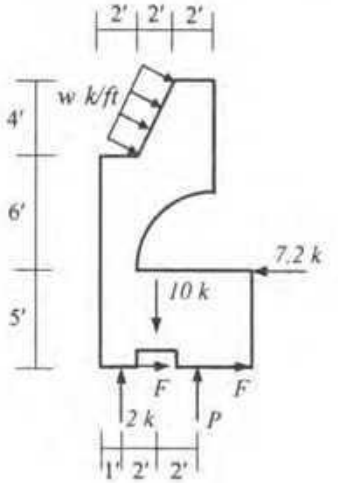
The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2009 (Set B)
Program: B. Sc. Engineering (Civil)

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

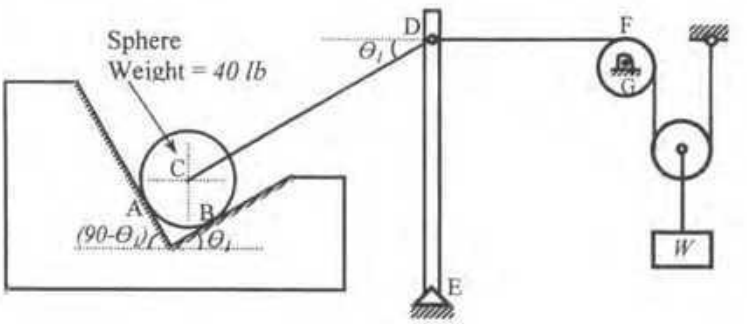
[Answer **any 10 (ten)** of the following **14 (fourteen)** questions]

1. The figure below shows a system of forces acting on a structure. For equilibrium condition, calculate P, F and w.

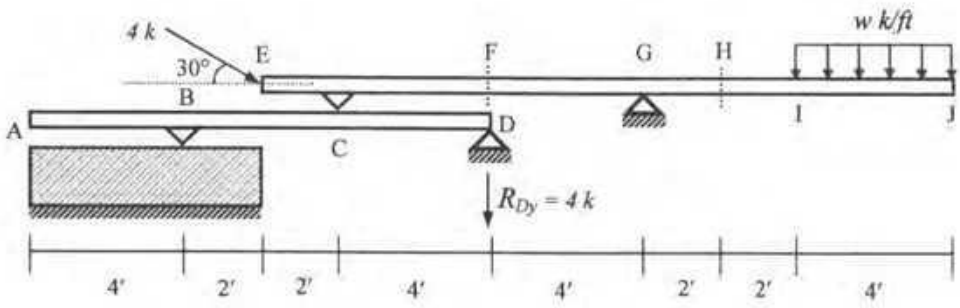


2. For the problem described in question 1, calculate the magnitude, direction and location of the resultant for $P = 30\ k$, $F = 1.6\ k$ and $w = 2\ k/ft$.

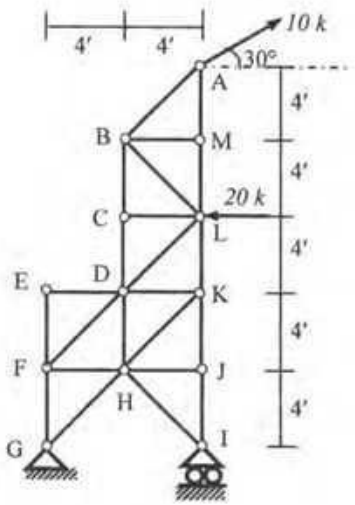
3. In the figure below, the weight of the block is *40 lb*. Calculate W and Θ_1, so that normal reaction at A is zero and B is 34.64 *lb*. Also calculate the force exerted on bearing G (Assume all surfaces frictionless).



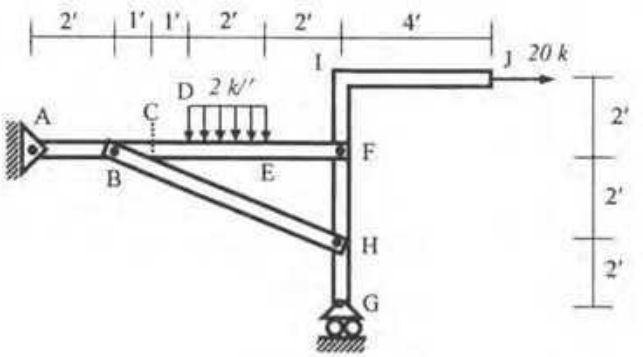
4. In the figure shown below, calculate w so that the reaction at D (R_{Dy}) is $4\ k$ as shown. Also calculate axial forces, shear forces and bending moments at F and H.



