pattern of pollution and self purification of a stream and its effect on biological life in a curve and briefly discuss each zone. (8)

**b)** Design a waste stabilization pond system to treat wastewater from a low-income settlement with a population of 20000 at Mirpur, Dhaka. The average wastewater flow is about 100 l/person/day and the BOD contribution is 40 gm/person/day. The temperature of the month December is 23°C. Assume the fecal coliform concentrations of raw and treated wastewater are $1 \times 10^8$ and 1000 per 100 ml respectively. Assume: Anaerobic, Facultative and Maturation pond depths are 3 m, 1.5 m and 1.0 m respectively. 75% removal efficiency in the facultative pond and consider two maturation pond. You can assume any other reasonable data if necessary. $k_{20°C} = 0.3\ d^{-1}$ and $k_{b20°C} = 0.7\ d^{-1}$. (17)

**6.a)** Mention the processes to improve dewater ability of sludge. (4)

**b)** Explain the term "dissolve oxygen sag curve" with diagram. (5)

**c)** What are the design criteria of (surface loading, effluent $BOD_5$, depth etc.) of facultative pond in waste stabilization pond system? (6)

**d)** What are the possible effects of discharging waste water in a stream having pH = 6.8 and temperature = 35°C. The waste water quality are as following: (6)
i) pH = 10.2; ii) temperature = 39°C

**e)** What are the major differences in principles while designing and layout of water distribution pipes and sewer pipes? (4)

**7.a)** Briefly discuss the various growth phase of bacteria with neat diagram. (8)

**b)** A city discharges 1.55 $m^3/s$ of sewage into a stream whose minimum rate, of flow is 8.5 $m^3/s$. The velocity of stream is 3.2 km/h. The temperature of the sewage is 20°C and that of the water of stream is 12°C. The 20°C $BOD_5$ of the sewage is 180 mg/l and that of the stream water is 1.5 mg/l. The sewage contains no DO while the stream is 90% saturated with dissolved oxygen. The values of $K_1$ and $K_2$ at 20°C are 0.3/d and 0.7/d respectively. Use the temperature coefficient of 1.135 for $K_1$ and 1.024 for $K_2$. (17)
Determine -
(i) The critical oxygen deficit, critical (minimum) DO concentration and its location.
(ii) The DO at 100 and 150 km downstream from the point of discharge of sewage.

**8.a)** What are the methods of disposal of sewage effluent on land by irrigation? What are the advantages of the effluent disposal by irrigation? (10)

**b)** Describe the activated sludge process in detail and give the flow diagram. (10)

**c)** Show a cross section of septic tank and various zone of waste accumulation in it. (5)

**Formulae:**

1. $Q = A_i I$

2. $V_i = A_i \frac{D}{4}$

3. $\lambda_s = 10\, L_i\, Q / A$

4. $\lambda_v = L_i / t$

5. $A\, D = Q\, t$

6. $L_e = \frac{L_i}{(1+kt_1)(1+kt_2)....(1+kt_n)}, \quad k_{(T)} = 2.6(1.05)^{T-20}$

7. $N_e = \frac{N_i}{(1+k_b t_1)(1+k_b t_2)....(1+k_b t_n)}, \quad k_{b(T)} = 2.6(1.19)^{T-20}$

8. $D_t = \frac{K_1 L_a}{K_2 - K_1}\left(e^{-K_1 t} - e^{-K_2 t}\right) + D_a e^{-K_2 t}$

9. $t_c = \frac{1}{K_2 - K_1} \ln\left\{\frac{K_2}{K_1}\left(1 - \frac{D_a(K_2 - K_1)}{K_1 L_a}\right)\right\}$

10. $D_c = \frac{K_1}{K_2} L_a e^{-K_1 t_c}$

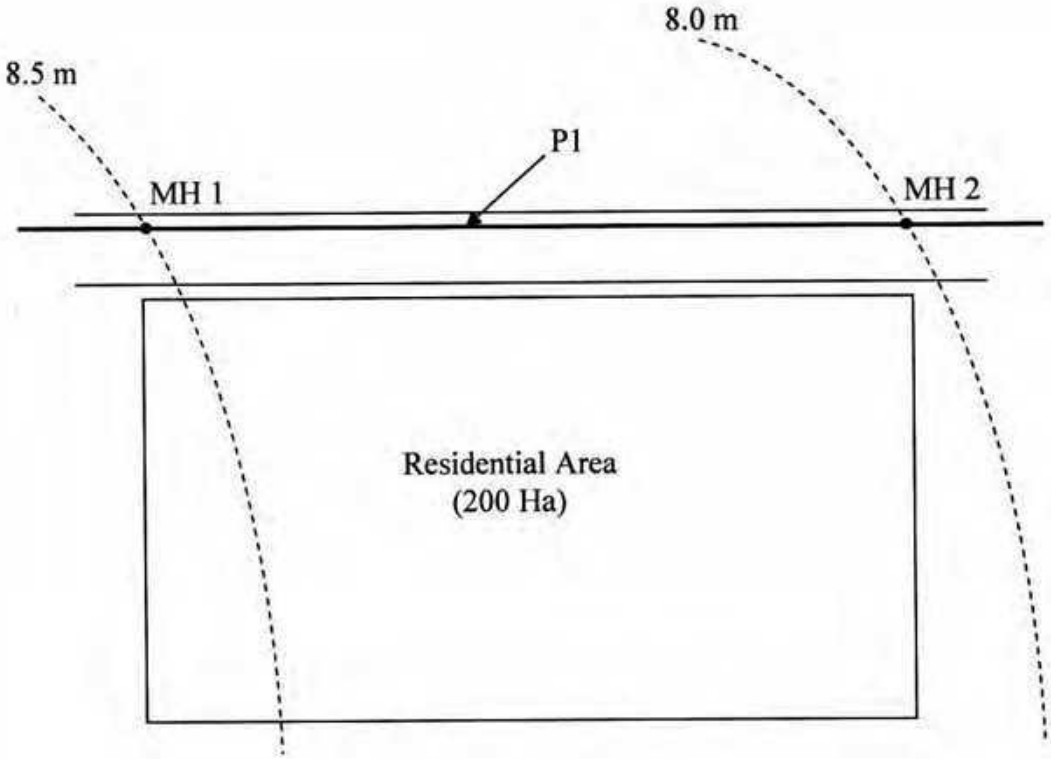
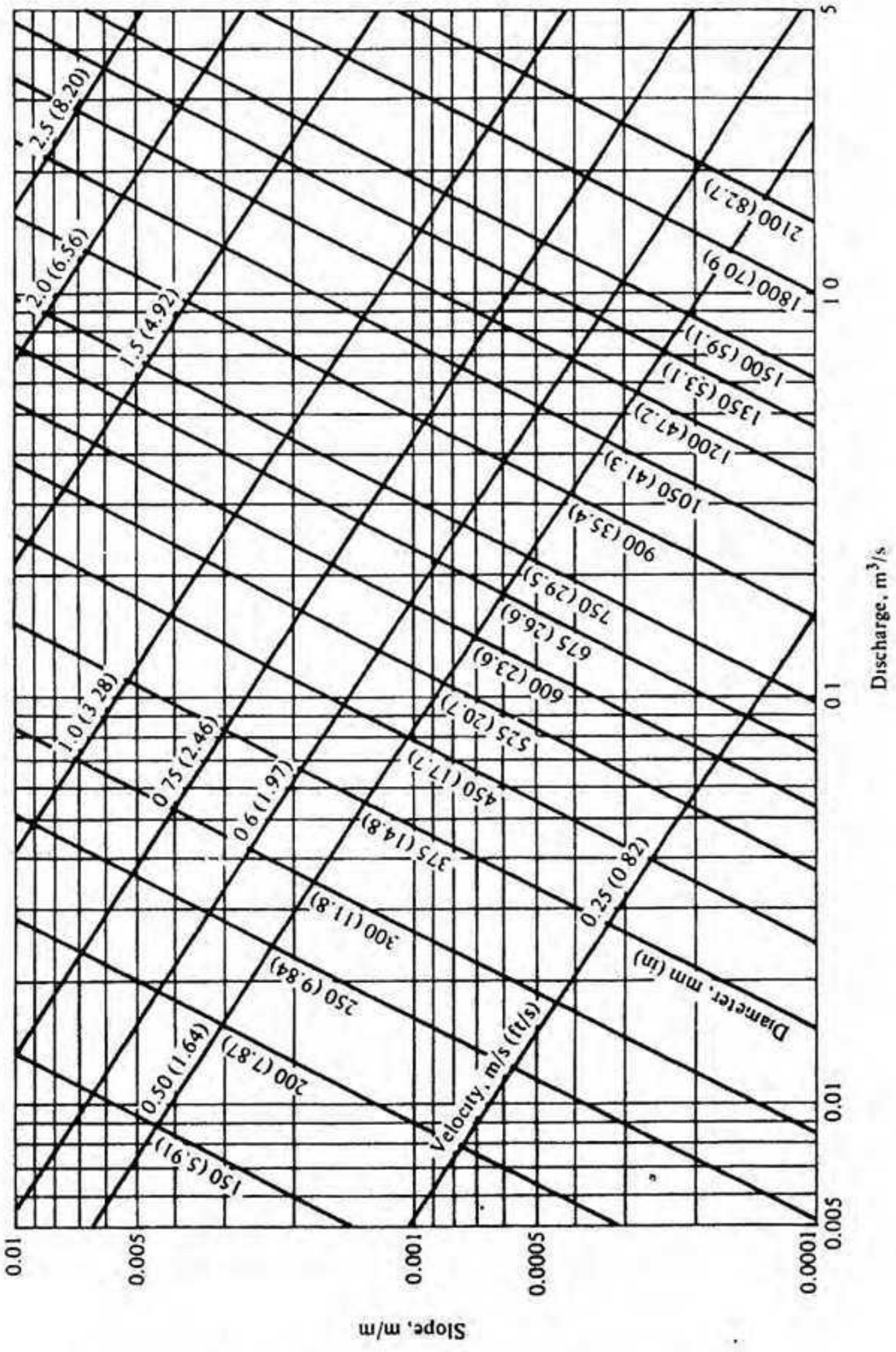



**Figure 1: For question 1. a)**




**Nomograph for solution of Manning's equation for n = 0.015**

# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination Spring 2010
## Program: B.Sc. Engineering (Civil)

Course Title: Transportation Engineering I (Transport & Traffic Design) Course Code: CE 351

Time: 3 Hours Full Marks: 100

There are **SEVEN** questions. Answer any **FIVE.**

1. (a) What are the different causes of traffic congestion? How can you eliminate congestion by Traffic Engineering Tools? (10)
   (b) A local street with 30 ft pavement width having a reflectance of 20%, carries a maximum of 300 vph at night time in both directions. Design Lighting system of the road considering fluorescent light source with mounting height of 30 ft and a maintenance factor of 0.8. Draw the lighting layout. Use attached Figure and Tables. . (10)

2. (a) Briefly explain the 'Fifth Five Year Plan' for Transport Planning in Bangladesh. (12)
   (b) What is All-red-period in traffic signal? (3)
   (c) Draw a typical Road Junction with different elements. (5)

3. (a) Classify and describe traffic sign according to function. (7)
   (b) What are the functions of traffic islands? (6)
   (c) What are the key locations of a road to provide street light? (3)
   (d) Write a short note on origin and destination survey. (4)

4. (a) Write down the responsibilities of the following ministries involved in the transportation control and management system in Bangladesh (10)
      i) Ministry of Communication
      ii) Ministry of Civil Aviation and Tourism
      iii)Ministry of LGRD and Co-operative.
   (b) Write a short note on different Road Markers. (7)
   (c) What is Refuge Island? (3)

5. (a) Describe Traffic Signal according to function. (8)
   (b) What is an Interchange? Mention the types of Interchanges. (1+3)
   (c) What are the reasons of providing shoulder in a rural road? (3)
   (d) What are the general requirements of traffic control devices? (5)

6. (a) What are the different factors that responsible for large bicycling demand in a country? Mention different bicycle facilities. (3+3)
   (b) Draw qualitative diagrams showing the relationship between Volume & Density, Speed & Volume and Speed & Density. (5)
   (c) What is Traffic Engineering? (3)
   (d) Write short notes on i) Right of Way ii) Median iii) Parking Facilities (6)

7. (a) Draw the urban highway cross section design features. (4)

(b) What is 98$^{th}$ Percentile Speed? (3)

(c) Two roads are connected by a horizontal circular curve on level ground. Inside the circular curve there exists an obstruction, which may reduce the ability of sight distance. Given the following data, calculate the stopping and passing sight distance required and sight distance available on the curve with figure. (13)

Given,

Distance from center of the road to the edge of obstruction,
c =205 ft
Radius of the curve=520 ft
Design speed of the road= 50 mph
Co-efficient of friction=0.14
Average speed of passing vehicle= 50 mph
Average speed of passed vehicle= 40 mph
Perception reaction time=2.5 sec
Average acceleration rate = 1.5 mph/sec
Time for preliminary delay= 3 sec
Average time while passing vehicle occupies the opposite lane=10 sec
Clearance Distance = 220 ft

TABLE 1 RECOMMENDED AVERAGE ILLUMINATION (LUMENS/FT²)

| Pedestrian traffic[1] | Vehicular traffic[2] (vph) | | | |
|---|---|---|---|---|
| | Very light (<150 vph) | Light (150 – 500 vph) | Medium (500 – 1,200 vph) | Heavy (>1,200 vph) |
| Heavy | - | 0.8 | 1.0 | 1.2 |
| Medium | - | 0.6 | 0.8 | 1.0 |
| Light | 0.2 | 0.4 | 0.6 | 0.8 |

Notes: (1) Heavy: As on main business street
Medium: As on secondary business streets
Light: As on local streets
(2) Night hour flow in both directions

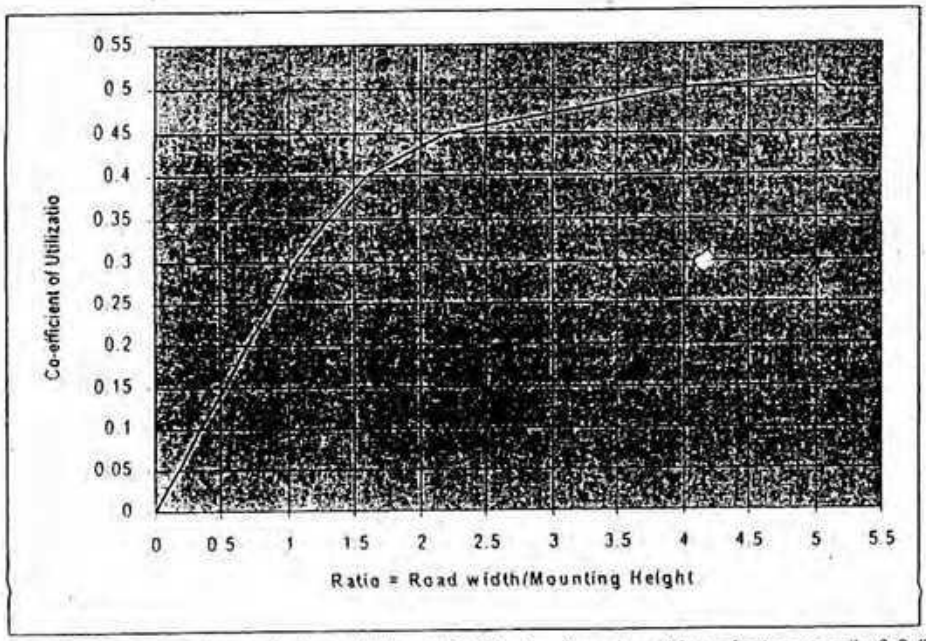
TABLE 2 ADJUSTMENT FACTORS FOR RECOMMENDED AVERAGE ILLUMINATION VALUES

| Surface Reflectance | Adjustment Factors |
|---|---|
| 3 % or less | 1.5 |
| 10% | 1.0 |
| 20% or more | 0.75 |

TABLE 3 LIGHTING SOURCE CHARACTERISTICS

| Source Types | Expected Life (hrs) | Lighting Efficiency (Lumens/Watt) | Wattage (Watt) |
|---|---|---|---|
| Tungsten | 1000 | 8 – 14 | Up to 1000 |
| Fluorescent | 6000 | 50 – 75 | Up to 250 |
| Sodium | 6000 | 100 – 120 | Up to 160 |
| Mercury | 7500 | 20 – 60 | Up to 400 |

FIGURE 1 CO-EFFICIENT OF UTILIZATION CURVES *(FOR LIGHT DISTRIBUTION TYPE III)*




Note: Due to poor maintenance, the actual co-efficient of utilization is reduced by a factor usually 0.8 (i.e. taken as 80%).

TABLE 4 RECOMMENDED ARRANGEMENT OF STREET LIGHTING

| Type of Arrangement | Pavement Width |
|---|---|
| One side | Width <= 30ft |
| Both sides – Staggered | 30ft > Width <= 60ft |
| Both sides – Opposite | Width > 60ft |

# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination Spring- 2010
## Program: B.Sc. Engineering (Civil)

Course Title: Open Channel Flow  Course Code: CE 361  Credit: 3.00
Time: 3 hours  Full Marks: 150

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Answer any **SIX** out of **EIGHT** Questions. The figures in the right margin indicate full marks.

1 a. Define Pressurised and Open Channel Flow. "It is much more difficult to solve problems in open channels than in pressure pipes"-Justify the statement. 5

b. A trapezoidal channel has a bottom width of 6 m and side slopes of 2 (H):1 (V). Compute the discharge and determine the state of flow in this channel if the depth of flow is 1.5 m and the mean velocity of flow is 2.30 m/s. If elementary waves are created in this channel, determine the speed of the wave fronts upstream and downstream. 8

c. Why the velocity distribution in open channel flow is not uniform? 4

d. In a wide channel the velocity varies along a vertical as u = 1+0.6z, where 'u' is the velocity at a distance 'z' from the channel bottom. (i) compute the velocity distribution coefficients $\alpha$ and $\beta$. The depth of flow in the channel is 5 m. 8

2 a Show that the critical depth ($y_c$) and velocity ($V_c$) for a rectangular channel can be expressed by $y_c = \sqrt[3]{\frac{q^2}{g}}$ and $V_c = \sqrt[3]{qg}$ respectively, where 'q' is the discharge per unit width and 'g' is the acceleration due to gravity. 6

b. A sharp crested weir in a rectangular channel has a discharge 4 $m^2/s$ per unit width as shown in the Figure 1. Estimate the energy loss due to the weir. Take $\alpha = 1.2$. 5

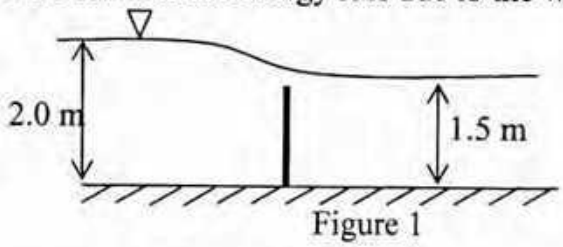


Figure 1

c. A trapezoidal channel has a bottom width of 6.0 m, side slopes of 2:1. Calculate the critical depth and the corresponding specific energy for a discharge of 8 $m^3/s$. 6

d. A broad crested weir with an upstream square corner and spanning the full width of a rectangular canal of width 2.5 m is planned. The proposed crest length is 4.00 m and the crest elevation is 1.25 m above the bed. Calculate the water surface elevation upstream of the weir when the discharge is 5.0 $m^3/s$. 8

3 a. Explain why a uniform flow cannot occur (a) in a frictionless channel (b) in a horizontal channel, and (c) channel with adverse slope. 6

b. Mention the factors that affect Manning's roughness coefficient. 5

c. The sides of a laboratory flume are made of glass (n=0.010) and the bottom is made of wood (n=0.015). The flume is trapezoidal with b=2 m, side slope of 2H:1V and is laid on a slope of 0.001. Compute the discharge in the flume if depth of flow is 1.2 m. 5

d. A trapezoidal channel has a bottom width of 6.0 m, side slopes of 2:1, and n=0.025. 9
(a) Determine the normal slope at a normal depth of 1.0 m when the discharge is 20 $m^3/s$.
(b) Determine the critical slope when the discharge is 20 $m^3/s$.
(c) Determine the critical slope when the normal depth is 1 m.