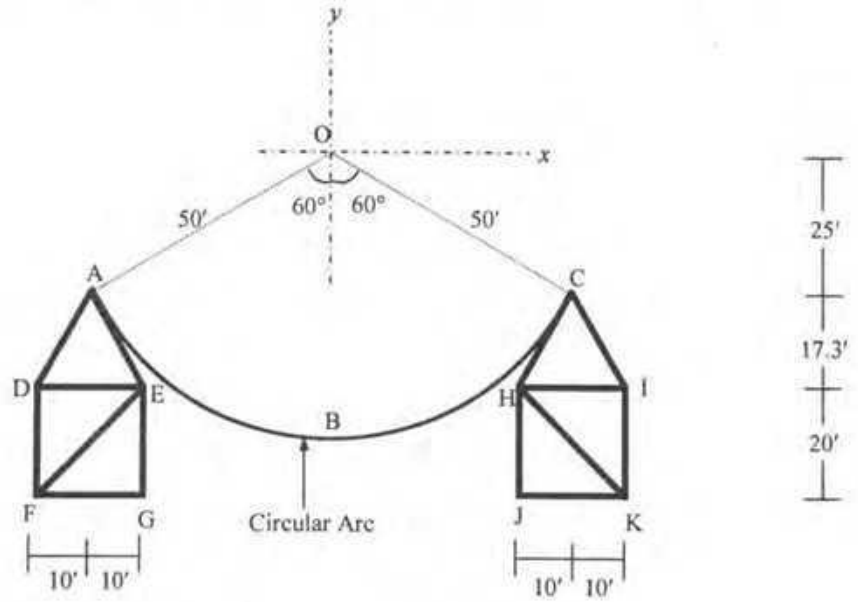
5. In the truss shown below, identify the zero force members without showing any calculation. Using method of sections, calculate the forces in members BC, DL and LK. Also calculate the support reactions.



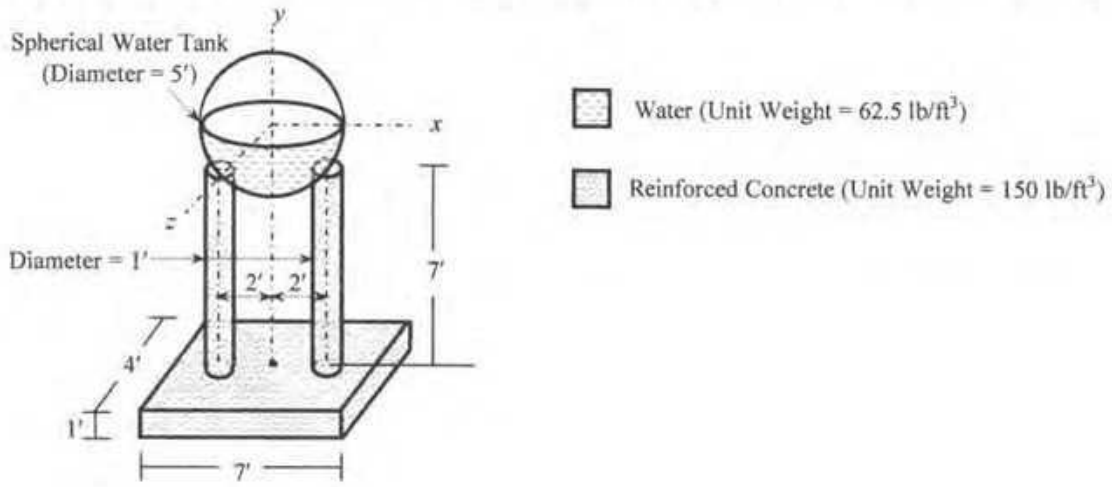
6. In the structure shown below, calculate the pin reactions at F and axial force, shear force and bending moment at C.



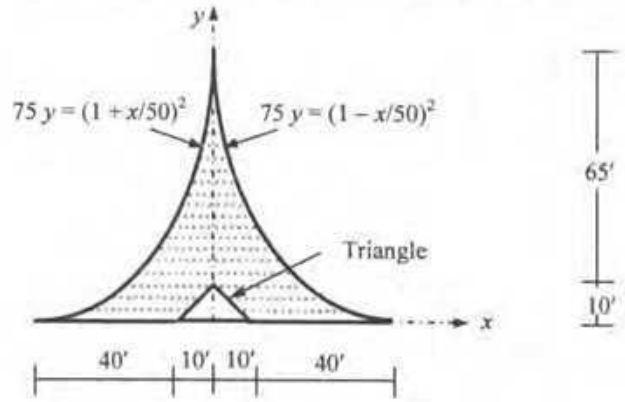
7. Locate the center of gravity of the structure shown below by its centerlines.
The circular arc ABC weighs 10 lb/ft and all the other members weigh 20 lb/ft.



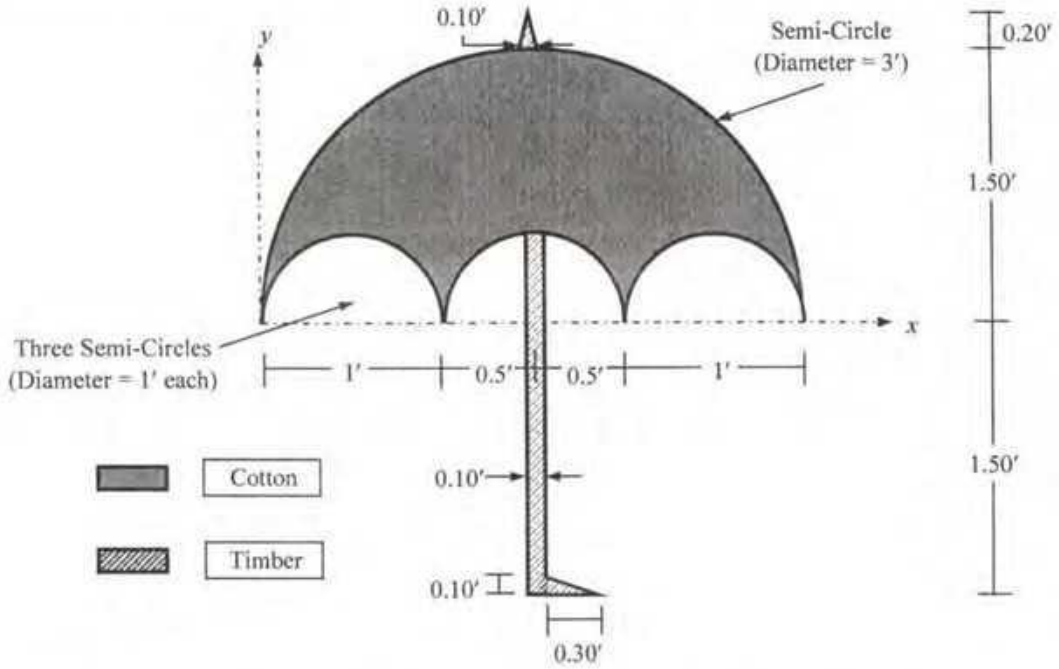
8. Locate the center of gravity of the structure shown below
[Neglect the self-weight of the spherical water tank and assume the tank to be half-filled with water].



9. Locate the centroid of the shaded area shown in the figure below.



10. Locate the centroid of the shaded area shown in the figure below.

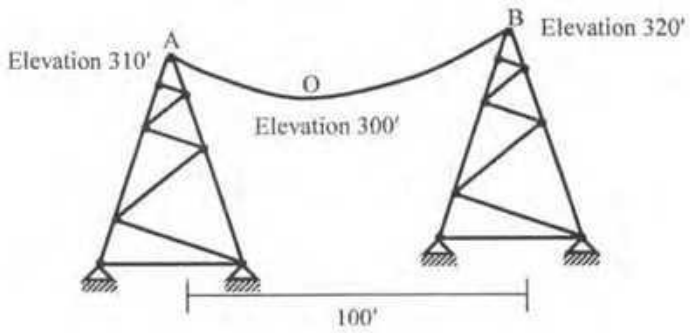


11. Calculate the moments of inertia about the x-axis and y-axis of the shaded area shown in Question 10.

12. For the shaded timber area shown in Question 10 (symbol ▨), the location of the centroid is given by $\bar{x} = 1.51'$, $\bar{y} = -0.47'$, while the centroidal radii of gyration are $\bar{k}_x = 0.59'$, $\bar{k}_y = 0.05'$.

    Calculate the minimum radius of gyration of the area and show the corresponding principal axis.

13. The maximum tension in cable AOB shown below is 100 kips.
    Calculate the load (w) distributed uniformly over its horizontal length. Also calculate the horizontal and vertical forces on the towers A and B.



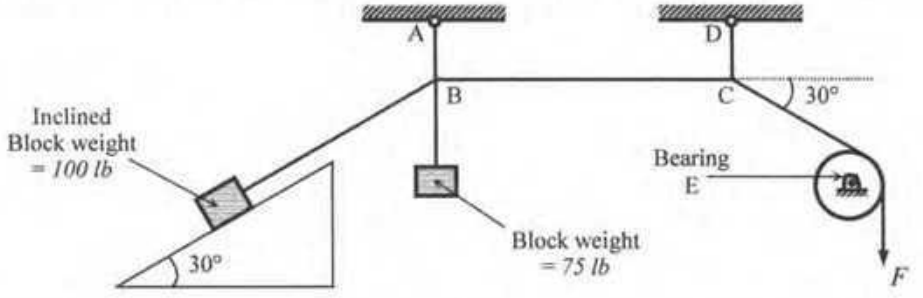
14. Answer Question 13 assuming the load (w) is uniformly distributed over the cable length [Start iteration assuming $k = 80'$ and continue for three trials].

The University of Asia Pacific
Department of Civil Engineering
Midterm Examination Spring 2009
Program: B. Sc. Engineering (Civil)

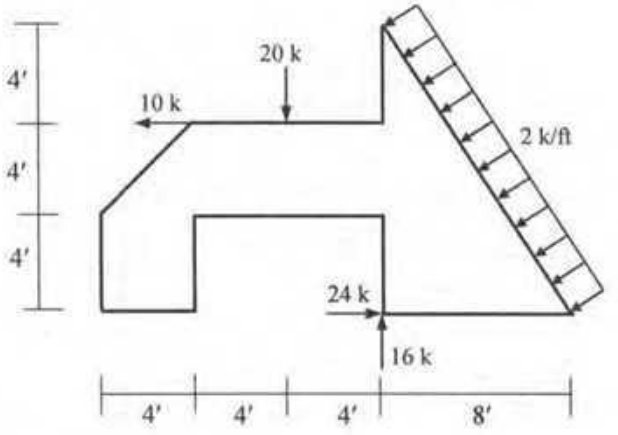
Course Title: Engineering Mechanics I | Credit Hours: 3.0 | Course Code: CE 101
Time: 1 hour | Full Marks: 40 (= 4 × 10)

[Answer **any 4 (four)** of the following **5 (five)** questions]

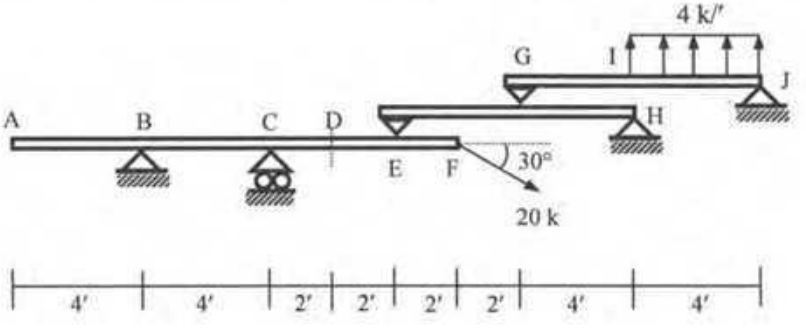
1. Calculate F, so that the cable, block and pulley system remains in equilibrium as shown in the figure below. Also calculate the tension in the cable AB and the force exerted on bearing E.