4 a. Explain with neat sketches how hydraulic jump is formed in a channel? 5

b. Draw typical velocity distribution curve at a section in hydraulic jump. 4

c. Explain with neat sketches various types of hydraulic jumps. 8

d. Water flows in a horizontal rectangular channel 6 m wide at a depth of 0.52 m and a velocity of 15.2 m/s. If a hydraulic jump forms in this channel, determine (i) type (ii) the downstream depth needed to form the jump (iii) length and (iii) head loss of the jump. 8

5 a. Water flows at a velocity of 1 m/s and a depth of 1.50 m in a long rectangular channel 3 m wide. Compute (a) the height of a smooth upward step in the channel bed to produce critical flow (b) the downstream depth produced by a smooth upward step of 0.25 m, and (c) the upstream depth produced by a smooth upward step of 0.75 m. 12

b. A rectangular channel is 3.5 m wide and conveys a discharge of 15.0 $m^3/s$ at a depth of 2.0 m. It is proposed to reduce the width of the channel at a hydraulic structure. Assuming the transition to be horizontal and the flow to be frictionless determine the water surface elevations upstream and downstream of the constriction when the constricted width is 2.00 m. 8

c. A rectangular canal of 2.0 m wide has its depth backed-up to a height of 1.2 m by a sharp-crested sluice gate. If the gate opening is 0.30 m and the downstream flow is free, estimate the discharge through the gate. (Assume $C_d$=0.75) 5

6 a. What do you mean by best hydraulic section? Using the best hydraulic section concept show that the hydraulic radius of a trapezoidal channel is half of the depth of flow. 8

b. A trapezoidal section is to be built of rough un-sized timber (n=0.015) with a drop of 2 m per km. What will be the depth of water for most efficient section for a flow of 1.5 $m^3/s$? 5

c. Find out the height and width of a stable canal ( 0.5 H : 1V) using Kennedy's equation to carry a discharge of 12 $m^3/s$ at a slope of 2 $x10^{-4}$. (Given, n = 0.020 and m=0.88.) 6

d. Find out the height and width of a regime channel ( 0.5 H : 1V) to carry a discharge 15 $m^3/s$ using Lacey's equation. Mean sediment size of the sand is 0.6 mm. 6

7. a. What is free board? What are the purposes of providing free board? 3

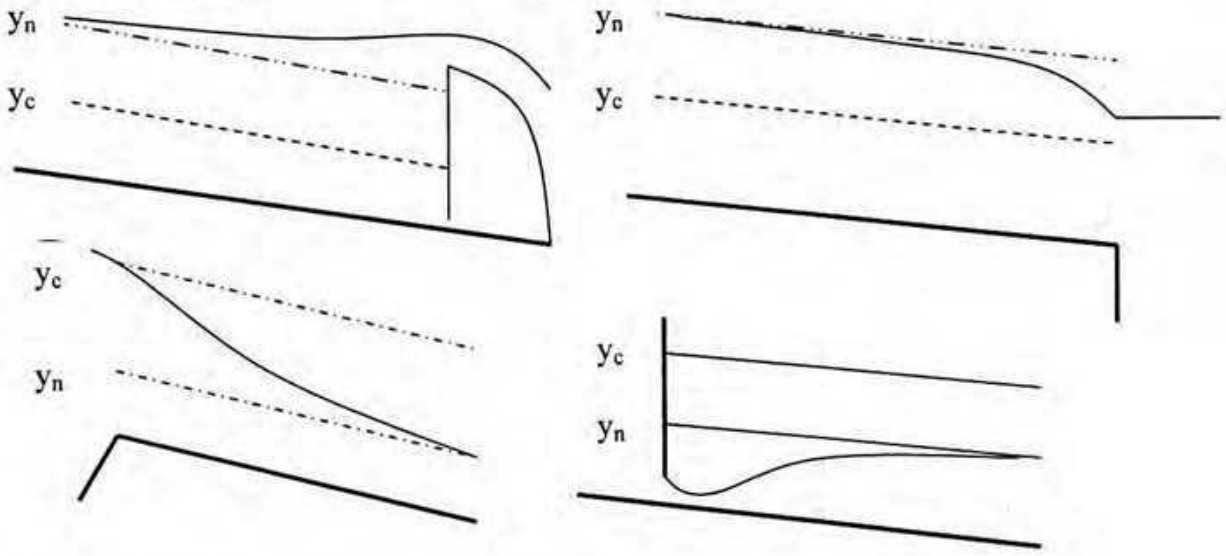
b. What are the reasons for lining channels? 4

c. Define (a) Tractive force, and (b) Regime Channel 6

d. Design a canal to carry 55.00 $m^3/s$ of clear water through 6.0 mm gravel (manning's roughness coefficient =0.012 and angle of Repose 36°) on a slope of $10^{-4}$. The canal is to be trapezoidal in shape having side slopes of 2 H: 1 V. The average temperature = 20°c for which $\nu = 10^{-6}\ m^2/s$ and $\rho_s = 2.65$. 12

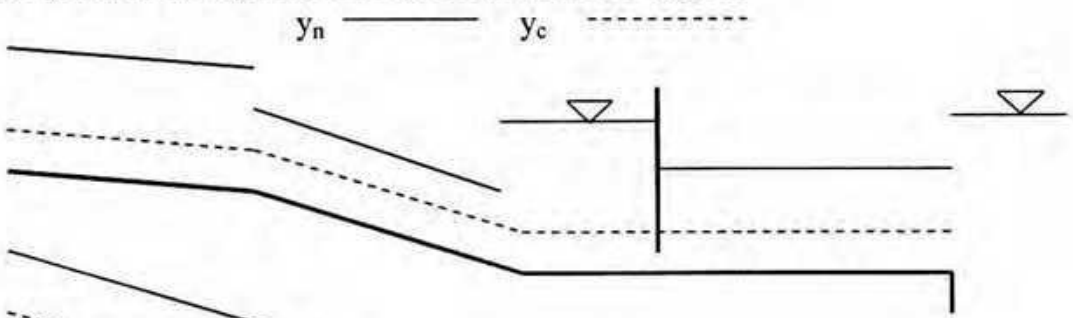
8 a. In the dynamic equation of gradually varied flow, $\frac{dy}{dx} = \frac{S_o - S_f}{1 - \frac{Q^2 T}{gA^3}}$, explain each term of the equation. 7

b. Identify the flow profiles for the following structures, 8

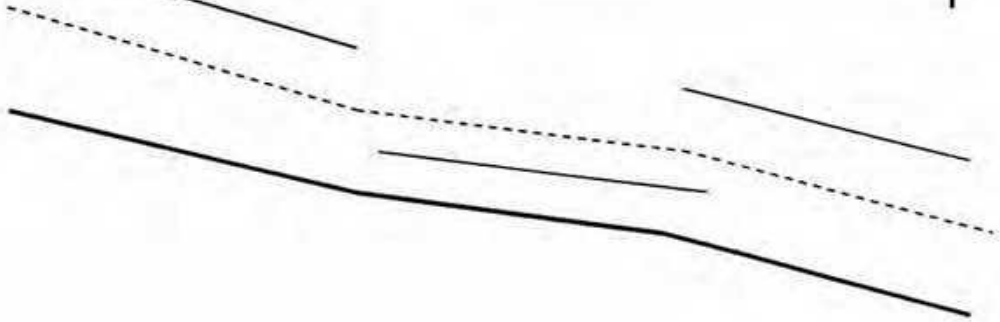



c. Sketch the possible flow profiles for the following two figures 1

(i)




(ii)



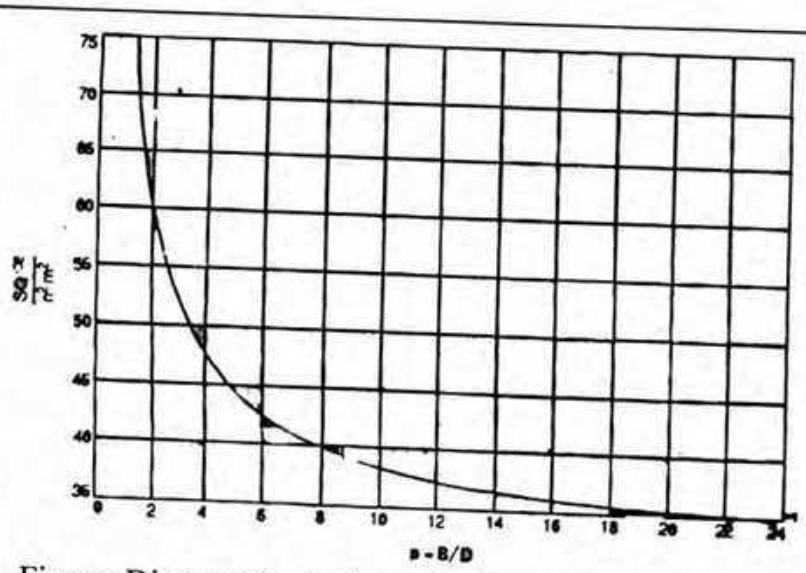



Figure: Diagram for design using Kennedy's equation

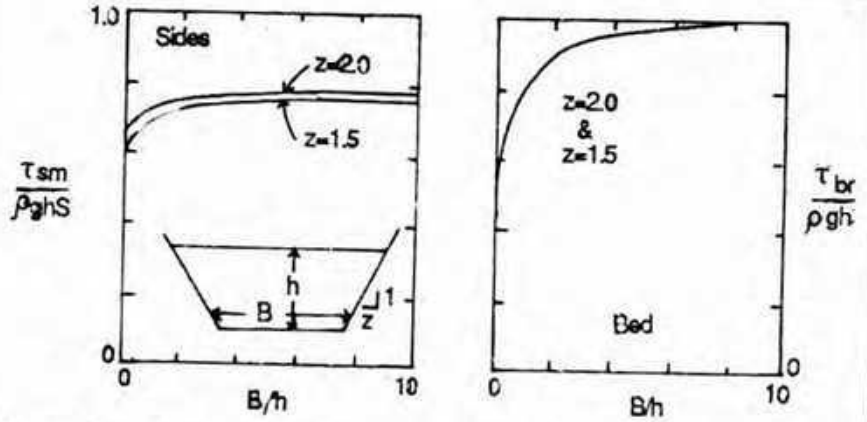



Figure: Maximum shear stresses on bed and sides of smooth trapezoidal channels

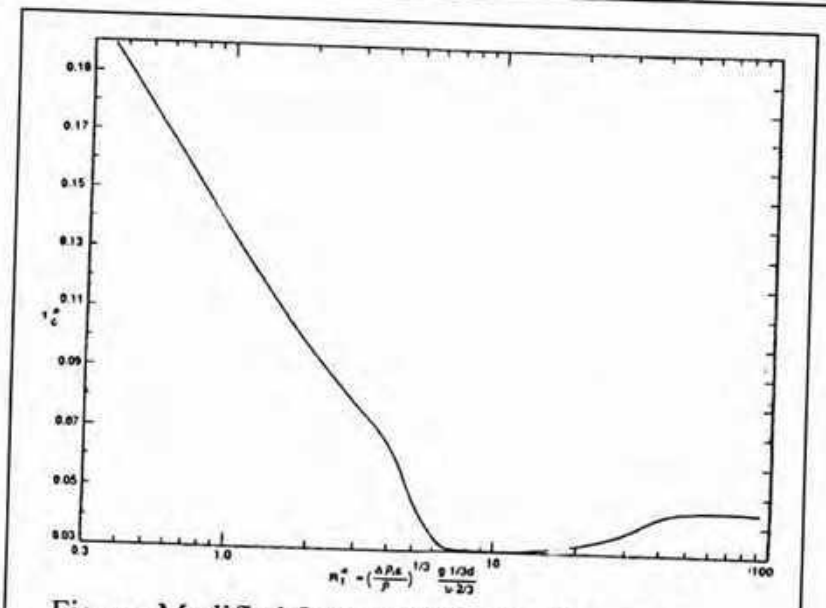



Figure: Modified form of Yalin-Karahan curve

**FORMULAE**

1. $\alpha = \frac{\int v^3 dA}{V^3 A}$ 2. $\beta = \frac{\sum v^2 \Delta A}{V^2 A}$ 3. $u = \frac{\int u.dy}{y}$ 4. $P = \gamma h$

5. , $h = h_s + c$ or, $h = h_s - c$ 6. $c = \frac{d}{g}\frac{v^2}{r}$ 7. $\left(\frac{P}{\gamma} + Z\right) = \int \frac{V^2}{gr} dr + cons\tan t$

8. $a_n = \frac{v^2}{r}$ 9. $\frac{y_2}{y_1} = \frac{1}{2}(\sqrt{1+8F_1^2} - 1)$ or, $\frac{y_1}{y_2} = \frac{1}{2}(\sqrt{1+8F_2^2} - 1)$

10. $\Delta E = E_1 - E_2$ 11. $\Delta E = \frac{(y_2 - y_1)^3}{4y_1 y_2}$ 12. $\frac{L_j}{y_1} = 9.75(F_1 - 1)^{1.01}$

13. $E_2 = E_1 - \Delta Z_1$ 14. $\frac{V_c^2}{2g} = \frac{y_c}{2}$, $E_c = \frac{3y_c}{2}$; $y_c = \left(\frac{q^2}{g}\right)^{\frac{1}{3}}$

15. $Q = \frac{2}{3} C_d \sqrt{2g} L H_1^{\frac{3}{2}}$ 16. $C_d = 0.611 + 0.08(H_1/P)$ which is valid for $H_1/P \leq 5.0$

17. For long weirs, $H_1/B_w \leq 0.1$ , $C_d = 0.561(H_1/B_w)^{0.022}$

For broad crested weirs, $0.1 \leq H_1/B_w \leq 0.35$ , $C_d = 0.028(H_1/B_w) + 0.521$

For narrow crested weirs, $0.45 \leq H_1/B_w \leq 1.5$ , $C_d = 0.120(H_1/B_w) + 0.492$

18. $Q = C_d A\sqrt{2g\Delta H}$ 19. $V = \frac{1}{n} R^{\frac{2}{3}} S^{\frac{1}{2}}$ 20. $n = \frac{d_{50}^{\frac{1}{6}}}{21.1}$ 21. $n = \frac{d_{90}^{\frac{1}{6}}}{26}$

22. $n_{eq} = \frac{(\sum n_i^{\frac{3}{2}} P_i)^{\frac{2}{3}}}{P^{\frac{2}{3}}}$ 23. $\frac{\tau_s}{\tau_b} = K = \cos\theta\sqrt{1 - \frac{\tan^2\theta}{\tan^2\phi}}$ 24. $\tau_b = 0.90\tau_c$

25. $\tau_c^* = \frac{\tau_c}{g(\Delta\rho_s)d}$ Where, $\Delta\rho_s = \rho_s - \rho$ 26. $R_1^* = \left(\frac{\Delta\rho_s}{\rho}\right)^{\frac{1}{3}}\left(\frac{g^{\frac{1}{3}}d}{\nu^{\frac{2}{3}}}\right)$

27. $\tau_{bm} \leq \tau_b$, $\tau_{sm} \leq \tau_s$ 28. A =(b+zy)y and P= b + 2y$\sqrt{1+z^2}$ 29. $\frac{Q^2}{g} = \frac{(B + zy_c)^3 y_c^3}{B + 2zy_c}$ 30. $B_c = 1.84\frac{Q}{\sqrt{g}E_1^{\frac{3}{2}}}$

31. $E_1' = 1.5y_c = E_c$

32. $h = \left[\frac{1.818Q}{(p+0.5)m}\right]^{0.378}$

33. $P = 4.75\sqrt{Q}$

34. $R = 0.47\left(\frac{Q}{f_s}\right)^{\frac{1}{3}}$

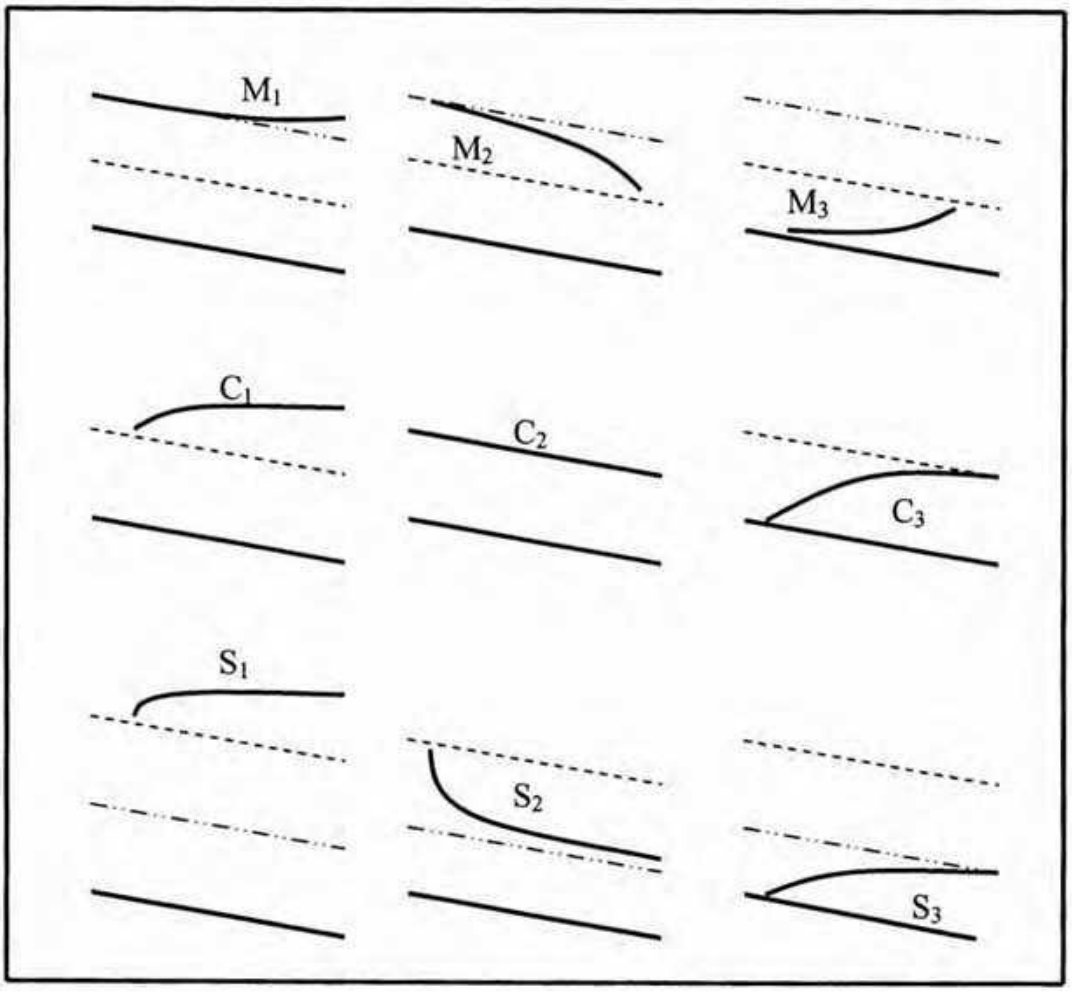
35. $S = 3\times10^{-4} f_s^{\frac{5}{3}} / Q^{\frac{1}{6}}$

36. $f_s = 1.76\sqrt{d}$

37. $Q = C_d A\sqrt{2g\Delta H}$

38. $y_2 = C_c a$

39. $C_d = \frac{C_c}{\sqrt{\left(1-(\frac{ac_c}{H_1}\right)^2}}$



# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination, Spring 2010
## Program: B.Sc Engineering (Civil)

Course Title: Engineering Hydrology Course Code.: CE 363 Credit hrs: 3
Time: 3 hours Full Marks: 150

**Part A**
**There are FOUR questions answer any THREE**

1. (a) Explain the following (any Three) (9)
   i) Depth-duration-frequency curve
   ii) Infiltration capacity
   iii) Rational method to estimate the magnitude of a flood peak
   iv) Consistency test for rainfall records
   v) Pan coefficient

   (b) Distinguish between the following (any Four) (8)
   i) Depression storage and interception
   ii) Field capacity and permanent wilting point
   iii) Hydraulic and hydrologic method of flood routing
   iv) Cold and warm fronts.
   v) Storm hydrograph and Direct runoff hydrograph

   (c) How to determine the precipitable water in a saturated air column. (8)

2. (a) Explain the procedure for (i) checking a rainfall data for consistency and (ii) supplementing the missing rainfall data. (10)

   (b) Four rain gauges located within a rectangular area with four corners at (0,0), (0,13), (14,13), and (14,0) have the following coordinates and recorded rainfalls: (15)

| Raingauge location | Rainfall (cm) |
|---|---|
| (2, 9) | 2.2 |
| (7, 11) | 3.5 |
| (12, 10) | 4.3 |
| (6, 2) | 6.4 |

   All coordinates are expressed in Km. Compute the average rainfall in the area by the Thiessen method.