2. For the force system shown in the figure below, calculate the magnitude, direction and location of the resultant.



3. In the beam loaded as shown below, calculate the
   (i) reactions at supports B, C, H and J
   (ii) axial force, shear force and bending moment on the right of D.

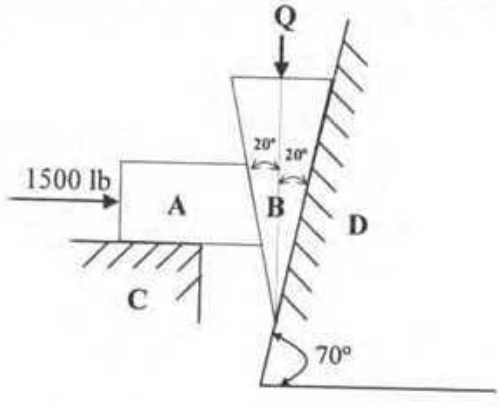


The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2009
Program: B.Sc. Engineering (Civil)

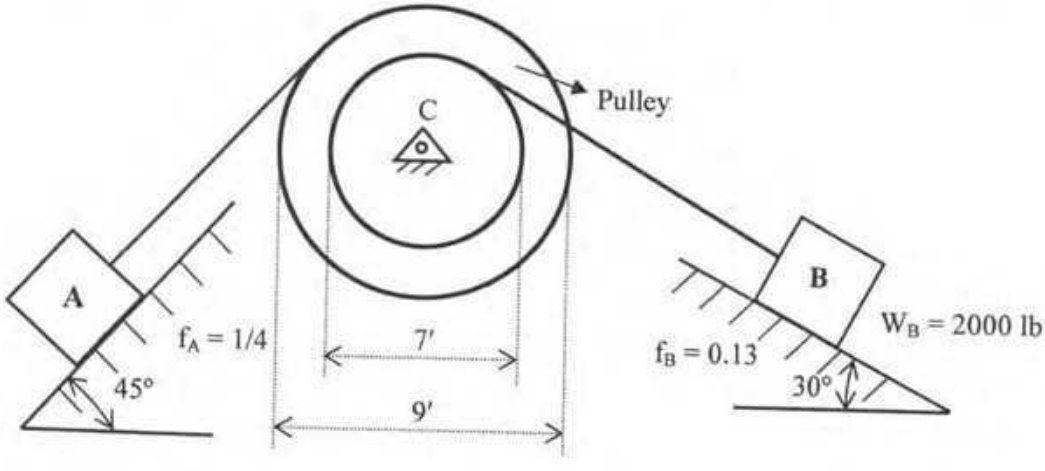
Course Title: Engineering Mechanics II Course Code: CE 103 Credit hr.: 3.00
Time: 3.0 hours Full Marks: 100

There are **FOURTEEN** questions. Answer any **TEN**. The figures in the right margin indicate the marks of the questions.

1. As shown in the figure below, a resistance of 1500 lb is exerted on the block **A**, which in turn presses against the wedge **B**. Neglect the weight of blocks **A** and **B** and assume that f = ¼ for all surfaces. What force **Q** will cause the wedge **B** to be in impending motion downward? **(10)**

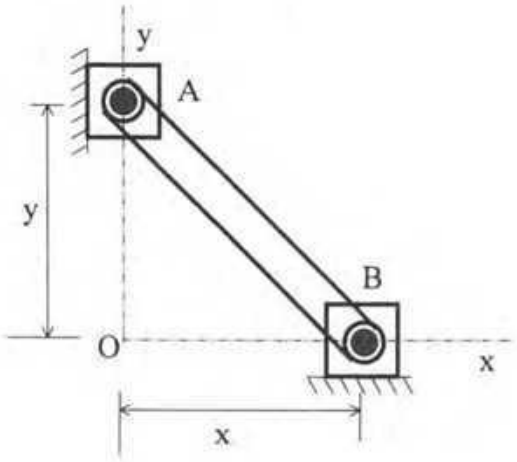


2. In the following figure, for impending clockwise motion of the pulley, what is the weight of the body **A**? The bearing at **C** is smooth. **(10)**

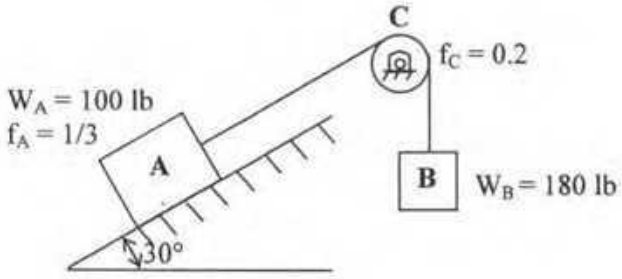


3. Derive an expression for the moment of inertia of a homogeneous right circular cylinder about its geometric axis. If the cast iron cylinder is 16″ in diameter and 32″ long, what is its moment of inertia about the same axis? Cast iron weighs 450 lb/ft^3. **(10)**