3. (a) Discuss the factors that affect the process of evaporation? (10)

   (b) Sketch the schematic diagram of energy budget method of estimating evaporation from a lake. (5)

(c) Estimate the daily potential evapotranspiration for the following data by Penman's formula: (10)

i) Slope of the saturation vapour pressure vs. temperature at the mean air temperature = 1.00 mm/°C
ii) Mean temperature = 19°C
iii) Relative humidity = 75%
iv) Wind velocity at 2 m height = 85 km/day
v) Saturated vapour pressure $e_w$ = 16.5 mm of Hg
vi) Net radiation = 1.99 mm of water per day
vii) Psychrometric constant = 0.49 mm of Hg/°C

4. (a) Discuss the role of the shape, slope and drainage density of a basin affect the shape of a flood hydrograph. (6)

(b) Rainfall of magnitude 3.8cm and 2.8cm occurring on two consecutive 4-h durations on a catchment of area 27 $km^2$ produced the following hydrograph of flow at the outlet of the catchment. Estimate the rainfall excess and Φ-index. (7)

| Time (h) | -6 | 0 | 6 | 12 | 18 | 24 | 30 | 36 | 42 |
|---|---|---|---|---|---|---|---|---|---|
| Observed Flow ($m^3/s$) | 6 | 5 | 13 | 26 | 21 | 16 | 12 | 9 | 7 |

| Time (h) | 48 | 54 | 60 | 66 |
|---|---|---|---|---|
| Observed Flow ($m^3/s$) | 5 | 5 | 4.5 | 4.5 |

(c) The ordinates of a 6-h unit hydrograph are as given below: (12)

| Time (h) | 0 | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 |
|---|---|---|---|---|---|---|---|---|---|
| Ordinate of 6-hUH ($m^3/s$) | 0 | 20 | 60 | 150 | 120 | 90 | 66 | 50 | 32 |

| Time (h) | 54 | 60 | 66 |
|---|---|---|---|
| Ordinate of 6-hUH ($m^3/s$) | 20 | 10 | 0 |

If two storms, each of 1 cm rainfall excess and 6-h duration occur in succession, calculate the resulting hydrograph of flow. Assume base flow to be uniform at $10 m^3/s$.

**Part B**

**There are FOUR questions answer any THREE**

(Assume any reasonable data if not given)

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5. (a) What are the assumptions of a unit hydrograph? (3)

(b) A basin has 400 sq. km oh area, L = 35 km and $L_{ca}$ = 10 km. Assuming $C_t$ = 1.5 and $C_p$ = 0.7 develop a 3-h synthetic unit hydrograph for this basin using Snyder's method. (10)

(c) The ordinates of a 2-hr UH are given below. Determine the ordinates of an S-curve hydrograph and using this determine the ordinates of a 4-h unit hydrograph. (12)

| Time (h) | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 |
|---|---|---|---|---|---|---|---|---|
| 2-hr UH ordinates (cumec) | 0 | 25 | 100 | 160 | 190 | 170 | 110 | 70 |

| Time (hr) | 16 | 18 | 20 | 22 |
|---|---|---|---|---|
| 2-hr UH ordinates (cumec) | 30 | 20 | 6 | 0 |

6. (a) How does channel routing differ from reservoir flood routing? What are the factors to be considered in choosing the routing period? (5)

(b) The inflow and outflow hydrographs for a reach of a river are given below. Determine the best values of the Muskingum coefficients k and x for the reach. (20)

| Time (hr) | Inflow (cumec) | Outflow (cumec) |
|---|---|---|
| 0 | 20 | 20 |
| 12 | 191 | 30 |
| 24 | 249 | 120 |
| 36 | 164 | 176 |
| 48 | 110 | 164 |
| 60 | 82 | 135 |
| 72 | 62 | 116 |
| 84 | 48 | 90 |
| 96 | 32 | 68 |
| 108 | 28 | 52 |

7. (a) Derive the required expression and different steps for reservoir routing. What data are required for reservoir routing? (10)

(b) The storage in the reach of a stream has been studied. The values of x and K in Muskingum equation have been identified as 0.28 and 1.6 days. If the inflow hydrograph to the reach is as given below, compute the outflow hydrograph. Assume the outflow from the reach at t=0 as 3.5 $m^3/s$. (15)

| Time (hr) | 0 | 6 | 12 | 18 | 24 | 30 |
|---|---|---|---|---|---|---|
| Inflow (cumec) | 35 | 55 | 92 | 130 | 160 | 140 |

8. (a) Explain the stream flow measurements by area-velocity and dilution method. (10)

(b) Using 30 years data and Gumble's method the flood magnitudes, for return periods of 100 and 50 years for a river are found to be 1200 and 1060 $m^3/s$ respectively. (15)

(i) Determine the mean and standard deviation of the data used and

(ii) estimate the magnitude of a flood with a return period of 500 years.

(iii) What are the 80% confidence limits for this estimate in (ii)?

# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination Spring 2010
## Program: B. Sc. Engineering (Civil)

Course Title: Professional Practices and Communications — Course Code: CE 403
Time: 2 Hours — Full Marks: 100

There are **FOUR** Questions. Answer any **THREE** of them.

1. **a)** What is contracting? Write down the steps in making a contract plan. **(4+8)**

   **b)** How time available to achieve planning objective effects: a) Method of contracting. b) Cost of working overtime c) Method of Construction. Explain briefly on each of these selections. **(13 $^1/_3$)**

   **c)** Discuss on the points the main contractor is liable to the employer. **(8)**

2. **a)** Discuss the main points of difference between full turnkey and partial turnkey contracting. How these differences pose advantageous and disadvantageous to each of them? **(17$^1/_3$)**

   **b)** Explain how the following factors effect decision making of proper method of contracting: **(4*4=16)**
   a) Project size, complexity and employer resources
   b) Method of Funding
   c) Time for Completion
   d) Certainty of out-run costs.

3. **a)** Describe briefly the legal consequences that may arise from contract plan. **(10)**

   **b)** What are the liabilities of an employer? **(7$^1/_3$)**

   **c)** Write Short Notes on: **(4*4=16)**
   a) Duty of Care in Pricing
   b) Reasonable Skill and Care
   c) Collateral Warranties
   d) Damage Claims for Misrepresentation

4. **a)** What are the general bases of negotiation for single tenders? **(12)**

   **b)** List the items for negotiation of costs and prices in single tender. **(8)**

   **c)** Briefly describe the method of breakdown of unit costs, quantities and component elements of work for a building or civil engineering contract. **(13 $^1/_3$)**

# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination Spring 2010 (Set A)
## Program: B. Sc. Engineering (Civil)

Course Title: Structural Engineering III | Credit Hours: 3.0 | Course Code: CE 411
Time: 3 hours | Full Marks: 100 (= 10 × 10)

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

1. Fig. 1 shows a plane truss whose joints *b* and *c* deflect 10-mm to left and right respectively due to the forces applied. Calculate the (i) axial force in all members, (ii) applied forces $P_1$ and $P_2$ [Given: $S_x$ = constant = 5000 N/mm].

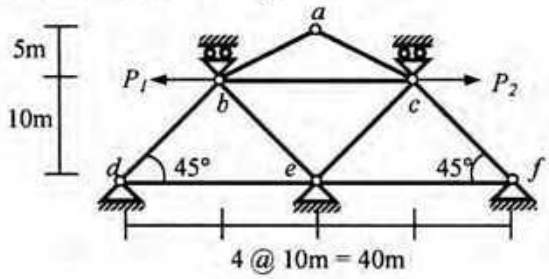
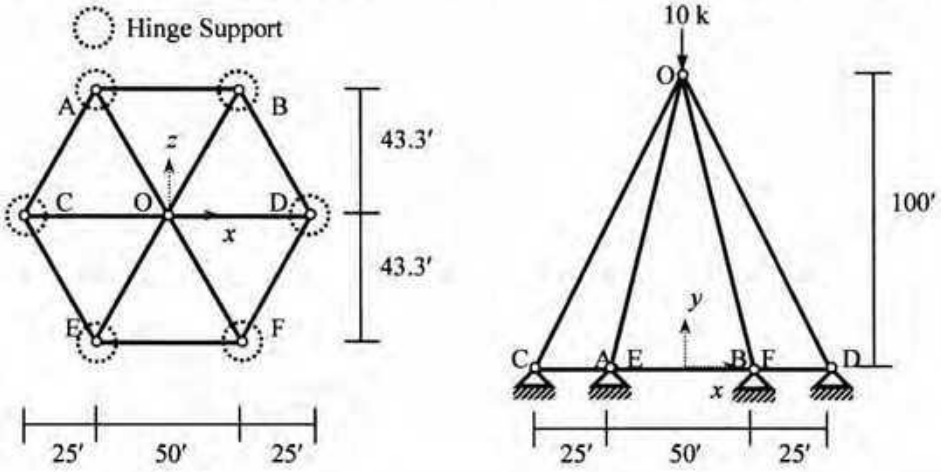



Fig. 1

2. Ignoring the zero-force members, formulate the stiffness matrix, load vector and write down the boundary conditions of the truss shown in Fig. 1.

3. Use the Stiffness Method to calculate the deflections (in *x*-, *y*- and *z*-directions) at joint O of the space truss OABCDEF shown in Fig. 2 (with nodal coordinates) [Given: $S_x$ = constant = 250 k/ft].

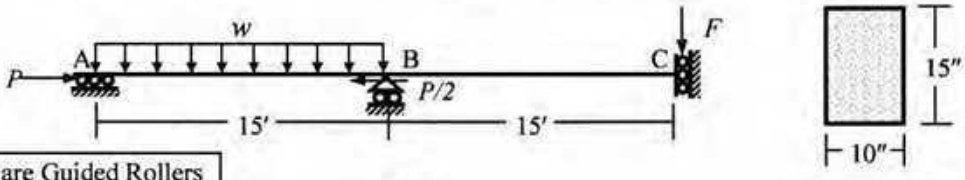



Top View | Front View

| Nodal Coordinates (in ft) |
|---|
| O (0, 100, 0), A (–25, 0, 43.3), B (25, 0, 43.3), C (–50, 0, 0), D (50, 0, 0), E (–25, 0, –43.3), F (25, 0, –43.3) |

Fig. 2

4. Assemble the stiffness matrix, load vector and calculate the unknown joint deflections and rotations of the beam ABC shown in Fig. 3, considering flexural and axial deformations as well as boundary conditions [Given: $P$ = 250 k, $w$ = 1 k/ft, $F$ = 10 k, $E = 400 \times 10^3$ k/ft$^2$].




| A and C are Guided Rollers |
|---|

Fig. 3 | Beam Section

5. Use the Stiffness Method (considering flexural deformations only) to calculate the unknown joint deflections and rotations of the frame loaded as shown in Fig. 4
[Given: EI = constant = $10 \times 10^3$ kN-m$^2$].

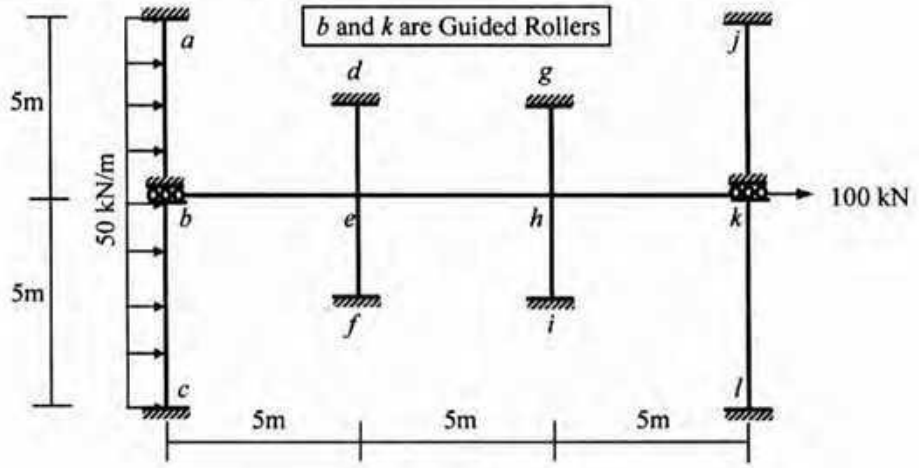



Fig. 4

6. Use the Stiffness Method to calculate the unknown joint deflections and rotations of the beam ABC loaded as shown in Fig. 3, considering flexural deformations only
(i) without geometric nonlinearity, (ii) with geometric nonlinearity.

7. Use the Stiffness Method (with geometric nonlinearity) to calculate the force $P$ needed to cause buckling of the beam ABC shown in Fig. 3.

8. Use the bending moment diagram to calculate forces $P$ needed to develop plastic hinge mechanism in the reinforced concrete beam ABCDE loaded as shown in Fig. 5 [Given: $f_c' = 20$ MPa, $f_y = 276$ MPa].

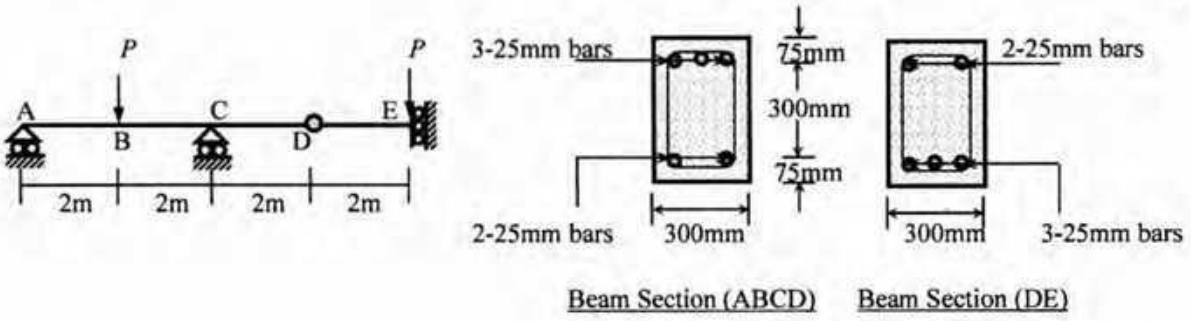



Fig. 5

9. Use Energy Method to calculate the plastic moment $M_p$ necessary to prevent plastic hinge mechanism from developing in the beam *abcdef* loaded as shown in Fig. 6
[Given: Plastic Moment $M_{p(abc)} = 2\,M_{p\,(cdef)} = M_p$].

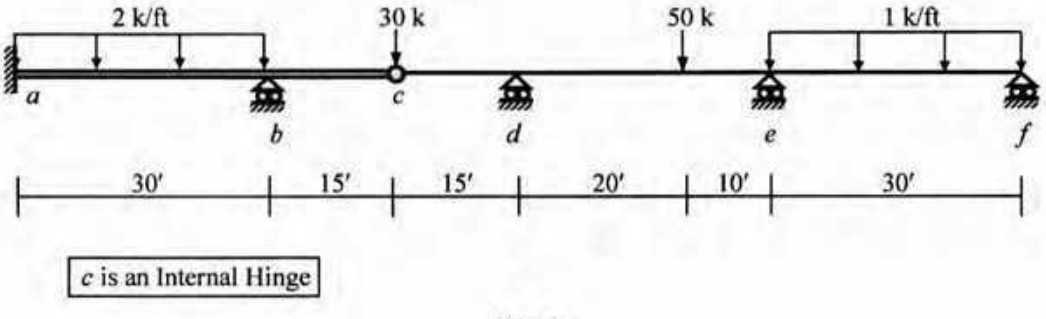



Fig. 6

10. Use the lumped-mass matrix (considering flexural deformations only) to calculate the natural frequencies of the beam ABC shown in Fig. 3, if it weighs 0.15 k/ft.

11. Use the Constant Average Acceleration (CAA) Method to calculate the horizontal deflection of member *be* in the frame loaded as shown in Fig. 7, at time $t = 0.10$ sec after starting with zero initial displacement and velocity
[Given: $EI = 40 \times 10^3$ kN-m$^2$, Total mass of the frame = 10 kN-s$^2$/m, Damping Ratio = 0.05].

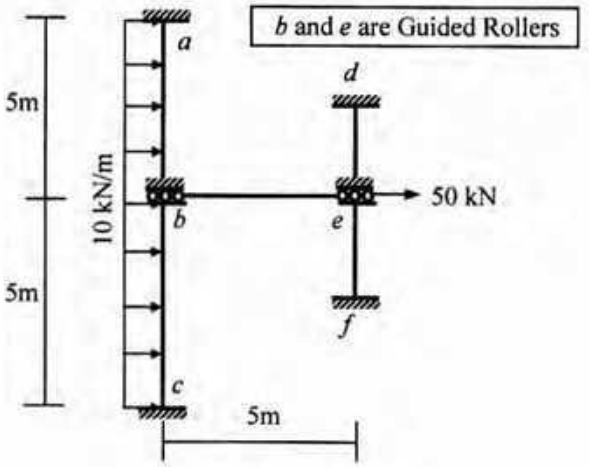
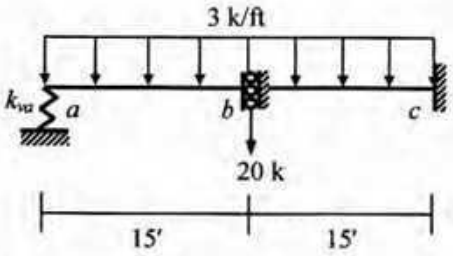



Fig. 7




*b* is a Guided Roller support

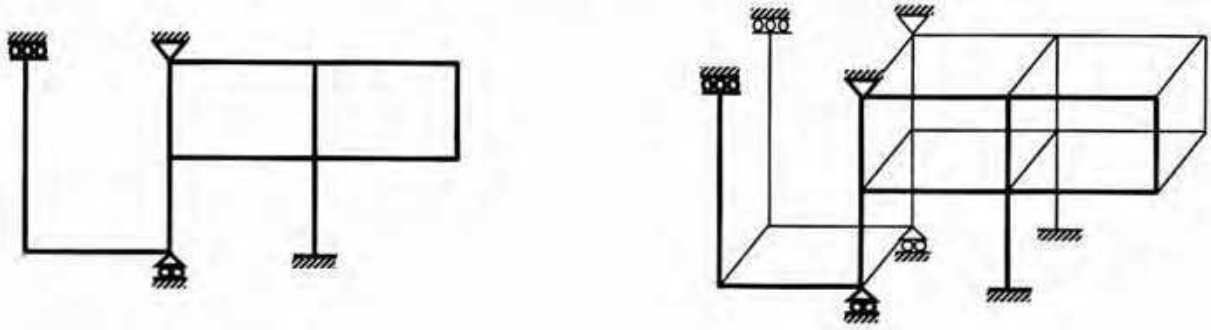
$k_{va}$ is the Vertical Stiffness of foundation at *a*

Fig. 8

12. For the beam loaded as shown in Fig. 8, use the Stiffness Method to calculate the vertical deflections (with no rotation) at joints *a* and *b*, if *a* is supported by a circular foundation of radius 3-ft on sub-soil (half-space) with shear-wave velocity ($v_s$) equal to (i) 1000 ft/sec, (ii) 300 ft/sec
[Given: Unit weight of soil = 0.12 k/ft$^3$, Poisson's ratio = 0.25, $EI = 40 \times 10^3$ k-ft$^2$].

13. Determine the size of the stiffness matrices (with and without considering the boundary conditions) of the 2D frame and 3D frame shown in Fig. 9.

Also determine the size of the stiffness matrices if axial deformations are neglected.



2D Frame

3D Frame

Fig. 9

14. Briefly explain
(i) the difference between the stiffness matrices of a 2D Frame member and a 3D Truss member although they are of the same size ($6 \times 6$)
(ii) the terms 'geometric nonlinearity' and instability of a frame structure
(iii) the term 'plastic hinge' and its difference with internal hinge within a structure
(iv) the difference between 'lumped-mass matrix' and 'consistent mass matrix' of a structure
(v) why the effect of foundation flexibility can be beneficial or harmful to a structure.

# List of Useful Formulae for CE 411

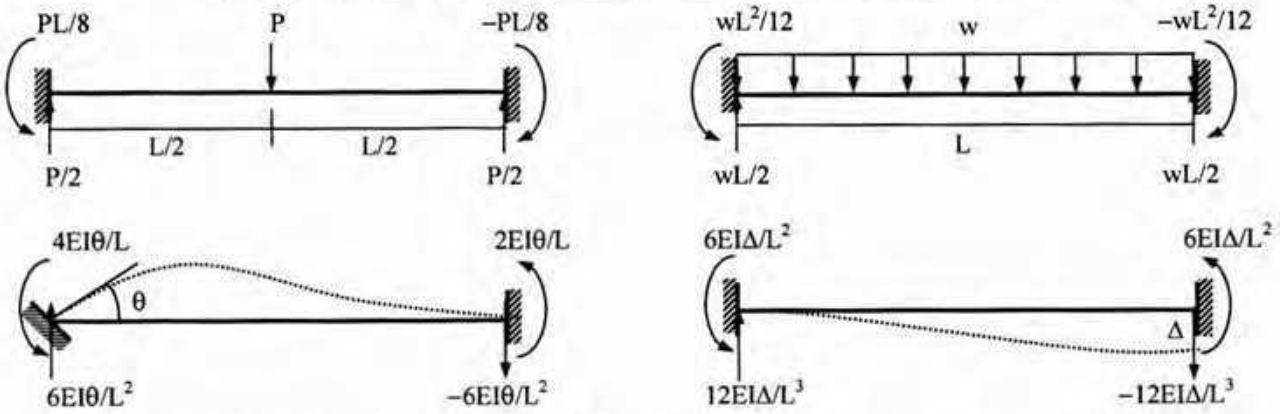
* The stiffness matrix $\mathbf{K_m}^G$ of a 2D truss member in the global axis system is given by

$$\mathbf{K_m}^G = S_x \begin{pmatrix} C^2 & CS & -C^2 & -CS \\ CS & S^2 & -CS & -S^2 \\ -C^2 & -CS & C^2 & CS \\ -CS & -S^2 & CS & S^2 \end{pmatrix}$$

and Truss member force, $P_{AB} = S_x [(u_B - u_A) C + (v_B - v_A) S]$

[where $C = \cos\theta$, $S = \sin\theta$]

Fixed End Reactions for One-dimensional Prismatic Members under Typical Loadings




* The stiffness matrix of a 3D truss member in the global axes system [using $C_x = \cos\alpha$, $C_y = \cos\beta$, $C_z = \cos\gamma$] is

$$\mathbf{K_m}^G = S_x \begin{pmatrix} C_x^2 & C_xC_y & C_xC_z & -C_x^2 & -C_xC_y & -C_xC_z \\ C_yC_x & C_y^2 & C_yC_z & -C_yC_x & -C_y^2 & -C_yC_z \\ C_zC_x & C_zC_y & C_z^2 & -C_zC_x & -C_zC_y & -C_z^2 \\ -C_x^2 & -C_xC_y & -C_xC_z & C_x^2 & C_xC_y & C_xC_z \\ -C_yC_x & -C_y^2 & -C_yC_z & C_yC_x & C_y^2 & C_yC_z \\ -C_zC_x & -C_zC_y & -C_z^2 & C_zC_x & C_zC_y & C_z^2 \end{pmatrix}$$

$C_x = L_x/L$, $C_y = L_y/L$, $C_z = L_z/L$
where $L = \sqrt{[L_x^2 + L_y^2 + L_z^2]}$

* Member force $P_{AB} = S_x [(u_B - u_A) C_x + (v_B - v_A) C_y + (w_B - w_A) C_z]$

* Ignoring axial deformations, the matrices $\mathbf{K_m}^L$ and $\mathbf{G_m}^L$ of a frame member in the local axis system are

$$\mathbf{K_m}^L = \begin{pmatrix} S_1 & S_2 & -S_1 & S_2 \\ S_2 & S_3 & -S_2 & S_4 \\ -S_1 & -S_2 & S_1 & -S_2 \\ S_2 & S_4 & -S_2 & S_3 \end{pmatrix} \qquad \mathbf{G_m}^L = (P/30L) \begin{pmatrix} 36 & 3L & -36 & 3L \\ 3L & 4L^2 & -3L & -L^2 \\ -36 & -3L & 36 & -3L \\ 3L & -L^2 & -3L & 4L^2 \end{pmatrix}$$

where $S_1 = 12EI/L^3$, $S_2 = 6EI/L^2$, $S_3 = 4EI/L$, $S_4 = 2EI/L$

* $\mathbf{K_{total}} = \mathbf{K} + \mathbf{G}$, buckling occurs (i.e., $P = P_{cr}$) when $|\mathbf{K_{total}}| = 0$

* For sections of Elastic-Fully-Plastic material, $A_t = A_c = A/2$, and $M_p = A_c\,\bar{y}_c + A_t\,\bar{y}_t$
* For RC sections, $M_p = A_s f_y (d - a/2)$, where $a = A_s f_y/(0.85 f_c' b)$
* Virtual work done by external forces ($\delta W_E$) = Virtual work done by internal forces ($\delta W_I$)
* For simply supported beams under (i) concentrated midspan load $P_u = 4 M_p/L$, and (ii) UDL $w_u = 8 M_p/L^2$
* For fixed-ended beams under (i) concentrated midspan load $P_u = 8 M_p/L$, and (ii) UDL $w_u = 16 M_p/L^2$
* For hinged-fixed ended beams under UDL $w_u = 11.66 M_p/L^2$

* Using CAA Method, $(m + c\Delta t/2 + k\Delta t^2/4)a_{i+1} = f_{i+1} - ku_i - (c + k\Delta t)v_i - (c\Delta t/2 + k\Delta t^2/4)a_i$
[m = Total mass, c = Damping = $2\xi\sqrt{(km)}$, where $\xi$ = Damping Ratio]
Also $v_{i+1} = v_i + (a_i + a_{i+1})\Delta t/2$, and $u_{i+1} = u_i + v_i\,\Delta t + (a_i + a_{i+1})\Delta t^2/4$, starting with $a_0 = (f_0 - cv_0 - ku_0)/m$

* Lumped-Mass matrix for beam [$m_0$ = Mass per unit length]

$$\mathbf{M_m} = (m_0 L/2) \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

Consistent-Mass matrix for beam

$$\mathbf{M_m} = (m_0 L/420) \begin{pmatrix} 156 & 22L & 54 & -13L \\ 22L & 4L^2 & 13L & -3L^2 \\ 54 & 13L & 156 & -22L \\ -13L & -3L^2 & -22L & 4L^2 \end{pmatrix}$$

* At natural frequency (i.e., $\omega = \omega_n$), $|\mathbf{K} - \omega_n^2 \mathbf{M}| = 0$

* Stiffness of Circular Surface Foundations on Half-Space

| Motion | Horizontal | Vertical | Rotational | Torsional |
|---|---|---|---|---|
| $K_{Halfspace}$ | $8GR/(2-\nu)$ | $4GR/(1-\nu)$ | $8GR^3/(3-3\nu)$ | $16GR^3/3$ |

## Foundation Cost upto PL

| Storey | $Q_a$= 2 ksf | $Q_a$= 2 .50ksf | $Q_a$= 3.0 ksf | $Q_a$= 3.5 ksf | $Q_a$= 4.0 ksf | $Q_a$= 4.5 ksf | $Q_a$= 5.0 ksf |
|---|---|---|---|---|---|---|---|
| 1 | 3982 | 3875 | 3811 | 3769 | 3740 | 3718 | 3702 |
| 2 | 4684 | 4381 | 4199 | 4080 | 3997 | 3936 | 3830 |
| 3 | 5591 | 5036 | 4702 | 4482 | 4329 | 4217 | 4133 |
| 4 | 6566 | 5811 | 5296 | 4958 | 4723 | 4551 | 4421 |
| 5 | 8001 | 6774 | 6035 | 5550 | 5212 | 4965 | 4778 |
| 6 | 9495 | 7851 | 6862 | 6213 | 5759 | 5429 | 5178 |
| 7 | 10961 | 8908 | 7673 | 6862 | 6296 | 5883 | 5571 |
| 8 | | 10043 | 8544 | 7560 | 6873 | 6371 | 5992 |
| 9 | | 11252 | 9471 | 8302 | 7487 | 6891 | 6441 |
| 10 | | 12529 | 10451 | 9088 | 8136 | 7441 | 6915 |
| 11 | | | 11482 | 9913 | 8818 | 8019 | 7414 |
| 12 | | | 12561 | 10777 | 9532 | 8623 | 7936 |
| 13 | | | | 11679 | 10277 | 9254 | 8480 |
| 14 | | | | 12614 | 11051 | 9909 | 9046 |
| 15 | | | | | 11853 | 10588 | 9632 |

## Superstructure Cost

| Building Category | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |
| - | | Non-Residential (fc=19-21 MPa, Brick Chips) | | | Residential (fc=19-21 MPa, Brick Chips) | | | Non-Residential (fc=22-25 MPa, Stone Chips) | | | Residential (fc=22-25 MPa, Stone Chips) | | |
| Level | Floor | Economy | Standard | Superior | Economy | Standard | Superior | Economy | Standard | Superior | Economy | Standard | Superior |
| 0 | GF Park | 5449 | 5812 | 6538 | 5634 | 6010 | 6761 | 5922 | 6317 | 7107 | 6124 | 6532 | 7349 |
| 0A | Habitation | 8545 | 9601 | 12674 | 8837 | 9929 | 13106 | 9020 | 10135 | 13378 | 9631 | 10792 | 14274 |
| 1 | 1 st Floor | 8242 | 9360 | 12224 | 8523 | 9576 | 12640 | 8699 | 9776 | 12903 | 9289 | 10409 | 13767 |
| 2 | 2nd Floor | 8365 | 9399 | 12407 | 8651 | 9720 | 12830 | 8830 | 9921 | 13096 | 9568 | 10565 | 14180 |
| 3 | 3 rd Floor | 8491 | 9540 | 12593 | 8780 | 9866 | 13023 | 8962 | 10070 | 13293 | 9855 | 10723 | 14606 |
| 4 | 4 th Floor | 8618 | 9683 | 12782 | 8912 | 10014 | 13218 | 9097 | 10221 | 13492 | 10151 | 10884 | 15044 |
| 5 | 5 th Floor | 8748 | 9829 | 12974 | 9046 | 10154 | 13416 | 9233 | 10374 | 13694 | 10455 | 11046 | 15495 |
| 6 | 6 th Floor | 8835 | 9927 | 13104 | 9136 | 10265 | 13550 | 9326 | 10478 | 13831 | 11030 | 11158 | 15960 |

## ADDITIONAL COST FOR

| | | |
|---|---|---|
| 1. Roof top RCC Parapet | Tk. 953.00/ sqm | |
| 2. Roof top RCC water Tank | 83.00 / gallon | |
| 3. Internal Sanitary and Water Supply | | |
| (i) Residential Building | Economy | Tk. 475 /sqm |
| | Standard | Tk.712 /sqm |
| | Superior | Tk. 1068 /sqm |
| (i) Non-Residential Building | Economy | Tk. 356 /sqm |
| | Standard | Tk.534 /sqm |
| | Superior | Tk. 801 /sqm |
| 4. Internal Electrification | | |
| (i) Residential Building | Economy | Tk. 1032 /sqm |
| | Standard | Tk.1289 /sqm |
| | Superior | Tk. 1547 /sqm |
| (i) Non-Residential Building | Economy | Tk. 774 /sqm |
| | Standard | Tk.967 /sqm |
| | Superior | Tk. 1161 /sqm |
| 5. Gas Connection | GF | Tk. 256 / sqm |
| | Other floors | Tk. 102 /sqm |
| 6. External Water Supply | 59.00 / gallon | |
| 7. Boundary Wall | | Tk. 3486 / m |

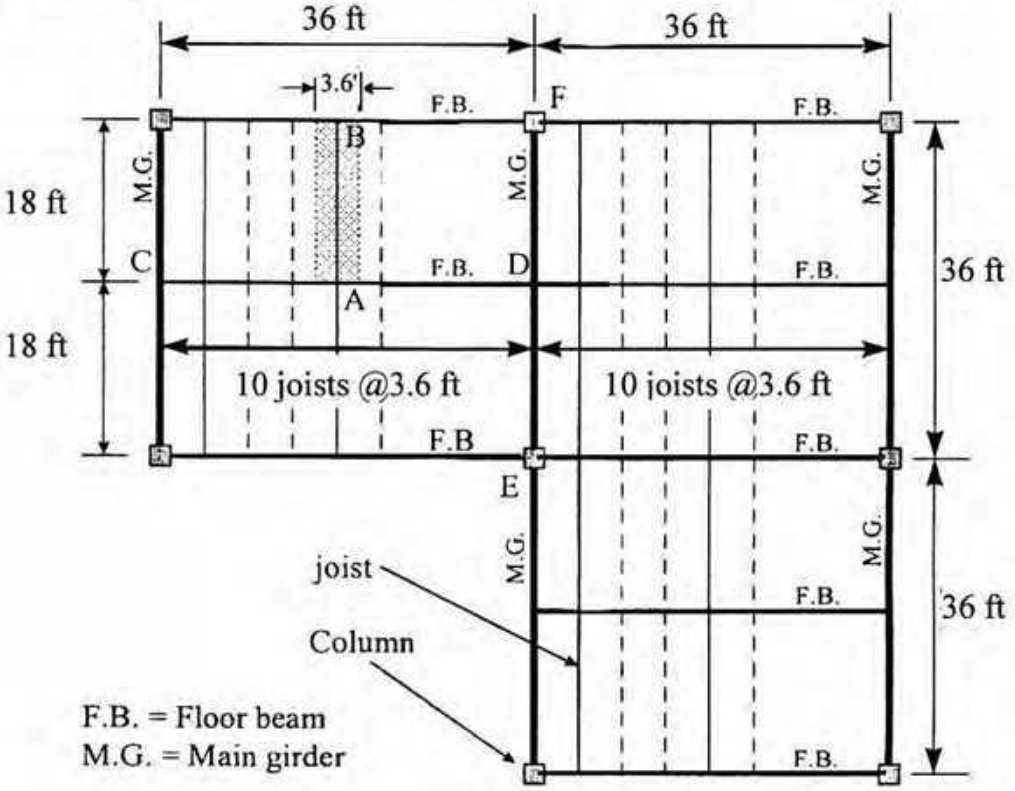
8. 18% cost should be deducted for departmental construction

# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination Spring 2010
## Program: B. Sc Engineering (Civil)

Course Title: Structural Engineering VI — Course Code: CE 417
Time : 2.00 Hours — Full Marks:100

[There are **06 (six)** questions. Answer **question 1** and **any 03(three) questions** from the rest. **Question 1** is compulsory]

1(a). Design the main girder EF of the floor plan shown in the following figure. Design the girder as a rolled flanged section and use AISC/ASD specification. Assume, lateral torsional buckling of the beam. *[Use the attached appendices* ] [25]




Flow of load: **Floor** ⟶ **joist** ⟶ **floor beam** ⟶ **main girder** ⟶ **column**

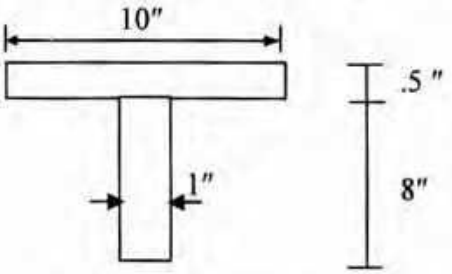
**Given Loads**:

| | |
|---|---|
| 4" concrete composite floor slab | : 50 psf |
| Live Load | : 70 psf |
| Partition: | : 50 psf |
| Joist **W6×9** | : 9 lb/ft |
| Floor beam W **10×88** | : 88 lb/ft |

**Other specifications:**
Yield strength of steel, $F_y$= 50 ksi, Young's modulus, E= 30000 ksi

(b) Define (i) unstiffened element (ii) lateral torsional buckling and (iii) non-compact section. [03]

(c) The section shown in the following figure is selected to be used as beam. Find the value of Plastic moment, ($M_p$) of this section about major axis. Use $F_y$= 36 ksi [06]

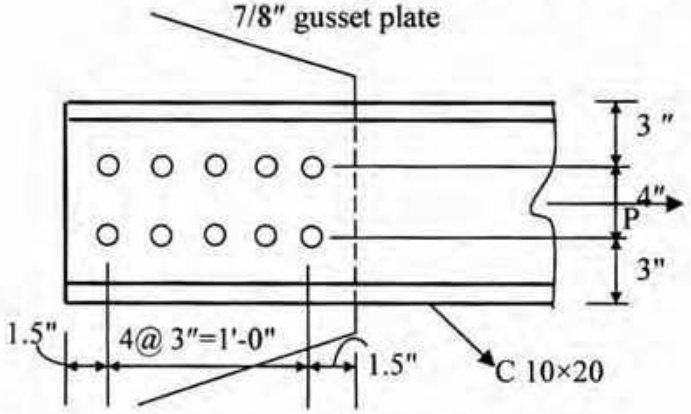



2(a) Determine the design load, P by LRFD for a single channel C10×20 (Gross area, $A_g$=5.88 in$^2$, web thickness, $t_w$=0.379″) connected to a 7/8″ thick gusset plate as shown below. Holes are for 7/8″diameter bolts and the plate is made from A36 structural steel. Assume design shearing strength of the bolts = 48 ksi, reduction coefficient, U=0.85. Investigate all failure modes. [18]

Given: Design strength on gross area, $\phi_t P_n = 0.9 F_y A_g$

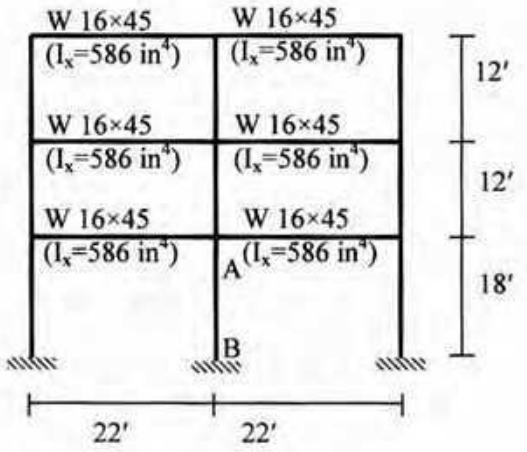
Design strength on effective net area, $\phi_t P_n = 0.75 F_u A_e$

Design strength for block shear, $\phi R_n$= larger of $\begin{cases} 0.75(0.60F_yA_{gv} + F_uA_{nt}) \\ 0.75(0.60F_uA_{nv} + F_yA_{gt}) \end{cases}$

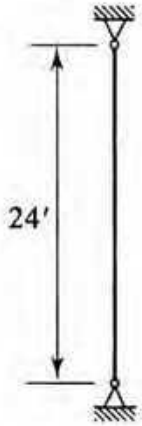



(b) Write short notes on [04]
(i) Weathering steel and (ii) Slip critical connection in bolted connection.

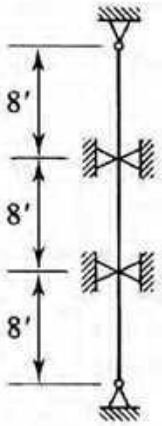
3(a). Select lightest W section ($F_y$=50 ksi) for Column AB. Use AISC/ASD method. [14]
Given: DL=70$^k$ and LL=180$^k$ for Column AB.
Assume (1) Column is oriented in such a way that major axis bending occurs in the plane of the frame. (2) Columns are braced at each story level for out-of-plane buckling ($K_y$=1.0)
(3) The same column section is used for all stories. *[Use the attached appendices ]*



(b) Using AISC/LRFD method, calculate the design compressive load for the column section **W12×96** as shown below. The column is 24 ft long. Assume that it is pin-supported at the top and bottom in both direction and that additional supports are provided to prevent buckling about the y axis (as shown in the figure). [08]



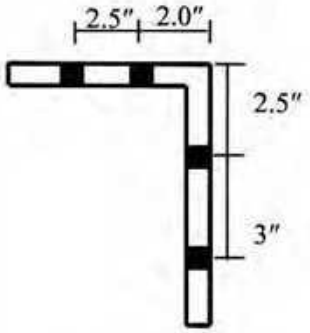

*x*-direction



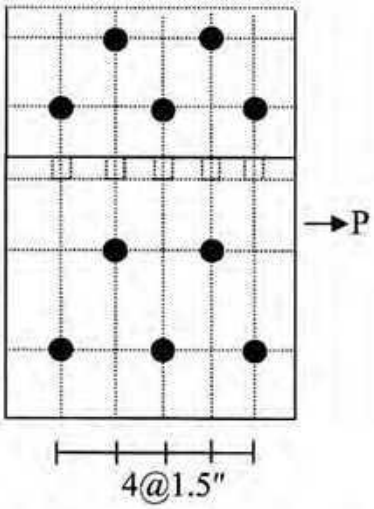

*y*-direction

| **Column: W12X96** |
|---|
| $A = 28.2$ in.$^2$ |
| $r_x = 5.44$ in. |
| $r_y = 3.09$ in. |

4(a) Find the design tensile strength by AISC/LRFD of the angle shown in figure below [Given: $F_y$=36 ksi, $F_u$=58 ksi and holes are for ¾ in. diameter bolt]. [12]

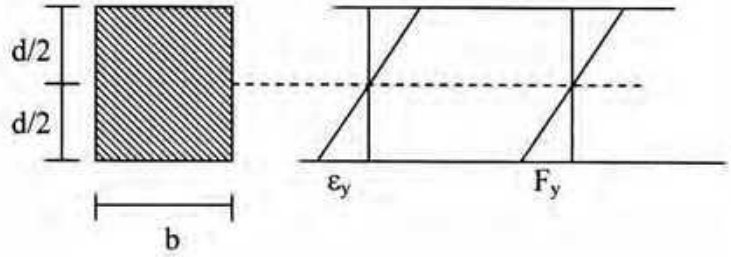



L 8×6×5/8

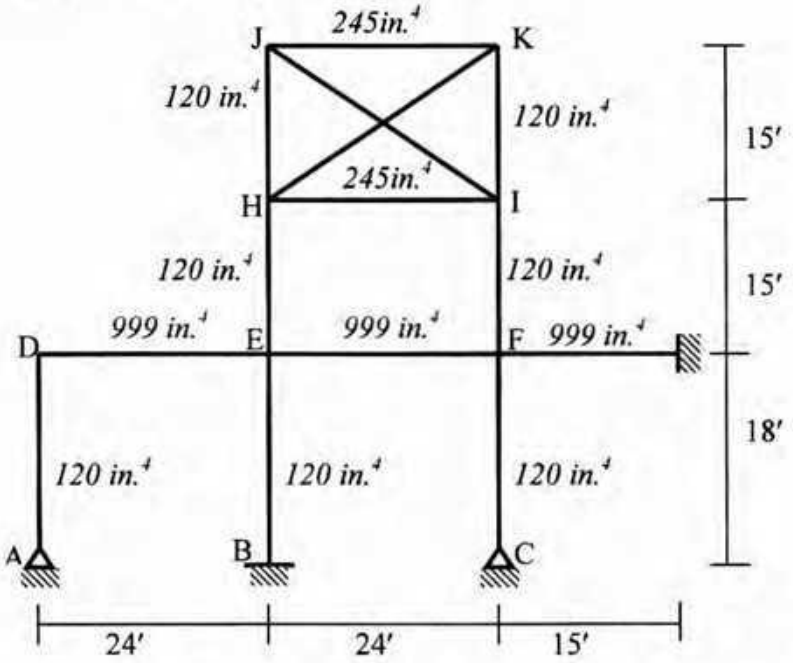



(b) Define gage length (g). How can you find the gage length when bolts are staggered on two legs of an angle. Explain with sketches. [04]