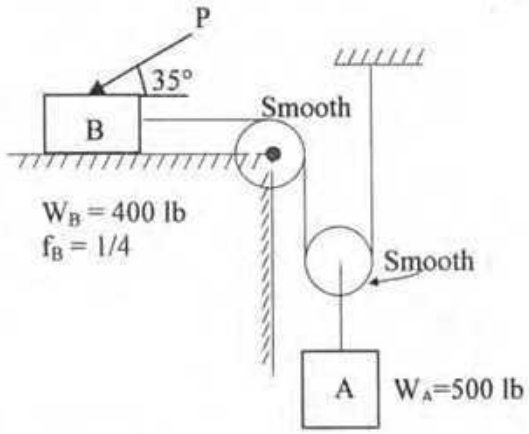
4. The sliding members A and B of the following figure are constrained to move all times in the y and x directions, respectively. They are connected by the rod **AB** whose length is 10 ft. At the instant when x = 8 ft, v_B = 25 fps toward the right and a_B = 10 fps^2 toward the left. Determine the velocity and acceleration of **A** at this instant. **(10)**



5. In the following figure, **(10)**
   (a) What are the forces in the cables attached to bodies **A** and **B**?
   (b) What is the speed of the bodies after they move 20 ft from rest?

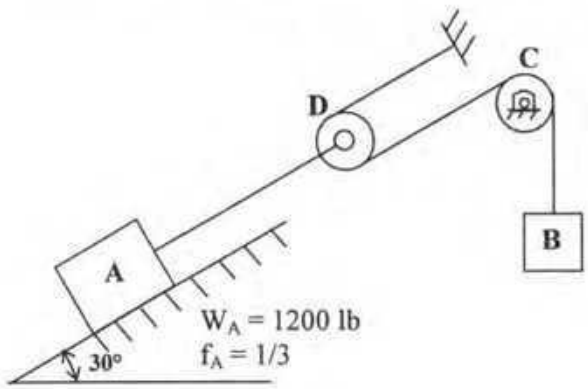


6. In the following figure, the body **B** is moving rightward at 30 fps. The weight of the cable and pulleys and the friction at the pulleys are negligible. **(10)**



(a) What constant force **P** will bring the bodies **A** and **B** to rest, when the body **B** has a displacement of 20 ft rightward?
(b) What are the tensions in the cables attached to **A** and **B**?

7. In the following figure, the pulleys **C** and **D** are frictionless and weightless. **(10)**
(a) If block **A** moves 50 ft from rest up the incline in 20 sec, what is the weight of block **B**?
(b) What are the forces in the cables attached to the blocks **A** and **B**?
(c) What is the change of potential energy for the whole system?

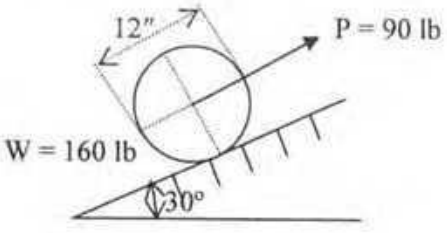


8. In the figure given below, a 160 lb cylinder is being rolled up the 30° incline by a constant force of **P** = 90 lb parallel to the plane. **(10)**

(a) What is the speed of its c.g. after a displacement of 20 ft from rest?

(b) What is its angular acceleration?

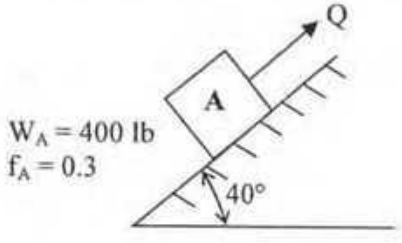
(c) What is the frictional force between the plane and the cylinder? What coefficient of friction is necessary for rolling?



9. A 400 lb body **A** moves up a 40° incline under the action of a force $Q = 3x^2 + 5x + 350$ lb, where x is the displacement in ft parallel to the plane. If the body starts from rest, **(10)**

(a) What is the net work and the speed of the body after a displacement of 25 ft?

(b) What is the change of potential energy for the body?

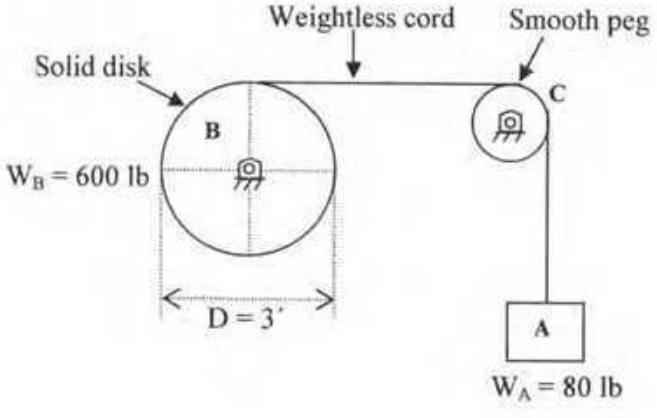


10. Refer to the following figure, neglecting frictional effects, calculate - **(10)**

(a) the time taken for **A** to attain a speed 40 fps from an initial speed of 25 fps.

(b) the tension in the cord.

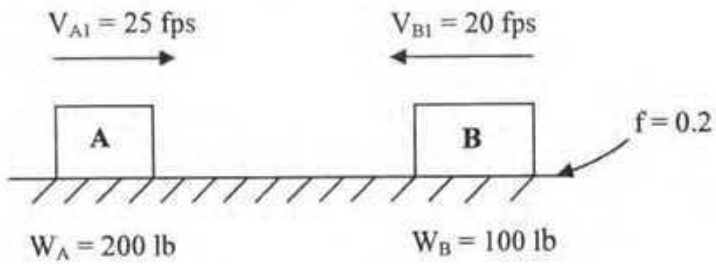
Neglect frictional effects.