(c) For a rectangular cross section of a steel member , the strain and stress diagrams at yield are given below. Yield moment capacity for the section is given by $M_y=F_yS$, where, section modulus, $S=bd^2/6$. If the section is strained 5 times at its yield strain $\varepsilon_y$, what will be its bending moment in terms of $M_y$ ? [06]



5(a). Determine the effective length factor for column CF and FI of the following frame. The moments of inertia for the columns and beams are shown in the figure [08]
*[Use nomograph provided with the question paper].*

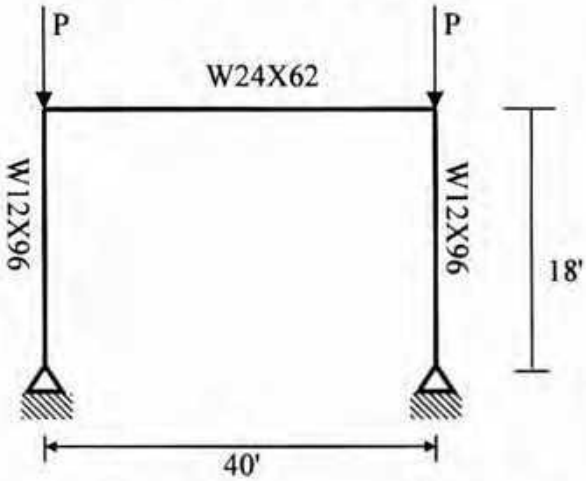



(b) Determine the critical load P for the frame of the following figure. All members are made of A36 steel ($F_y$=36 ksi). The column is placed with its web in the plane of frame and is supported against buckling out of plane. [14]

*Given: $F_{cr}=F_y[1-1/2(KL/r/(C_c)^2]$, where, $C_c=\sqrt{(2\pi^2 E/F_y)}$ for buckling in the inelastic range and*

$F_E=\pi^2E/(KL/r)^2$ *for buckling in elastic range and E=30,000 ksi*

*[Use nomograph provided with the question paper]*

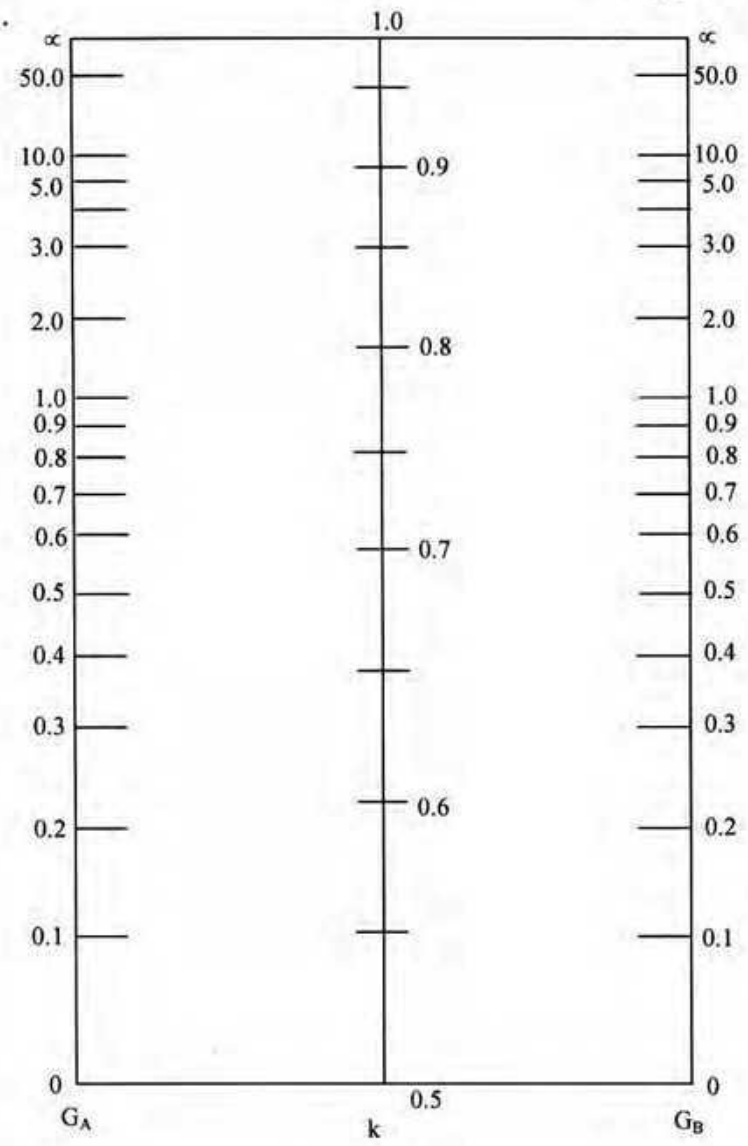



| Beam W24X62 | Column W12X96 |
|---|---|
| $I_x$ =1550 in$^4$<br>A= 18.2 in$^2$<br>$r_x$= 9.23 in | $I_x$=833 in$^4$<br>A=28.2 in$^2$<br>$r_x$= 5.44 in |

6(a) Draw Stress –strain curves for various types of steel. Classify carbon-manganese steel and show carbon content in them. [05]

(b) Select the lightest single angle member as a tension diagonal member for a roof truss of A36 steel ($F_y$=36 ksi, $F_u$=58 ksi) using AISC/LRFD method. The axial tension is 80 kips dead load and 10 kips live load and the member is 15 ft long. Assume 7/8″ diameter bolts are located on a single gage line in standard holes. Assume the preferable limit on slenderness ratio, L/r is 240. [*Use the attached appendices*] [17]

## Appendix-1

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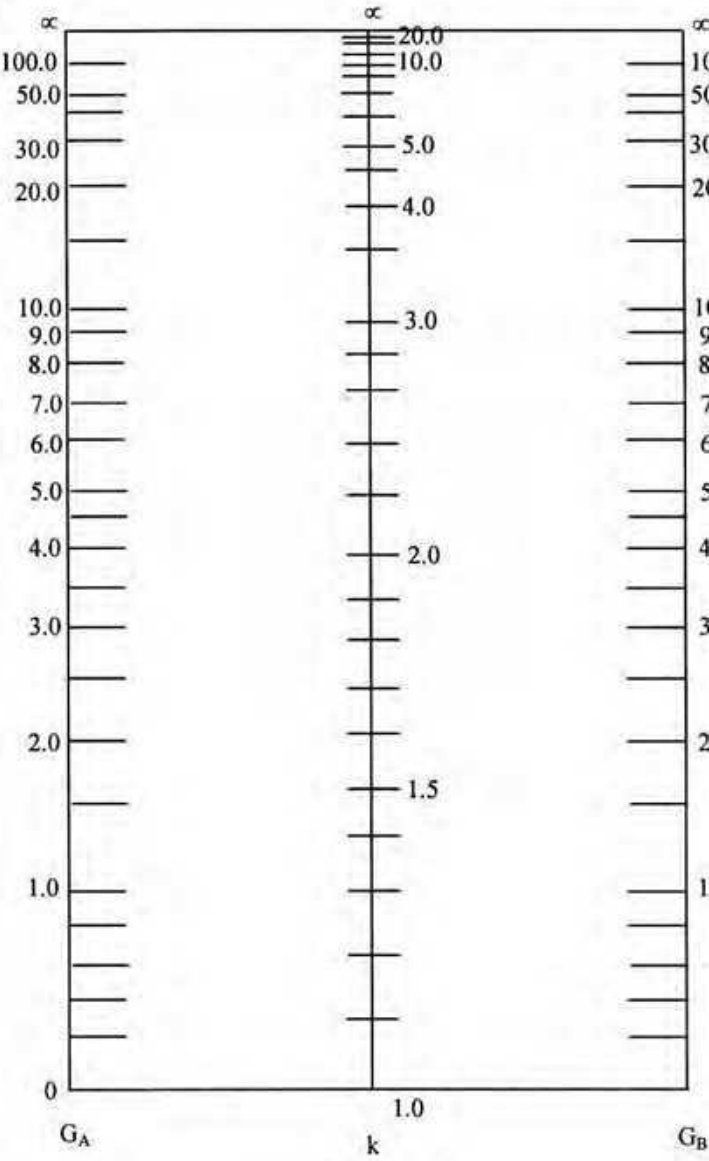


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**Alignment Charts for Effective Length Factors k**

G = Ratio of ∑EI/L of compression members to ∑EI/L of flexural members in a plane at one end of a compressio member.
k = Effective length factor.

***Correction factors for beam stiffness***

| Condition | Side sway | No side sway |
|---|---|---|
| Far end of beam hinged | ½ | 3/2 |
| Far end of beam fixed | 2/3 | 2 |

## Appendix-2

Formulas **(the symbols carry their usual meaning)**

$$L_c = \begin{cases} \dfrac{76b_f}{\sqrt{F_y}} \\ \dfrac{20000}{F_y \dfrac{d}{A_f}} \end{cases}$$

$F_b = 0.6F_y$ if $L_c < L < L_u = \begin{cases} \dfrac{20000C_b}{\dfrac{d}{A_f}F_y} \\ r_T\sqrt{\dfrac{102000C_b}{F_y}} \end{cases}$

$$F_b = \begin{cases} \dfrac{12000C_b}{L\dfrac{d}{A_f}} \\ [\dfrac{2}{3} - \dfrac{F_y(\dfrac{L}{r_T})^2}{1530\times10^3 C_b}]F_y \end{cases}$$

But not greater than $0.6F_y$; if $\dfrac{L}{r_T} \le \sqrt{\dfrac{510000C_b}{F_y}}$

$$F_b = \begin{cases} \dfrac{170000C_b}{(\dfrac{L}{r_t})^2} \\ \dfrac{12000C_b}{L\dfrac{d}{A_f}} \end{cases}$$

But not greater than $0.6F_y$; if $\dfrac{L}{r_T} > \sqrt{\dfrac{510000C_b}{F_y}}$

*$C_b = 1.75 + 1.05(M_1/M_2) + 0.3(M_1/M_2)^2$ Where, $M_1$ is the smaller of the two end moments $M_1$ and $M_2$, $M_1/M_2$ is positive for reverse-curvature bending.*

$f_s = VQ/I_{xx}t_w$ [where $Q = t_w d_w^2/8 + A_f(d_w + t_f)/2$]

$f_{s(all)} = 0.4f_y$ if $d_w/t_w \le 369/\sqrt{f_y}$

$= 148\sqrt{f_y}/(d_w/t_w)$ if $369/\sqrt{f_y} \le d_w/t_w \le 532/\sqrt{f_y}$

$= 78000/(d_w/t_w)^2$ if $d_w/t_w \ge 532/\sqrt{f_y}$

$$F_a = \frac{F_y\left[\,1-\frac{1}{2}\left(\frac{KL/r}{C_c}\right)^2\,\right]}{\frac{5}{3}+\frac{3}{8}\left(\frac{KL/r}{C_c}\right)-\frac{1}{8}\left(\frac{KL/r}{C_c}\right)^3} \qquad \text{if} \quad \frac{KL}{r} \le C_c$$

$$F_a = \frac{12\pi^2 E}{23\left(\frac{KL}{r}\right)^2} \qquad \text{if} \quad \frac{KL}{r} \ge C_c$$

$$\text{Where, } C_c = \sqrt{\frac{2\pi^2 E}{F_y}}$$

$\varphi_c P_n = \varphi_c A_g F_c = 0.85 A_g F_{cr}$

if, $\lambda_c \le 1.5$ $\qquad F_{cr} = \left(0.658^{\lambda_c^2}\right) F_y$ (inelastic buckling)

if, $\lambda_c > 1.5$ $\qquad F_{cr} = \left[\frac{0.877}{\lambda_c^2}\right] F_y$ (elastic buckling)

$$\lambda_c = \frac{K\,L}{r\,\pi}\sqrt{\frac{F_y}{E}}$$

# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination Spring 2010
## Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering IV | Course Code: CE 433
Time: 2 Hours | Full Marks: 100

There are **Six** questions. Answer any **Five** of them.

1. a) Define point sources and non-point sources of water pollutants. **(6)**
   b) The river Balu is flowing along at a velocity of 10 km/day has a DO content of 5 mg/L and an ultimate CBOD of 25 mg/L at a distance of x = 0 km, i.e., immediately downstream of discharge by Norai khal. The CBOD decay rate constant is 0.2 $day^{-1}$ and re-aeration constant is 0.4 $day^{-1}$. Saturation DO is 9.0 mg/L. Find, **(14)**
      i) Location of the critical point in time and distance.
      ii) Initial DO deficit and DO deficit at critical point.
      iii) DO at 2km downstream of discharge.
      iv) DO level at critical point and also comment on the aquatic life of the Balu river.

2. a) What is eutrophication? How it could be controlled? **(6)**
   b) Write short note on NBOD. **(4)**
   c) Prove that, at any time t, $BOD_t = L_o(1-e^{-kt})$, where the symbols have their usual meaning. **(10)**

3. a) Define oligotrophic, eutrophic and mesotrophic lake. **(6)**
   b) Using Phosphorus mass balance in a well-mixed lake, derive an expression for concentration of Phosphorus in a lake. And hence find out average Phosphorus concentration in a lake whose properties are given below: **(14)**
      Surface area: $100 \times 10^6$ $m^2$, Phosphorus settling rate: 10 m/year
      Effluent flow rate: 0.4 $m^3/s$, Effluent Phosphorus concentration: 10.0 mg/L
      Flow rate of the lake: 20 $m^3/s$ with no Phosphorus.

4. a) What are the adverse impacts of thermal pollution on a water body? **(5)**
   b) In determination of BOD why seeding is necessary? **(3)**
   c) Explain the effect of temperature and NBOD on DO sag curve. **(6)**
   d) Describe thermal stratification and its impacts. **(6)**

5. a) Write down the assumptions for the Gaussian Plume Model. **(5)**
   b) A coal fired brick kiln, burns 5.2 metric tons of coal per hour. The coal has a sulfur content of 3.2% and 25% of this sulphur is emitted as $SO_2$. Wind speed at stack height of 10 ft is 3.2 m/s. On an adiabatic atmosphere considering ground reflection but no inversion layer find,
      i) Downwind concentration along center line at 2.5 km downwind from the source.
      ii) Concentration at 200 m left of the centerline of the plume at 2.5 km downwind.
   (Given, p = 0.2 and the dispersion coefficient chart is provided.) **(15)**

6. a) Explain the effect of effective stack height and atmospheric stability on downwind ground concentration of air pollutants. **(6)**
   b) Define: Maximum mixing depth, ventilation co-efficient, adiabatic lapse rate, ambient lapse rate **(5)**
   c) On a particular road, cars are travelling at a speed of 65 km/hr and average distance between cars is 60 m. Each car is emitting CO at the rate of 3.5 gm/km. Wind speed is 3.1 m/s. The atmosphere is stable. Estimate the ground level concentration of CO at a distance 500 m downwind considering ground reflection. **(9)**

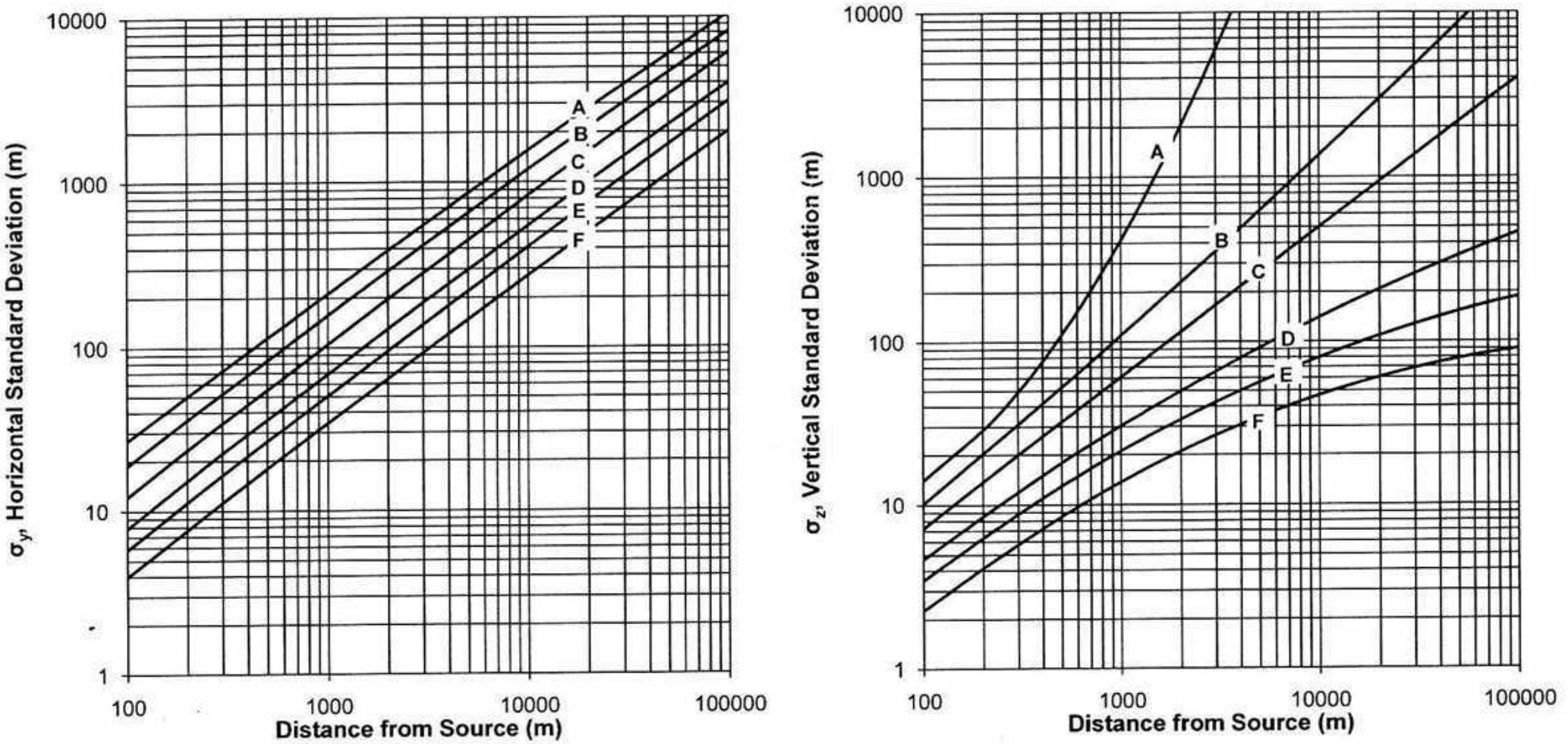



**Figure:** Gaussian dispersion coefficients as a function of downwind distance for different stability class

# Khosla's Pressure Curves

Plate 11·1(a)

$\alpha_1 = \frac{b_1}{d}$ $\quad \alpha_2 = \frac{b_2}{d}$ $\quad \alpha = \frac{b}{d}$

**Sheet pile not at end**

$\phi_E = (1/\pi)\cos^{-1}\left(\frac{\lambda_1 - 1}{\lambda}\right)$

$\phi_C = (1/\pi)\cos^{-1}\left(\frac{\lambda_1 + 1}{\lambda}\right)$

$\phi_D = (1/\pi)\cos^{-1}\left(\frac{\lambda_1}{\lambda}\right)$

To find $\phi_E$ for any value of $\alpha$ and base ratio $b_1/b$, read $\phi_C$ for base ratio $(1-b_1/b)$ for that value of $\alpha$ and subtract from 100

Thus $\phi_E$ for $b_1/b = 0{\cdot}4$ and $\alpha = 4$, $= 100 - \phi_C$

for $b_1/b = 0{\cdot}6$ and $\alpha = 4$, $= 100 - 29{\cdot}1 = 70{\cdot}9\%$

To get $\phi_D$ for values of $b_1/b$ less than 0·5 read $\phi_D$ for base ratio $(1-b_1/b)$ and subtract from 100

Thus $\phi_D$ for $b_1/b = 0{\cdot}4$ and $\alpha = 4$

$= 100 - \phi_D$ for $b_1/b = 0{\cdot}6$ and $\alpha = 4$

$= 100 - 44{\cdot}8 = 55{\cdot}2$

$\lambda_1 = \frac{\sqrt{1+\alpha_1^2} - \sqrt{1+\alpha_2^2}}{2}$

$\lambda = \frac{\sqrt{1+\alpha_1^2} + \sqrt{1+\alpha_2^2}}{2}$

Values of $1/\alpha = d/b$

Sheet pile at end

Depressed floor

$\phi_E = (1/\pi)\cos^{-1}\left(\frac{\lambda - 2}{\lambda}\right)$

$\phi_D = (1/\pi)\cos^{-1}\left(\frac{\lambda - 1}{\lambda}\right)$

$\phi_{C_1} = 100 - \phi_E$

$\phi_{D_1} = 100 - \phi_D$

$\phi_{D_1}' = 100 - \phi_{D'}$ (Depressed floor)

$\phi_{D'} = \phi_D - 2/3\,(\phi_E - \phi_D) + 3/\alpha^2$ (Depressed floor)

$\lambda = \frac{1+\sqrt{1+\alpha^2}}{2}$

Scale for $\phi = \frac{P}{H} \times 100$

Values of $\phi_C = \frac{P_C}{H} \times 100$

Values of $\phi_D = \frac{P_D}{H} \times 100$

Ratio $\frac{b_1}{b}$

# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination, Spring 2010
## Program: B.Sc Engineering (Civil)

Course Title: Irrigation and Flood Control; Course Code.: CE 461; Credit hrs: 3
Time: 3 hours Full Marks: 150

**Part A**

**Answer question no. 1 and any FOUR from the rest**

(Assume any reasonable data if not given)

1. (a) Explain the following (any Four) (10)
   i) Economical section of a canal
   ii) Optimum utilization of irrigation water and net irrigation requirement
   iii) Water distribution efficiency and water use efficiency
   iv) Importance of a Berm
   v) Launching apron

   (b) Distinguish between the following (any Four) (10)
   i) Weir and Barrage
   ii) Aqueduct and siphon aqueduct
   iii) Super passage and siphon super passage
   iv) Level crossing and 'inlet and outlet'
   v) Montague fall and Inglis fall with sketch.

2. (a) Define base, delta and duty and establish a relation between them. Explain the influence of several factors, which affect duty. (10)

   (b) The gross command area of an irrigation project is 1.5 lakh hectares, where 7500 hectares are uncultivable. The area of kharif crop is 60000 hectares and that of Rabi crop is 40000 hectares. The duty of Kharif is 3000 hectares/cumec and the duty of Rabi is 4000 hectares/cumec.
   Find (a) The design discharge of channel assuming 10% transmission loss.
   (b) Intensity of irrigation for Kharif and Rabi. (10)

3. (a)What are important aspects need to be included in an irrigation project report. Also explain in details, how will you proceed for determining the approximate design discharge of an irrigation project. (10)

   (b) Compute the depth and frequency of irrigation required for a certain crop with data given below: (10)
   Root zone depth = 100 cm; Field capacity = 22%
   Wilting point = 12%; Apparent Specific gravity of soil = 1.5

Consumptive use = 25 mm/day; Efficiency of irrigation = 50%
Assume 50% depletion on available moisture before application of irrigation water at field capacity.

4. (a) Why should lining be provided in canals? How will you justify economically the necessity of lining an existing canal? (10)

   (b) A canal of length 5 km and of discharge capacity 3.5 cumec is proposed to be lined with boulder lining. The total cost of lining is estimated as 4 lakhs. The life of lining is considered as 60 years. Justify the lining in the canal from the folowing data. (10)

| | |
|---|---|
| Rate of interest | = 8 % |
| Seepage loss | = 2 % |
| Revenue for irrigation water | = Tk. 75 per hect-m |
| Maintenance cost per Km for lined canal | = Tk. 1000 |
| Maintenance cost per Km for unlined canal | = Tk. 2500 |
| Base period of crop | = 120 days |
| Additional benefit/Km | = Tk. 1000 |

5. (a) What are the causes of failure of a hydraulic structure and how to prevent them? Sketch a typical layout plan of a head works and its components (6)

   (b) What is exit gradient? How does it affect the design of a weir? (4)

   (c) Describe different corrections needed to a pressure obtained underneath a barrage using Khosla'a chart. (10)

6. (a) Why spillways are provided in a dam? Describe an ogee spill way with a neat sketch. (6)

(b) What is meant by cross-drainage works? Explain its necessity. (6)

(c) What is a canal fall? Describe an ogee fall and rapid fall with sketch. (8)

## Part B
## Answer Question no. 5 and any THREE from the rest

1. What are the types of measures of flood management? Distinguish between them. Write down the methods of Flood management under each type. (2+3+7=12)

2. Explain the following (any three) (12)
   (i) IWRM and IFM
   (ii) Flood and the poor
   (iii) Efforescence
   (iv) Soil reclamation from salinity

3.(a) Write down the names of the major studies and plans that shaped the water resources development of Bangladesh. (6)
(b) Write down the major issues that have been identified in the NWMP (6)

4. What is water logging? What are the causes of water logging? How can you control water logging? (3+4+5=12)

5. (a)What is Leaching Requirement? (5)

   (b)Estimate the Leaching Requirement when EC value of saturated soil extract of soil is 12milli mho/cm at 25°C. The EC value of irrigation water is 1.0 milli mho/cm. What will be the required depth of water to be applied to the field if the consumptive use requirement of the crop is 80 mm? EC value of leaching water may be suitably assumed. (9)

6. What are the types of lift irrigation? What are the advantages and disadvantages of Centrifugal pumps? (3+9=12)

# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination Spring 2010
## Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering VIII (GIS and Remote Sensing) Course Code: CE 531 Credit: 2.00

Time: 2 hours Full Marks: 50

**Answer all questions. Use ArcView software to solve these problems. Use "Spring_10" data folder.**

12+2+4+2=20

1. Bangladesh upozilla map is given in "Thana_1.shp". Soil type is given in 'soil.xls' file.
   (a) Create a map based on soil classification. (use color schemes as "Fruits & Vegetables")
   (b) Find out how many upozilla have (i) Floodplain Soil (ii) Hill Soil (iii) Peat & (iv) Terrace
   (c) Calculate the total area in sqkm under (i) Floodplain Soil (ii) Hill Soil (iii) Peat & (iv) Terrace
   (d) Prepare a layout showing thana wise soil classification.

3+3+3+6=15

2. a. There are 64 districts (district.shp) in Bangladesh. Create a new theme map of whole Bangladesh.
   b. Add **districts.shp** in your view. There are four airports in Bangladesh. They are situated in Dhaka, Chittagang, Sylhet and Jessore District. Create a point theme map showing the four airports and add attributes as follows:

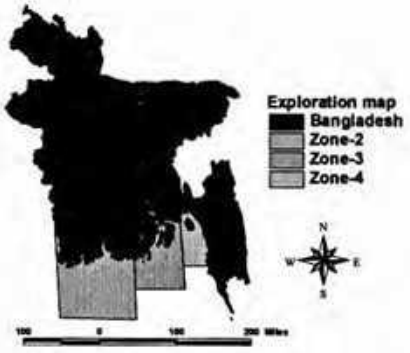
| Shape | Airport | Status | X | Y |
|---|---|---|---|---|
| Point | Dhaka | International | 90.33 | 23.72 |
| Point | Jessore | International | 91.97 | 22.27 |
| Point | Barisal | Domestic | 91.87 | 24.90 |
| Point | Sylhet | International | 88.60 | 24.48 |

Save the newly created point theme map as **'airport.shp'.**

c. Add **districts.shp** in your view. A highway is proposed from **Dhaka** to **Chittagong** city. Create a line theme map and save it as **highway.shp** and add attributes as follows:

| Shape | Highway | Length(km) |
|---|---|---|
| Line | Dhaka-Chittagong | 280 |

d. Bangladesh wants to explore oil and gas in the Bay of Bengal. For this it divides the area under consideration into three zones, namely zone 1, zone 2 and zone 3. Create a new map with the help of existing map. The figures may be as shown below,




$4 + 3 + 4 + 4 = 15$

3. a. You have a shape file 'sectors.shp' representing a sector in Uttara (Each polygon represents a holding, thus there are 5701 holdings). There are 5 sectors in Uttara area. You have also a map trees.shp representing the position of tress in Uttara areas (tree.shp). Find out, How many trees are located in sector 10 to sector 14?

b. There are four community centres at Uttara area namely, (i) Uttara Community Centre (ii) Istikutum Community Centre and (iii) Aponjon Community Centre (iv) Ekuse Community Centre. The locations of the community centres are given in the map 'centres.shp'. Find out the number of holdings situated within a distance of 5000 miles from each community centre.

c. The path of rail line in Dhaka city is given in the shape file line.shp. There are 4 rail lines in the map namely line-1, line-2, line-3 and line-4. The Dhaka metropolitan map is also given in dhaka_1.shp. Find out the number of wards that cross the rail lines 1 to 4.

d. Dhaka metropolitan map is given in dhaka_1.shp. What is the perimeter in km of ward nos 25, 45 and 55? What is the total perimeter of Dhaka city?

# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination Spring 2010
## Program: B. Sc. Engineering (Civil)

Course Title: Chemistry | Course Code: CHEM 111
Time: 3 Hours | Full Marks: 50

There are SEVEN Questions. Answer any **FIVE**.

| | | |
|---|---|---|
| 1 | (a) What is 'Associated liquid ? Why is a water called so ? | 1.0 |
| | Discuss the structure-property relationship of water. | 4.0 |
| | (b) What is water of crystallization ? | 1.0 |
| | Discuss 'Thermal stability' and 'Catalytic action' of water. | 4.0 |
| 2 | (a) Distinguish between benzosol and alcosol. | 1.0 |
| | How the sol can be classified based on DP and DM ? | 4.0 |
| | (b) How the sols are prepared by the peptization method ? | 5.0 |
| 3 | (a) What is wet corrosion ? | 1.0 |
| | Discuss the aspects of wet corrosion in a Daniel cell. | 4.0 |
| | (b) Classify wet corrosion based on the environment. | 1.0 |
| | Discuss the phenomenon of 'under ground corrosion'. | 4.0 |
| 4 | (a) Distinguish between 'High polymer and Low polymer'. | 1.0 |
| | How a polymer can be classified based on its mechanical properties ? | 4.0 |
| | (b) Give the reaction steps for the preparation of (i) Nylon 66 and (ii) melamine. | 5.0 |
| 5 | (a) What is 'Acid rain ? | 1.0 |
| | Discuss the various chemical reactions that are responsible for acid rain. | 4.0 |
| | (b) Mention the reactions taking place in the atmosphere involving the following: (i) $SO_2$ and (ii) $Cl_2$. | 5.0 |
| 6 | (a) Distinguish between 'Soft water and Hard water'. | 1.0 |
| | How a water can be made soft by Calgon and Caustic processes ? | 4.0 |
| | (b) Discuss the chemical reactions of water with (i) metals and (ii) metals carbides. | 5.0 |
| 7 | (a) What is chemical solution ?. | 1.0 |
| | Discuss the energitics for the dissolution of a solid in liquid. | 4.0 |
| | (b) What is Dynamic equilibrium ? | 1.0 |
| | Discuss the Dynamic equilibrium that exist in a saturated solution and state how Le Chatelier principle can be applied to that equilibrium system. | 4.0 |

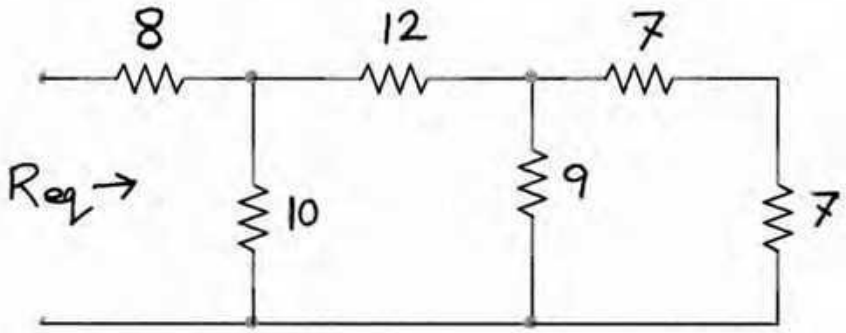
# The University of Asia Pacific
## Department of Civil Engineering (CE)
## Semester Final Examination, Fall - 2010
## Program: B. Sc Engineering (2nd Year/ 1st Semester)

Course Title: Basic Electrical Engineering  Course No. ECE 201  Credit Hours: 3.00

Time: 3.00 Hours  Full Marks: 150

[There are **eight** questions. Answer any **six**. Figures in the right margin indicate marks]

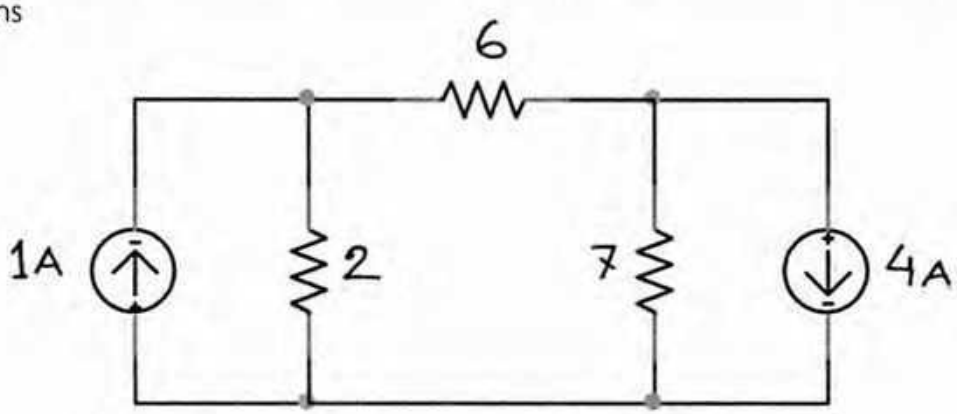
**1.** a. Find the $R_{eq}$ as indicated in the following figure. All the resistances are given in ohms. [13]



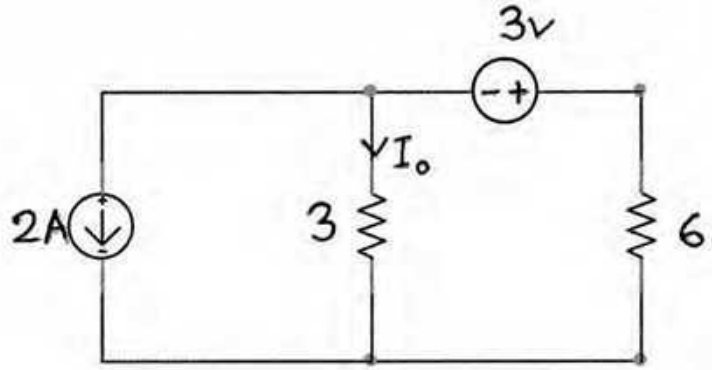

b. i) State KVL, KCL & Ohm's Law. [6+6=12]

ii) Define voltage, current & power

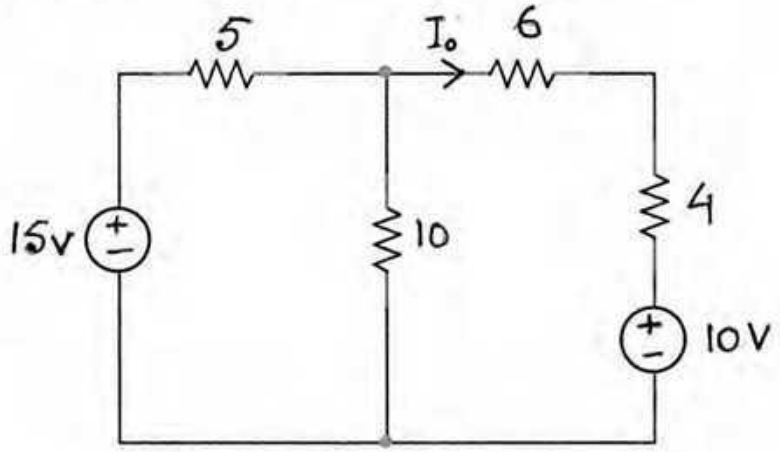
**2.** a. Using the Nodal analysis find the node voltage . All the resistances are given in ohms [13]



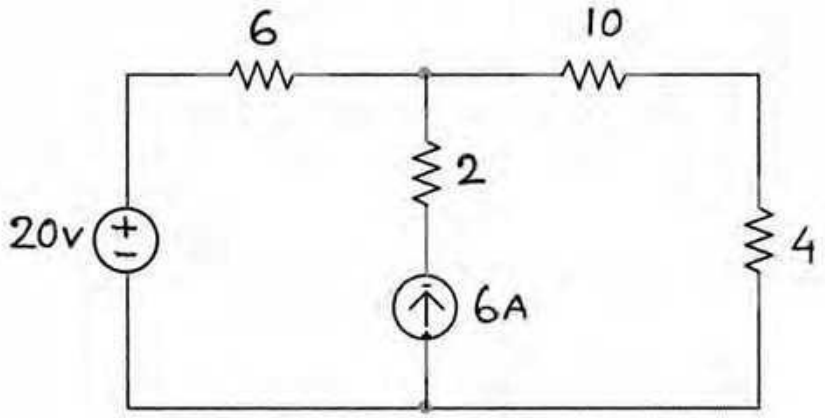
b. Find $I_o$ using Nodal analysis . All the resistances are given in ohms [12]




**3. a.** Find $I_o$ using Mesh Analysis. All the resistances are given in ohms [13]

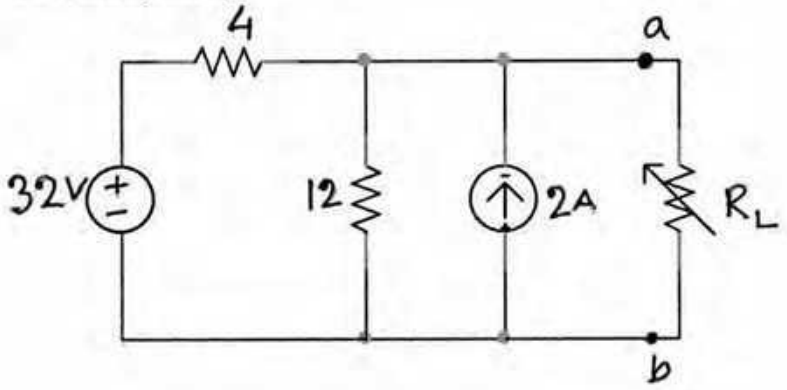



**b.** Find the mesh currents using the mesh analysis. All the resistances are given in ohms. [12]

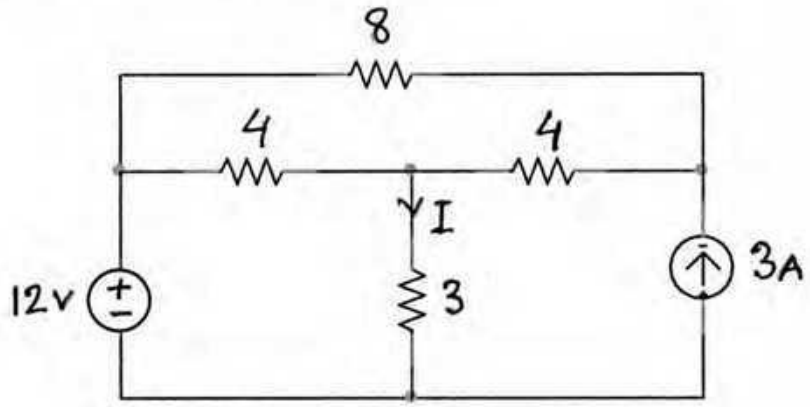


4 a . Derive Maximum Power Transfer Theorem.Draw the Power vs Load curve [11]

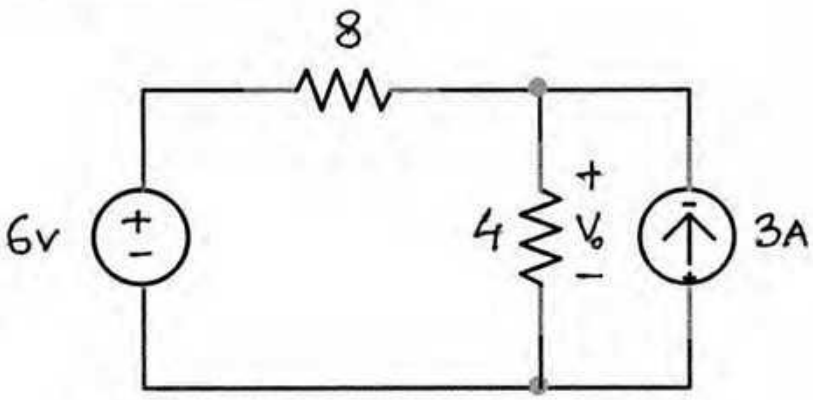
b. Find $V_{th}$ and R with respect to terminal a-b. Draw the Thevenin's Equivalent circuit and calculate the maximum power absorbed by the $R_L$ [14]




5. a. Find I using the superposition theorem [12.5]




b. Find $V_o$ using the superposition theorem [12.5]