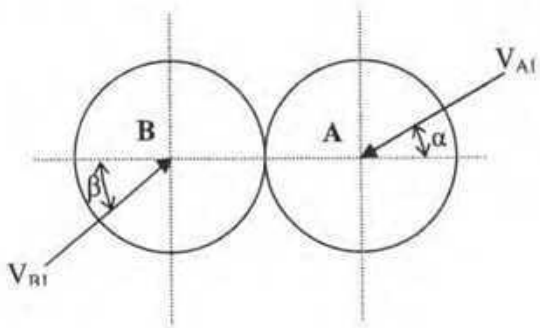
11. Two bodies **A** and **B,** having the velocities of 25 fps and 20 fps respectively are moving towards each other in the same line of motion and consequently strike. Coefficient of restitution is 0.4. These bodies are sliding on a horizontal plane, where f = 0.2. The impact is direct and central. **(10)**

(a) How far apart are the bodies when they come to rest?

(b) What is the loss of kinetic energy during impact?

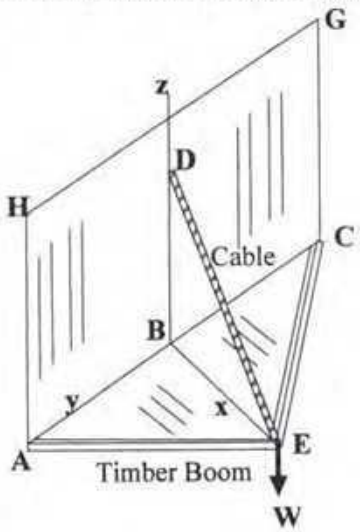


12. Two smooth spheres **A** and **B** of equal diameter and on a horizontal plane collide with oblique central impact, as shown in the following figure. Each sphere weighs 10 lb. Coefficient of restitution is 0.75. What are the absolute velocities (including directions) of each sphere after impact? **(10)**

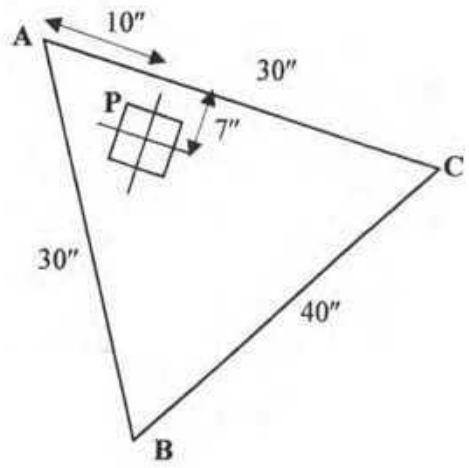


V_{A1} = 40 fps
V_{B1} = 30 fps
α = 35°
β = 40°

13. The following figure represents a boom that supports a load **W** = 800 lb. If **AB** = **BC** = 7 ft, **BD** = 6 ft, and **BE** = 5 ft., find the tension in cable **DE** and the force in members **AE** and **CE**. **(10)**



14. As shown in the following figure, the weight **P** = 90 lb is placed on a triangular table. Find the reactions at supports **A**, **B** and **C**. **(10)**



Formulae:

1. $T_1 = T_2 e^{f\theta}$

2. $a_{normal} = \frac{v^2}{r} = \omega^2 r$

3. $a_{\text{tangential}} = r\alpha$

4. $K.E = \frac{mv_0^2}{2} + \frac{I_0\omega^2}{2} + v_0\omega m\bar{y} = \frac{3}{4}m\bar{v}^2$

5. $e = \frac{V_{B2} - V_{A2}}{V_{A1} - V_{B1}}$

The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2009
Program: B.Sc Engineering (Civil)

Course # CE 105
Full Marks: 150

Course Title: Surveying
Time : 3 hrs

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 contour? What are the uses of contour map? (2+3)
   (b) The top of a tower was sighted from two stations P and R at very different levels, the stations P and R being in line with the top of the tower. The angle of elevation from P to the top of the tower was 39° 40' and that from R to the top of the tower was 29° 43'.The angle of elevation from R to a vane 2 m above the foot of the staff held at P was 14° 40'. The height of instrument at P and R were 1.97 m and 1.76 m, respectively. The horizontal distance between P and R was 127 m and the reduced level of R was 115.87 m. Find the R.L of the top of the tower and horizontal distance from P to the tower. (13)
   (c) What is local attraction? How is it detected and eliminated? (7)

2. (a) Explain the "closing error" of a compass survey? Show how can you adjust it by graphical method? (8)
   (b) A steel tape is 30 m long at a temperature of 65^0 F with a pull of 16 kg when lying horizontally on the ground. Its sectional area is 0.082 sq. cm, its weight is 2 kg and the co-efficient of expansion is 65×10^{-7} per 1^0 F. The tape is stretched over three equal spans. Calculate the actual length of the steel under the following conditions: temp 85^0 F, pull 18 kg. Take $E=2.109 \times 10^6$ kg/cm^2 (12)
   (c) What are the sources of error in surveying? (5)

3. (a) The following consecutive readings were taken with a level. The reduced level of the first point was 209.125 m. Calculate the reduced levels of the points by height of instrument method and make a check for it. (15)