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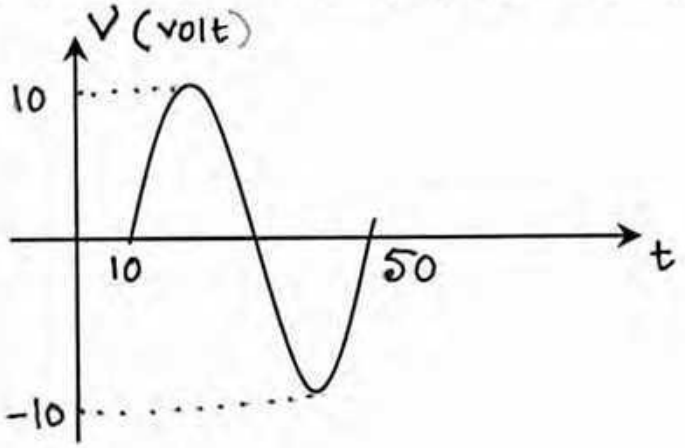
6. a. Calculate the phase angle between $V = 10 \cos (wt + 50^0)$ and $I = 12 \sin (wt - 10^0)$. Draw the corresponding waveform & also state which sinusoid is leading [12.5]

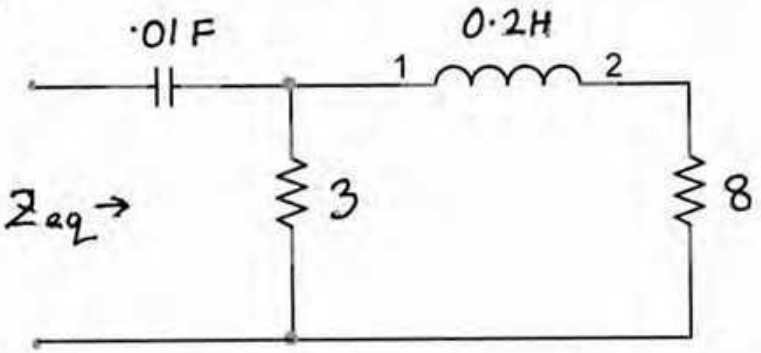
b. Find the following parameters from the graph [12.5]

i) Amplitude ii) Time period iii) Frequency iv) Angular frequency



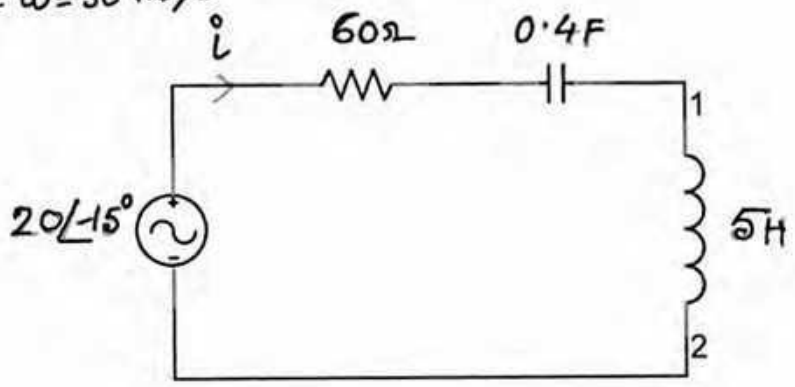

7. a. Prove that for a sinusoidal signal E(t), the Phasor form of dE(t)/dt is $j\omega\bar{E}$ and the phasor form of $\int E(t)$ is $E/jw$. [13]

b. Find the input impedance of the following circuit . Assume the circuit operates at w =50 rad/s [12]




8. a. With Necessary diagrams show that voltage leads current by $90^0$ in an inductor both in time domain and frequency domain [12]

b. Find i at ω=50 rad/s [13]

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# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination Spring Semester 2010
## Program: B.Sc Engineering (Civil)

Course Title: Principles of Economics | Course Code: ECN-201
Time: 2.00 Hour | Full Marks: 50

**There are SIX questions. Answer any FIVE of the following Questions (No. 1 - 6).**

1. a) Define 'production' and 'production function' in context of economics. *[3+5+2]*
   b) Discuss the 'law of diminishing marginal return'.
   c) How can you use the concept of 'economy of scale' in the construction sector?

2. a) Define 'marginal cost' with a numerical example. *[5+5]*
   b) Distinguish between economic cost and accounting cost.

3. a) Distinguish between monopoly and monopolistic form of market. *[5+3+2]*
   b) Discuss the characteristics of a perfect competitive market.
   c) What are forms of market of apartment industry in Dhaka city and cement industry in Bangladesh?

4. a) An increase in the price of cement from tk. 380 to tk. 400 leads to a decrease in quantity demanded for cement from 15,000 ton to 12,000 ton. Calculate the price elasticity of demand for cement. *[5+5]*
   b) Discuss the uses of income elasticity in business and economic decision making.

5. Discuss the role of the civil engineers in the economic development of a least developed country like Bangladesh. *[10]*

6. Write short notes on any FOUR of the followings *[2.5*4]*
   a) Cross elasticity of demand;
   b) Return to scale;
   c) Productivity;
   d) Homogeneous product;
   e) Economic development.

# The University of Asia Pacific
## Department of Civil Engineering
## Final Examination Spring 2010
## Program B.Sc. Engineering (Civil)

**Course Title: English Language 1** **Course code: HSS 101**
**Total Time: 3hours** **Full marks: 100**

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**Section A**
**Answer questions of this section on this question paper**

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**Q.1. Read the following passage and answer the questions that follow:**

In 1912 an American shipping company launched a new ship called the 'Titanic'. It was the largest and most luxurious ocean liner of that time. It weighed 46,000 tons and could carry about 2,200 passengers. Experts said that nothing could sink it. It was definitely unsinkable. On April 14, 1912, the ship sailed on its first voyage across the Atlantic from Southampton in England to New York in the United States, with 2,224 passengers, men, women and children. On April 15, just before midnight, the ship struck an iceberg. The iceberg tore a great hole in the ship's side, and the unsinkable 'Titanic' began to sink.

There was great alarm on board. Warning bells rang out. Everyone rushed to the lifeboats, but there was not enough room for them all. There was room for only 1,178 passengers. The lifeboats took mostly the women and children. It was a terrible scene. Wives were weeping because they had to leave their husbands to drown. Children were crying because they had to say goodbye to their fathers. The men had to remain on the ship. The Titanic sent out signals for help, but no help came. Another ship, the 'Californian' was only twenty miles away, but her radio operator was asleep and did not hear the distress signals.

In the early hours of the morning the 'Titanic' sank, while her band was playing bravely on deck. Twenty minutes later another liner the 'Carpathia' arrived on the scene and helped to rescue survivors from the icy water. But of the 2,224 passengers, only about 700 survived.

It was a terrible disaster. But something good came out of the sinking. In 1913 there was a committee of inquiry into the disaster. This drew up many new rules for shipping companies. Since then, every ship has had to provide lifeboat places for each passenger and has had to organize lifeboat drill during each voyage. Every ship has had to carry enough radio operators. Another important result was the formation of an international ice patrol. This patrol warns ships about ice and icebergs in the North Atlantic.

**A. Answer the following questions:** **10**

a) Did anything good come out from the sinking of the 'Titanic'?

b) What does an ice patrol do?

c) Why were so many lives lost in the 'Titanic' disaster? Which passengers were given the first places in the lifeboats?

d) How far away was the 'Californian' when the disaster happened? Why did it not go to the rescue?

e) What is an iceberg?

**B. Are the following statements true (√) or false (X)?** **4**

a) The Titanic was unsinkable.

b) The 'Titanic' was sailing from east to west.

c) The 'Californian' rescued survivors from the 'Titanic'.

d) Many passengers were lost because some of the lifeboats struck an iceberg.

e) There were not enough places in the lifeboats for all the passengers.

f) The 'Californian' had a radio operator on duty all the time.

g) About 1,500 of the passengers on the 'Titanic' lost their lives.

h) The international ice patrol warns ships about icebergs in the North Pacific.

**C. Find suitable words in the passage to complete the sentences:** **4**

a. Radio operators must not sleep when they are on ----------.

b. Bells rang out to give ----------of the disaster.

c. The passengers were standing on the ----------, waiting to get into the lifeboats.

d. The shipbuilders thought the titanic was ---------- even in a collision.

e. An ---------- is a person with special knowledge of a subject.

f. When the ship struck the iceberg the radio operator sent out ---------- signals.

g. The titanic sailed with more than 2,000 passengers on ----------.

h. Soldiers spend a lot of time doing ----------, to learn to obey orders.

**D. Match the explanations of column B with the phrases in column A.** 5

| A | B |
|---|---|
| i. to warn | a. to put a new ship into the water |
| ii. a lifeboat | b. very costly and comfortable |
| iii. luxurious | c. a group of musicians together |
| iv. a disaster | d. to tell about possible danger |
| v. a voyage | e. a large passenger ship |
| vi. to launch | f. a terrible accident |
| vii. a liner | g. a man who sends & receives wireless messages |
| viii. a radio operator | h. a journey by sea |
| ix. a band | i. part of a ship that people walk on |
| x. a deck | j. a boat for rescuing people from the sea |

**E. Put the verbs in brackets into their correct form:** 7

a. Many passengers ---------- (sleep) when the alarm bells ---------- (ring) out.

b. The band ---------- (play) bravely on deck while the ship---------- (sink).

c. When the 'Carpathia' ---------- (come) on the scene hundreds of passengers ---------- (struggle) in the icy water.

d. When the bells ---------- (ring) out the passengers ---------- (rush) to the lifeboats.

e. While some passengers were ---------- (get) into the lifeboats, others ---------- (jump) into the water.

f. When the patrol ---------- (see) the iceberg, all ships in the area ---------- (keep) a careful watch and their radio operators ---------- (listen) for warnings.

g. Something good ---------- (come) out of he sinking of the 'Titanic' though it ---------- (is) a terrible disaster.

**Q.2. Make one new word with any 10 of the base words using either a suffix or a prefix & then make sentences with those words. <u>Five words with suffix and five words with prefix</u>.** 10

**Prefix**

**un, im, in, il, dis, mis**

**Suffix**

**ful, less, able, ness, ment**

**Base word**

Possible, Thought, Agree, Care, Hope, Conscious, Human, Success, Polite, Help Understand, Legal, Stress, Popular

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

**Q.3.In each sentence there are homophones in phonetic script. Write the words in the gaps: (any 10)** **10**

- It seems /raɪt / _____ to warn you of the risk to / raɪt /_____on the walls.
- A / peə(r)/ _____ of children were crying for that yellow / peə(r)/ _____.
- The /rəuz / _____ plants were planted in neat / rəuz / _____
- She's heard the /teɪl / _____ of his seeing ghosts of dog wagging its/ teɪl/ _____.
- Rise of the transport /feə(r)/ / _____ seems not / feə(r)/ _____ for everybody.
- /ʧek/ _____ your signature before you submit your / ʧek/ _____.
- The /si:n/ _____of the accident was / si:n/ _____ by the people on the road.
- I was feeling /wi:k/ _____ throughout the / wi:k/ _____.
- /nɷn/_____ of the /nɷn/_____ has any contact with their families.
- The /prɪnsəpl / _____ has declared the fundamental /prɪnsəpl / _____of team work.
- The thief entered into a deserted /sti:l/_____mill to /sti:l/_____ the tools.
- The /pleɪn/ _____ landed on the /pleɪn/ _____ land.

**Q. 4. Rewrite the passage using proper punctuation marks, capital letters and correct spelling:** **10**

alan pearman a wheelclamp oficial was left dangling yesterday he and his car were hoisted 10 feet in the air by a fork-lift truck it happened after mr pearman 27 clamped a saab car on torquay harbourside it belonged to a crane driver steve carter 40 mr carters boss john Thompson hoisted mr pearmans fiesta van aloft –with him inside he claimed that mr carters car was parked legaly in the companies parking space mr thompson said i was so angry that if the forklift hadn't jammed id have dumpped him in the harbor the department of transport comented the owner of the vehicel should have displaied his parking permitt where it could easily be seen there have been a number of illegally parked cars this winter and we need to crak down on it.

**(Write answer of this question on the backside of this page)**

**Q.5. Write two sentences from each word expressing two different meanings (any five words):** **10**

- Form: 1.

  2.

- Change: 1.

  2.

- Case: 1.

  2.

- Row: 1.

  2.

- Poor: 1.

  2.

- Address: 1.

  2.

- Switch: 1.

  2.

---

**Section B**

**Write answer of this section in the UAP answer booklet**

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Q.6. Write a description of 1. The city you are living in; **or** 2. The most important person in your life. (200 words) 10

Q7. Write a paragraph comparing and contrasting between any of the following: (200 words)10

- ❖ Mobile phone and Computer
- ❖ Living in your hometown and living in Dhaka

Q.8. Write a letter to your friend telling him/her about your university life. (200 words) 10

**Or**

**Translate the following passage:**

১৯৯০-এর দশকের শেষভাগে পরিচালিত একটি জরিপ অনুযায়ী যুক্তরাষ্ট্রে ১২০০-এর অধিক মসজিদ রয়েছে। তবে এর মধ্যে ১০০-এর কম সংখ্যক প্রকৃত মসজিদ হিসেবে নির্মিত হয়েছিল। ঐ জরিপ অনুযায়ী যুক্তরাষ্ট্রের এই মসজিদগুলো প্রথমে অন্যান্য কাজের জন্য নির্মিত হয়েছিল এবং অধিকাংশ ইসলামিক ভবনগুলো প্রাথমিকভাবে অগ্নি নির্বাপক কেন্দ্র, থিয়েটার, গুদাম ঘর এবং দোকান হিসেবে নির্মাণ কারা হয়েছিল। অবশ্য ১৯৬৫ সালের পর পরিস্থিতির পরিবর্তন ঘটে যখন বিভিন্ন দেশ থেকে বিপুল সংখ্যায় মুসলিমরা যুক্তরাষ্ট্রে আসতে শুরু করে। এই সময় থেকে নামাজ আদায় এবং কম্যুনিটি সেন্টার হিসেবেই মুখ্যত মসজিদগুলো নির্মিত হয়। আমেরিকাতে বসবাসরত ধর্মীয় বৈচিত্র্য এবং জাতিগত বৈচিত্রের প্রতিফলন ঘটেছে মসজিদ এবং এগুলোর সাথে নির্মিত কম্যুনিটি সেন্টারগুলোর নির্মাণ শৈলী ও নকশার মধ্যে।

# The University of Asia Pacific

## Department of Architecture/ Business Admin/ CE/ CSE/ Pharmacy

## Final Examination Spring-2010

## Program: B Arch/ BBA/ B.Sc Engineering/ B Pharm

1st Year 2nd Semester

Course Title: English Language II Course Code: HSS 103 Credit: 3.00

Total Time: 3.00 Hours Full Marks: 50

### PART - A

**Answer any three of the following questions, marks 18 (6×3)**

1. Read the passage below and answer the questions that follow: **06**

***Will's Bicycle***

*Will's bicycle has a flat tyre. He can not ride it. He has to repair a puncture. He does not need to pay the man at the bicycle shop to mend it. He can repair it himself. He has taken out the inner tube. He has tested it and has found the puncture. The test is easy. You get a bucket of water. You blow up the inner tube with a bicycle pump and put the tube into water, bit by bit. You move the tube round till you see a stream of air bubbles coming up through the water. You mark the place where the air is coming out with a special pencil. Will has one of these pencils. His father has given him a repair outfit. The pencil is in the outfit. He has marked the place where the puncture is. When the inner tube is dry he is going to stick a rubber patch on the puncture. He is going to stick it on with a rubber solution. There are some patches and a tube of rubber solution in the repair outfit. When Will has repaired his bicycle he is going to ride it again.*

Now, answer these questions:

a) Why can Will not ride his bicycle?
b) How do you know when a tyre has a puncture?
c) Who is going to mend the puncture?
d) How do you find a puncture?
e) Who has given Will the things to mend the puncture with?
f) Why is Will watching till the inner tube is dry?

2. Rewrite any twelve (12) of the following sentences using appropriate modal verbs: **06**

a) There is a possibility of rain this afternoon.
b) We cannot but comply with our commitments.
c) He was in the habit of walking five kilometers everyday.
d) He is able to write an excellent piece.
e) You are permitted to represent your brother.
f) It is suggested that you take all your medicines on time.
g) I offer myself to assist you in taking him to a hospital.
h) I am obliged to meet my teacher after my class time.
i) You have the necessity to repair your car.
j) Am I allowed to discuss the matter, dear friend?
k) They are probably not at home now.
l) Do you permit me to use your telephone, sir?
m) He was able to do more hard work when he was studying in high school.
n) Perhaps George will help you if you give him a ring.

3. Join any twelve (12) of the following pairs of sentences with appropriate conjunctions or relative pronouns. Do not use the same joining word more than once: **06**

a) Bring me a glass of milk. It is on the table
b) I saw the man. He was delivering a nice lecture.

c) I must be quick. I will miss the programme.
d) I like him. He is honest and sincere.
e) He is a good player. He is a good student.
f) I will finish my studies. I will start a business.
g) The thief fled away. People chased him.
h) He works in an office. He runs a business.
i) We were playing outside. He was studying in his room.
j) I can't do the work. I do not know the process.
k) We live in the house. This needs to be painted.
l) He wants to be a pianist. He can not play the piano very well.
m) The roadside iftar items are not clean and hygienic. People take them.
n) I'll offer him a lift in my car. He has not asked for it.

4. Make sentences with any twelve (12) of the following idioms. **06**

| | | | |
|---|---|---|---|
| a) Keep one's fingers crossed | b) In the soup | c) A black sheep | d) Pull one's leg |
| e) Bear in mind | f) Out of the blue | g) Storm in teacup | h) Never mind |
| i) Give a hand | j) Blue collar worker | k) At finger tips | l) Day in day out |
| m) As light as a feather | n) On top of the world | | |

## PART – B

**Answer all the questions from this section, marks 32 (06+06+05+05+05+05)**

5. Write a paragraph on any one (1) of the followings using a topic sentence (word limit 140 words)**06**

a) Celebration of a National Day b) A Sports Event You Have Enjoyed Recently

6. Write single-sentence definitions of any six (6) of the following words as directed within brackets:**06**

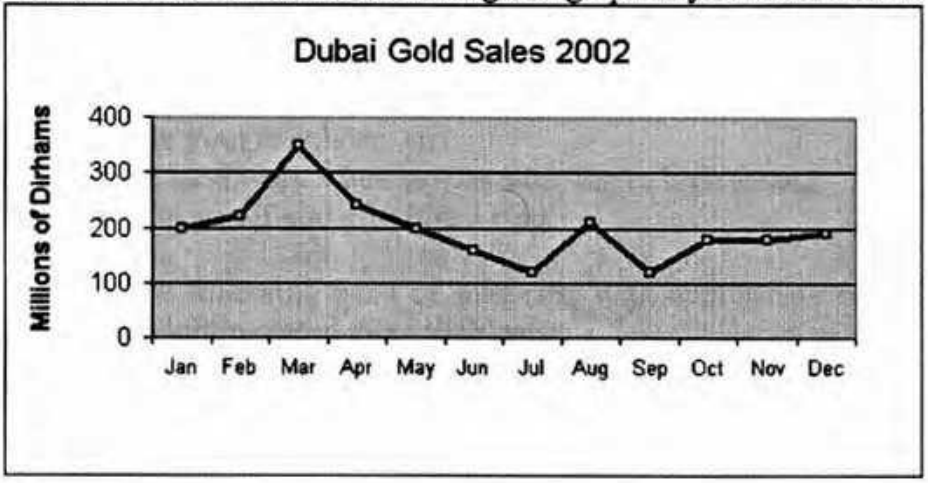
| | | |
|---|---|---|
| a) Benevolent (synonym) | b) OHP (class) | c) Dictionary (function) |
| d) Internet (negation) | e) Mobile Phone (description) | f) Memorandum (class) |
| g) Newspaper (function) | h) Fascinate (synonym) | |

7. UAP has recently arranged its Inter-departmental Football Competition 2010. As a reporter of a national daily, write a news-report on the event for publication in your newspaper. **05**

8. UAP's annual cultural programme is to be organized soon. As the Registrar and Convener of the Organizing Committee, write a memorandum to other members of the committee to this effect. **05**

9. Write a letter to the Registrar of your university seeking help for a study tour. **05**

10. The graph below shows sales of gold in Dubai for 12 months in 2002 in millions of dirhams. Describe and analyze the information available in the given graph in your own words. **05**



**The University of Asia Pacific**
**The Department of Interdepartmental Courses**
**Semester Final Examination, Spring 2010**
**Programmes: BArch, BBA, BSc Engineering (CE, CSE, EEE) and BPharm**

**Course Title: Bangladesh Studies: Society and Culture** **Course Code: HSS 111(a)**
**Credit: 2.00** **HSS 211(a)[for CE]**

**Time 2:00 hours** **Marks:50**

**All questions are of equal value**

**Answer <u>ANY FIVE</u> of the following**

1. Define culture and civilization. Distinguish between the two with examples.
2. What is social stratification? Discuss the characteristics of social stratification. Discuss in brief on slavery.
3. Discuss in brief the stratification pattern of urban Bangladesh.
4. Discuss in brief the functions of family. Discuss the types of marriage and family following different determinants.
5. Discuss the causes and consequences of urbanization in Bangladesh.
6. Define caste and social class. Discuss the divisions of caste and class.
7. Write in brief:

a) Rich farmer and Marginal farmer
b) Estate System

# The University of Asia Pacific

## Department of Interdepartmental Courses

**Semester Final Examination, Spring 2010**

**Programmes: BBA, BSc Engineering (CE, CSE, EEE) and BPharm**

**Course Title: Bangladesh Studies: History of Bangladesh** **Course Code: HSS 111(b)**
**Credit: 2.00** **HSS 211 (b) [for CE]**

**Time: 2 hours** **Full Marks: 50**

**All Questions are of equal value.**

**Answer any five of the following**

1. Discuss the early career of Bakhtiyar Khalji. How did he conquer Nadia?
2. Review the achievements of Sultan Shamsuddin Iliyas Shah as a Sultan of Bengal.
3. Who were the Bara-Bhuiyans? How did Subahdar Islam Khan Chisti suppress them?
4. Discuss the main causes for the battle of Palashi. What were the reasons behind Sirajjuddaula's defeat?
5. Why did the English East India Company introduce Permanent Settlement in Bengal? What were its results?
6. Describe Titu Mir's struggle against the Zamindars.
7. Briefly analyze the Six-point programme of Awami League in 1966.

# The University of Asia Pacific
# Department of Civil Engineering
# Final Examination Spring 2010
# Program: B.Sc Engineering (Civil)

Course Title: Principles of Management | Course Code: IMG 301
Time: 2 hours | Full Marks: 50

Choose any five (5) of the following 6 questions.

1. (a) What is Job Specialization? What are its benefits and limitations? (4)
   (b) Two specific issues that managers must address when distributing authority are delegation and decentralization --- Explain. (6)

2. (a) Explain Span of Management. With examples describe Graicunas's observation regarding Span of Management. (7)
   (b) Discuss the forms of Interdependence. (3)

3. (a) Define Organization and write about the managerial roles with some examples. (6)
   (b) Write about the Time frames for Planning. (4)

4. (a) Define Motivation and explain its importance with the Motivation framework. (5)
   (b) With a diagram discuss Maslow's Hierarchy of Needs theory. (5)

5. (a) What is leadership? What are the different methods, leaders or managers can apply for using power? (5)
   (b) Explain purposes of Control in the organization with examples. (5)

6. Write short notes on: (2.5x4) = 10

   (a) Chain of Command
   (b) Operational Plan and its types
   (c) Difference between Line and Staff positions
   (d) Economic dimension of General Environment

**THE UNIVERSITY OF ASIA PACIFIC**
**Department of Interdepartmental Courses**
**Final Examination Spring - 2010**
**Program: B.Sc. Engineering (CE)**

**Course Title: Math-I** **Course Code: MTH-101** **Credit: 3.00**
**Time: 3.00 Hrs.** **Full Marks: 150**

## Group-A( Differential Calculus)

Answer any **three (03)** of the followings:

| | | |
|---|---|---|
| 1.(a) | Find domain and range by drawing the graph of the following function $y = \|x\| + \|x+1\|$. | **15** |
| (b) | Evaluate:<br>i) $\lim_{x\to 0}\left(\frac{1}{x^2}-\frac{\cos 3x}{x^2}\right)$. ii) $\lim_{x\to 0}(e^x+x)^{\frac{1}{x}}$. | **5+5** |

| | | |
|---|---|---|
| 2.(a) | Define Tangent, Normal, Curvature, Radius of curvature and Centre of curvature. | **5+3+5+1+1** |
| (b) | What do you mean by directional derivative? Find the directional derivative of $f(x,y) = 3x^2y$ at the point (1, 2) in the direction of the vector $\vec{a} = 3\hat{i} + 4\hat{j}$ | **3+7** |

| | | |
|---|---|---|
| 3.(a) | Find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ if $z = x^4\sin(xy^3)$ | **5+5** |
| (b) | State and prove Euler's theorem on homogeneous function | **7** |
| (c) | If $u = \cos^{-1}\frac{x+y}{\sqrt{x}+\sqrt{y}}$, prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + \frac{1}{2}\cot u = 0$. | **8** |

| | | |
|---|---|---|
| 4. | A function, $f(x) = (x-2)^3(x+1)^2$, $-1 \le x \le 3$ is given: | |
| (a) | Find the intervals where the function, f(x) is increasing or decreasing. | **10** |
| (b) | Find the maxima and minima values of the function | **10** |
| (c) | Sketch the function using the information that you found from (a) and (b) | **5** |

## Group-B (Integral Calculus)

Answer any **three (03)** of the followings:

| | | |
|---|---|---|
| 5. | Evaluate the following standard integrals: (Any two)<br>i) $\int \frac{dx}{(2x+3)\sqrt{x^2+3x+2}}$; ii) $\int \frac{dx}{\sqrt{6+11x-10x^2}}$; iii) $\int \frac{x^2+4}{x^2+2x+3}dx$ | **12.5+12.5** |

| | | |
|---|---|---|
| 6.(a) | Integrate the following with respect to x using integration by parts<br>$\int \frac{e^{m\tan^{-1}x}}{(1+x^2)^2}dx$ | **10** |
| (b) | Integrate the following improper integral $\int_0^{\frac{\pi}{6}} \frac{\cos x}{\sqrt{1-2\sin x}}dx$ | **7** |
| (c) | Integrate the following definite integral $\int_0^{\pi} \frac{dx}{3+2\cos x}$ | **8** |

| | | |
|---|---|---|
| 7.(a) | Integrate the following as a limit of summation $\int_0^{\frac{\pi}{2}} \cos x\,dx$ | **10** |
| (b) | Evaluate $\int_0^a y^7\sqrt{a^4-y^4}dy$ | **5** |
| (c) | Find the reduction formula for $I_n = \int \cos^n x\,dx$ | **10** |

| | | |
|---|---|---|
| 8.(a) | Find the area of the surface generated by revolving the curve $y=\sqrt{4-x^2}$ about the x-axis. | **12** |
| (b) | Use a double integral to find the volume of the tetrahedron bounded by the coordinate planes and the $z = 4 - 4x - 2y$. | **13** |

# The University of Asia Pacific
## Department of Interdepartmental Courses
## Final Examination Spring 2010
## Program: B.Sc. Engineering (Civil)

Course Title: Mathematics -II | Credit: 3.00 | Course Code: MTH-103
Time: 3.00 Hrs. | Full Marks: 150

*There are two sections in the question paper namely **"SECTION A"** and **"SECTION B"**. You have to answer from both sections according to the instruction mentioned in each section.*

### SECTION-A

There are **FOUR** questions in this section, Answer any **THREE.**

1.(a) Represent graphically, i) a force of 10N in a direction $30^\circ$ north of east. ii) a force of 15N in a direction $30^\circ$ east of north. **(7)**

(b) Prove that the diagonals of a parallelogram bisect each other. **(10)**

(c) Specify vectors and scalars for the following cases and give reasons: i) Displacement ii) volume iii) Weight iv) Specific heat . **(8)**

2.(a) Determine a unit vector perpendicular to the plane of $\vec{A}=2\vec{i}-6\vec{j}-3\vec{k}$ and $\vec{B}=4\vec{i}+3\vec{j}-\vec{k}$. **(13)**

(b) Prove that diagonals of a rhombus are perpendicular. **(12)**

3.(a) How can you define ordinary derivatives of vectors? **(3)**

(b) A particle moves along the curve $x = 2\sin 3t$, $y = 2\cos 3t$, $z = 8t$, where t is the time. Determine its velocity and acceleration at time t and also find the magnitude of velocity and acceleration at $t = 0$. **(12)**

(c) Show that $\vec{A}.\frac{d\vec{A}}{dt} = A\frac{dA}{dt}$ . **(10)**

4.(a) State and prove Green's theorem. Verify Green's theorem in the plane for $\oint_c (xy+y^2)\,dx + x^2dy$, where c is the closed curve of the region bounded by $y = x$ and $y = x^2$. **(8+10)**

(b) Evaluate $\iint_s \vec{r}.\vec{n}\,ds$, where S is a closed surface. **(7)**

P.T.O.

## SECTION-B

There are **FOUR** questions in this section, Answer any **THREE.**

5.(a) Define direction cosine and direction ratio. **(3)**

(b) Find the ratio in which yz-plane divides the joint of the points (-2,4,7) and (3,-5,8) and also find the co-ordinates of the point of the intersection of this line with yz-plane. **(7)**

(c) A line makes angles $\alpha,\beta,\gamma,\delta$ with the four diagonals of a cube, prove that $\cos^2\alpha+\cos^2\beta+\cos^2\gamma+\cos^2\delta=\frac{4}{3}$. **(15)**

6.(a) Define plane. Find the equation of the plane passing through the lines of intersection of the planes $2x-y=0$ and $3z-y=0$ and perpendicular to the plane $4x+5y-3z+1=0$. **(2+8)**

(b) Find the equation of the plane passing through the points (2,2,1) and (9,3,6) and perpendicular to the plane $2x+6y+6z-9=0$. **(15)**

7.(a) Explain the general equation of a straight line. **(3)**

(b) Show that the lines $3x-2y+13=0$, $y+3z-26=0$ and $\frac{x+4}{5}=\frac{y-1}{-3}=\frac{z-3}{1}$ are perpendicular. **(7)**

(c) Find the magnitude and the equations of the line of shortest distance between the lines $\frac{x-8}{3}=\frac{y+9}{-16}=\frac{z-10}{7}$ and $\frac{x-15}{3}=\frac{y-29}{8}=\frac{z-5}{-5}$. **(15)**

8.(a) Define Sphere. Find the general equation of a sphere. **(1+4)**

(b) Find the equation of sphere through the points (0,0,0), (0,1,-1), (-1,2,0) & (1,2,3). **(10)**

(c) Find the co-ordinates of the centre and radius of the circle $x+2y+2z=20$, $x^2+y^2+z^2-2x-4y-6z=2$. **(10)**

**THE UNIVERSITY OF ASIA PACIFIC**
**Department of Interdepartmental Courses**
**Final Examination 'Spring-2010**
**Program: B.Sc. Engineering (CE)**

**Course Title: Math-III** **Course Code: MTH-201** **Credit: 3.00**
**Time: 3.00 Hours** **Full Marks: 150**

**Group-A**

**There are Four questions, Answer any 03(Three) of the followings:**

Q.1. (a) Prove that $R^2$ is a vector space.

(b) Let $T : V_3(R) \to V_3(R)$ be a linear mapping defined by
$T(x, y, z) = (x + 2y-z, y + z, x + y-2z)$. Find a basis and dimension of the
(i) Image of T and (ii) Kernel of T.

Q.2. Find all eigenvalues and corresponding eigenvectors of A. Also find an invertible matrix P such that $P^{-1}AP$ is diagonal where

$$A = \begin{pmatrix} 1 & 4 \\ 2 & 3 \end{pmatrix}.$$

Q.3. If T be the linear operator on $R^2$ is defined by $T(x, y) = (2y, 3x - y)$ with respect to the basis $\{f_1 = (1, 3),\ f_2 = (2, 5)\}$
Verify that $[T]_f [v]_f = [T(v)]_f$, $\forall v \in R^2$.

Q.4. State Cayley-Hamilton theorem. Prove the Cayley-Hamilton theorem.

Hence find the inverse of A (using by C-H theorem) where $A = \begin{pmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix}$.

## Group-B

**There are Four questions, Answer any 03(Three) of the followings:**

Q.5. (a) If a coin tossed 2 times. Find the Mathematical Expectation for the numbers of heads. and variance.

(b) If the probability of density function of x is $f(x) = \begin{cases} (5+x), & 1 \le x \le 5 \\ 0, & elsewhere \end{cases}$

Find (i) $P(x \le 3)$ (ii) $P(2 < x \le 4)$.

Q.6. Consider the bases of $R^2 : \{e_1=(1,0), e_2=(0,1)\}$ and $\{f_1=(1,2), f_2=(2,3)\}$

(i) Find the transition matrix P and Q from $\{e_i\}$ to $\{f_i\}$ and from $\{f_i\}$ to $\{e_i\}$ respectively.

(ii) Verify that $Q = P^{-1}$.

Q.7. (i) Find the dimension and a basis of U and W where

$U = \{(a,b,c,d): b+c+d = 0\}$

$W = \{(a,b,c,d): a+b = 0, c = 2d\}$

(ii) Show that the matrices A, B, $C \in V(R)$ are linearly independent where

$$A = \begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}, \quad B = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, \quad C = \begin{pmatrix} 1 & 1 \\ 0 & 0 \end{pmatrix}$$

Q.8.

(i) Find the coefficient of skewness, kurtosis and give comments for 25,15,23,27,25,23,20.

(ii) A box contains 4 white, 5 red and 6 green balls. Three balls are drawn at random

Find the probabilities of getting (i) all are red. (ii) 2 green balls. (iii) different colors. (iv) at least 2 red balls.

**THE UNIVERSITY OF ASIA PACIFIC**
**Department of Interdepartmental Courses**
**Semester Final Examination Spring - 2010**
**Program: B.Sc. Engineering (CE)**

**Course Title: Math-IV** **Course Code: MTH-203** **Credit: 3.00**
**Time: 3.00 Hrs.** **Full Marks: 150**

## Group-A( Laplace and Fourier transform)

Answer any **three (03)** of the followings:

| | | |
|---|---|---|
| 1.(a) | Define Laplace transform. Using integration evaluate i) $L\{e^{at}\}$ ii) $L\{\sin at\}$ | 1+4+4 |
| (b) | If $L\{F(t)\} = f(s) = \int_0^\infty e^{-st}F(t)dt$, then $L\{F''(t)\} = s^2f(s) - sF(0) - F'(0)$ | 6 |
| (c) | State and Prove Shifting property and change of scale property | 5+5 |

| | | |
|---|---|---|
| 2.(a) | Evaluate each of the followings:<br>i) $L^{-1}\left\{\frac{1}{s^{\frac{3}{2}}}\right\}$ ii) $L\{e^{4t}\sin 3t\}$ iii) $L\{t^2e^{-3t}\}$ iv) $L^{-1}\left\{\frac{s-2}{(s-2)^2-16}\right\}$ v) $L^{-1}\left\{\frac{1}{s^{-1/2}}\right\}$ | 7.5 |
| (b) | Find i) $L^{-1}\left\{\frac{5s+4}{s^3} - \frac{2s-18}{s^2+9} + \frac{24-30\sqrt{s}}{s^4}\right\}$ ii) $L^{-1}\left\{\frac{1}{\sqrt{2s+3}}\right\}$ iii) $L^{-1}\left\{\frac{6s-4}{s^2-4s+20}\right\}$ | 9.5+ 4 +4 |

| | | |
|---|---|---|
| 3.(a) | Define infinite Fourier sine and cosine transform. Establish the relation between Fourier transform and Lapalce transform . | 2+2+4 |
| (b) | Find the Fourier transform of $f(x) = \begin{cases} x, & \lvert x\rvert \le a \\ 0, & \lvert x\rvert > a \end{cases}$ | 8 |
| (c) | Show that $\int_0^\infty \frac{\cos\lambda x}{\lambda^2+1}dx = \frac{\pi}{2}e^{-x}$, $x \ge 0$ | 9 |

| | | |
|---|---|---|
| 4.(a) | Express the function $f(x) = \begin{cases} 1, & \lvert x\rvert \le 1 \\ 0, & \lvert x\rvert > 1 \end{cases}$ as a Fourier integral . Hence evaluate $\int_0^\infty \frac{\sin\lambda\cos\lambda x}{\lambda}d\lambda$ . | 10 |
| (b) | Find the finite Fourier sine and cosine transform of $f(x) = x^2$, $0<x<3$ | 7.5+7.5 |

P. T. O.

## Group-B Differential Equations)

Answer any **three (03)** of the followings:

| | | |
|---|---|---|
| 5.(a) | Explain equation reducible to Homogeneous Form. Solve the followings:<br>i) $\frac{dy}{dx} = \frac{x+2y-3}{2x+y-3}$ ii) $\frac{dy}{dx} = \frac{6x-4y+3}{3x-2y+1}$ | **4+9+7** |
| (b) | Using integrating Factor solve, $\left(x+y^2\right)dy+\left(y-x^2\right)dx = 0$ | **5** |

| | | |
|---|---|---|
| 6.(a) | How can you convert Bernoulli equation to Linear Differential equation? Explain it. | **10** |
| (b) | Solve the following equation:<br>$\frac{dy}{dx}\left(x^2y^3+xy\right) = 1$ | **15** |

| | | |
|---|---|---|
| 7.(a) | Find the necessary and sufficient condition for a differential equation for first degree being exact. | **15** |
| (b) | Is the differential equation $\left(x^2+y^2+x\right)dx + xydy = 0$ exact? If so, solve it. | **10** |

| | | |
|---|---|---|
| 8.(a) | Define Linear Differential Equations with constant co-efficient. Solve the followings:<br>i) $\frac{d^2y}{dx^2}+\frac{dy}{dx}+ y = \sin 2x$ ii) $D^2y + 2Dy + 2y = xe^{-x}$ | **2+8+8** |
| (b) | Write down the form of Homogeneous Linear Equations. Solve the following equation:<br>$x^2\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} - 4y = x^4$ | **7** |

# The University of Asia Pacific
## Department of Interdepartmental Courses
## Final Examination Spring-2010
## Program: B.Sc Engineering (CSE/CE/ARCH)

Course Title: Physics I | Course Code: PHY-101 | Credit: 3.00
Time: 3.00 Hours | Full Mark: 150

*[N.B- The figures in the margin indicate full marks. There are two sections in the question paper namely "**SECTION A**" and "**SECTION B**". You have to answer from both sections according to the instruction mentioned in each section.]*

### SECTION A

There are **FOUR** questions. Answer any **THREE**

1. (a) Prove that $T = \dfrac{r\left(h + \frac{r}{3}\right)\rho.g}{2\cos\theta}$, where the terms have their usual meanings. 18

(b) Calculate the excess pressure inside a soup bubble of radius 60 cm. Surface tension of soup solution is $5.8 \times 10^{-3}$ N/m. 7

2. (a) State and explain the Bernoulli's theorem and prove that $\frac{v^2}{2} + gh + \frac{p}{\rho} = \text{constant}$, where the terms have their meanings. 16

(b) Find the limiting velocity of a rain drop. Diameter of the rain drop is $3\text{x}10^{-3}$ m. [Density of air relative to water = $1.3\text{x}10^{-3}$, coefficient of viscosity of air = $1.81\text{x}10^{-4}$ S.I. units and density of water = $10^4$ kg/m$^2$] 9

3. (a) Derive the equation of Laplaces correction to Newton's formula for the velocity of sound in gas. 15

(b) Discuss the effect of temperature on the velocity of sound in gas. 8

(c) Calculate the increase in velocity of sound in air per degree celsius rise in temperature. 2

4. (a) What is Doppler effect? 8

(b) Derive the equation of Doppler effect when source at rest and observer in motion. 15

(c) Two trains traveling in the opposite direction at 100 km/hr each, cross each other while one of them is whistling. If the frequency of the note is 800 Hz, find the apparent pitch as heard by an observer in the other train:
(i) before the trains cross each other
(ii) after the trains have crossed each other 2

*[Turn over*

## SECTION B

There are **FOUR** questions. Answer any **THREE**

5. (a) What is called cantilever? Prove that depression $y = \frac{Wl^3}{3YI_g}$, where the terms have their usual meanings. 16

(b) A uniform rod of length 4.5 m is clamped horizontally at one end. A weight of 1.5 kg is attached at the free end. Calculate the depression at the mid point of the rod. The diameter of the rod is 0.08 m. ($Y = 3x10^{12}$ n/m$^2$) 9

6. (a) What is stationary wave? 8

(b) Show that the rate of energy transfer for a stationary wave is zero. 15

(c) A particle executes simple harmonic motion given by the equation $y = 12\sin\left(\frac{2\pi t}{10} + \frac{\pi}{4}\right)$, calculate (i) amplitude, (ii) frequency, (iii) epoch, (iv) acceleration at t = 5 s. 2

7. (a) What is interference of light? 8

(b) Show that the fringe width of bright and dark interference fringe in Young's experiment is equal. 15

(c) In Young's double slit experiment the separation of the slit is 1.9 mm and the fringe spacing is 0.31 mm at a distance of 1 metre from the slits. Calculate the wavelength of light. 2

8. (a) What is Newton's ring? 8

(b) Derive the necessary conditions for the formation of Newton's ring by reflected and transmitted light. 15

(c) A plano-convex lens of radius 300 cm is placed on an optically flat glass plate and is illuminated by monochromatic light. The diameter of the 8$^{th}$ dark ring formed by transmitted light is 0.72 cm. Calculate the wavelength of the light used. 2