Station	B.S.	I.S.	F.S.
1	0.386		
2		1.030	
3		1.925	
4		2.835	
5		3.730	
6	0.627		4.785
7		2.004	
8		3.120	
9			4.486

   (b) What are the differences between Height of Instrument Method and Rise and Fall Method? (5)
   (c) Prove, $C_c = d^2/2R$, here the symbols have their usual meanings. (5)

4. (a) What are the advantages and disadvantages of plane table surveying? (4)

(b) Define : i) Bench mark ii) latitude iii) pacing (6)

(c) An excavation is to be made for a reservoir 20 m long and 12 m wide at the bottom, having the slope of the excavation sides at 3 horizontal to 1 vertical. Calculate the volume of excavation if the depth is 5 m. The ground surface is level before excavation. (15)

SECTION B

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

5. (a) For a simple curve, define (i) Intersection angle, (ii) Deflection angle, (iii) Back tangent and (iv) External distance. Draw necessary sketches. (5)

(b) A road bend, which deflects 85°, is to be designed for a maximum speed of 90 km/hr, a maximum centrifugal ratio of 1/3 and a maximum rate to the change of acceleration of 30 cm/sec^3. The curve consists of a circular arc in combination with two cubic parabolas. Calculate- (20)

(i) Radius of the circular arc.
(ii) The requisite length of transition curve.
(iii) The total length of the composite curve.
(iv) The chainage of the beginning and end of transition curve and of the junctions of the transition curves with the circular arc if the chainage of the P.I is 46852 meters.

6. (a) What is a transition curve? Why is it provided? (5)

(b) Two tangents intersect at chainage 80+60, the deflection angle being 50° 25′. Calculate the necessary data of various chord lengths and tangential angles for setting out a curve of 30 chains 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 meters (100 links). (20)

7. (a) Define (i) Celestial poles and Celestial Equator (ii) Celestial Horizon (iii) Zenith and Nadir. Draw necessary sketches. (5)

(b) Find the zenith distance and altitude at the upper transit of the star having the declination of 65° 40′ N and the latitude of 26° 40′ N. (5)

(c) Find the shortest distance between two places A and B, given that the latitude of A and B are 20° 0′ N and 13° 23′ N and their longitudes are 50° 0′ E and 54° 21′ E, respectively. (15)

8. (a) What are forward overlap and sidelap in aerial photography? What are the reasons for overlapping? (5)

(b) A camera having focal length of 20 cm is used to take a vertical photograph of a terrain having an average elevation of 1200 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: 6000? (5)

(c) 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 100 m from water surface. Again the elevation of the ground surface is 200 m relative to a predefined datum. The territory covers an area of 12 km x 15 km. The scale of the photograph is 1 cm = 300 m. The photograph size is 15 cm x 15 cm. Determine the number of photographs to be taken to cover the area, if the desired overlap is 65% and the side lap is 30%. (15)

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

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 $A = \{b\,(h_1+h_2)/4 + h\,(w_1+w_2)/2\}$

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

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

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

15. $h = \dfrac{(b \pm s\cot\alpha_2)\sin\alpha_1 \sin\alpha_2}{\sin(\alpha_1 - \alpha_2)}$

16. $D = \dfrac{(b \pm s\cot\alpha_2)\tan\alpha_2}{\tan\alpha_1 - \tan\alpha_2}$

Note: Here the symbols have their usual meanings.

The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring- 2009
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

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.

SECTION A
Marks: 15

Answer any THREE.

1. Briefly discuss the important urban environmental issues in Bangladesh. Define renewable and non-renewable energy with examples. (5)

2. What is meant by *greenhouse gas*? Discuss these gases in terms of their potential to cause global warming. (5)

3. What is acid rain? Show in an idealized diagram selected aspects of acid rain formation and paths. (5)

4. Define Global warming. "The trapping heat in the atmosphere is somewhat analogous to a greenhouse" – explain. (5)

SECTION B
Marks: 35

Answer any THREE. All questions carry equal marks.

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. Write down the organogram of Dhaka Water Supply and Sewerage Authority (DWASA).

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

   d. Do you think the use of equipments helps in reducing construction cost? Explain why? Mention some limitations of using equipments.

2. a. One foreign company proposes the implementation of an underground transportation system under build, operate 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.

   b. Define contract. Write down the name of various types of contract.

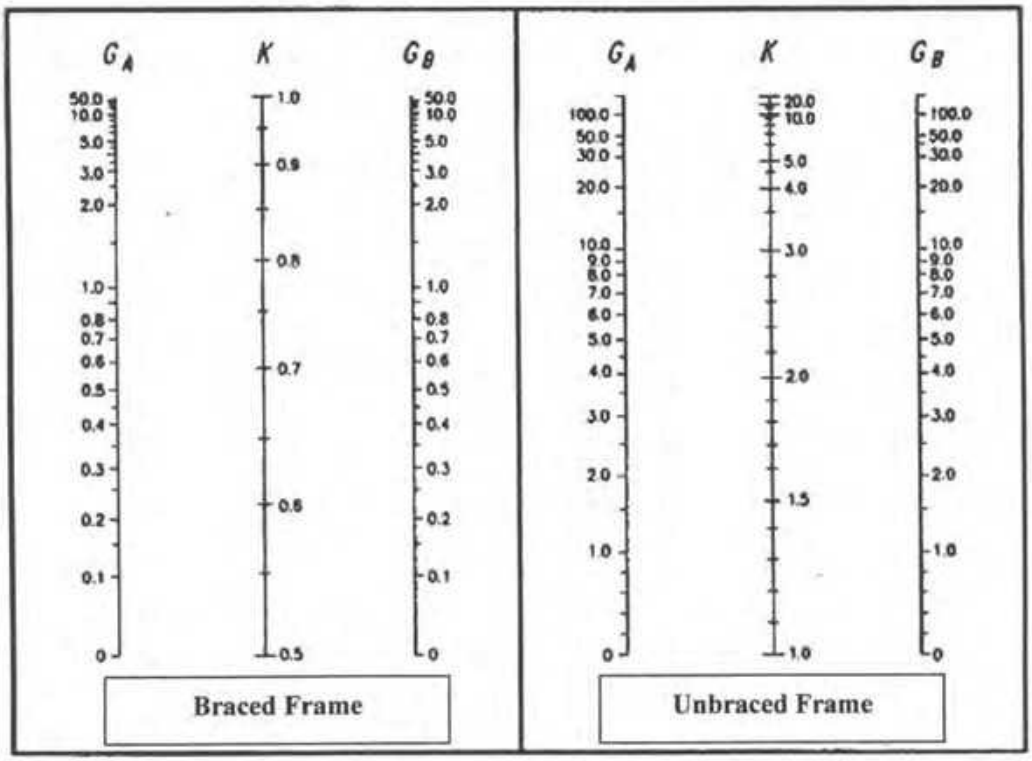
   c. Describe the road transportation network in Bangladesh.

3. The University of Asia Pacific is planning to construct a five 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	Specification
01	Land Size	60 m x 60 m
02	Road width	20 m
03	Building type	Educational (Economy)
04	Allowable Bearing Capacity (Q_a)	3.0 ksf
05	Floor Level	Five
06	Plinth Area	1500 Square meter
07	Type of structure	RCC Frame Structure Concrete with Stone Chips, fc=22-25 MPa
08	Ground Floor	70% Car Parking, 30% 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	80,000 Gallons
13	Boundary wall	RCC frame

4. From the previous data calculate the followings:
   (i) What will be the front set back?
   (ii) What will be the back and side set backs?
   (iii) What is the Floor Area Ratio (FAR) of the building? Does it comply with RAJUK rules, explain?
   (iv) Find the maximum number of floor levels that can be constructed.
   (v) What is the present ground coverage? Does it comply with RAJUK rules, explain?
   (vi) What is the required minimum parking space? Is the existing parking space sufficient?
   (vii) If the University authority wants to construct a twelve storied building, then what will be maximum allowable ground coverage? Assume ground floor is reserved for parking.

Appendix-1



Nomograph for effective length of columns in continuous frames.

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

Formulas (the symbols carry their usual meaning)

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

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

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

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.

$$F_{cr} = \left(0.658^{\lambda_c^2}\right)F_y \text{ if } \lambda_c \le 1.5$$

$$F_{cr} = \frac{0.877}{\lambda_c^2} F_y \text{ if } \lambda_c > 1.5 \qquad \text{Where, } \lambda_c = \frac{KL}{r\pi}\sqrt{\frac{F_y}{E}}$$

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

ALLOWABLE STRESS DESIGN SELECTION TABLE
For shapes used as beams

S_x

F_y = 50 ksi			S_x	Shape	Depth d	F_y	F_y = 36 ksi		
L_c	L_u	M_n					L_c	L_u	M_n
Ft	Ft	Kip-ft	In.^{3}		In.	Ksi	Ft	Ft	Kip-ft
14.2	23.8	3520	1280	W 40×324	40⅛	—	16.8	33.1	2530
14.0	38.3	3440	1250	W 30×391	33¼	—	16.5	53.2	2480
14.4	31.4	3380	1230	W 33×354	35½	—	17.0	43.7	2440
16.0	23.6	3360	1220	W 40×298	39¼	—	18.8	32.8	2420
14.9	27.5	3330	1210	W 36×328	37⅛	—	17.6	38.3	2400
14.2	21.8	3220	1170	W 40×297	39⅞	—	16.7	30.3	2320
13.3	43.3	3220	1170	W 27×407	30⅛	—	15.6	60.1	2320
12.5	52.1	3220	1170	W 24×450	29⅛	—	14.7	72.3	2320
13.9	35.1	3140	1140	W 30×357	32¼	—	16.3	48.7	2260
10.8	15.9	3080	1120	W 44×285	44	—	12.5	22.0	2220
14.9	25.4	3050	1110	W 36×300	36¼	—	17.6	35.3	2200
14.3	28.7	3050	1110	W 33×318	35⅛	—	16.9	39.9	2200
14.2	21.0	3030	1100	W 40×277	39¼	—	16.7	29.1	2180
15.9	21.2	3000	1090	W 40×268	39⅜	—	18.7	29.5	2160
13.1	39.7	2920	1060	W 27×368	30⅜	—	15.5	55.1	2100
12.4	48.3	2920	1060	W 24×408	28½	—	14.6	67.1	2100
14.9	23.8	2830	1030	W 36×280	36½	—	17.5	33.1	2040
13.8	32.4	2830	1030	W 30×326	32⅝	—	16.2	44.9	2040
14.2	26.2	2780	1010	W 33×291	34⅞	—	16.8	36.5	2000
14.1	18.9	2730	992	W 40×249	39⅜	—	16.6	26.3	1960
15.9	19.0	2700	983	W 40×244	39	—	18.7	26.5	1950
10.6	14.2	2700	983	W 44×248	43⅝	—	12.5	19.8	1950
13.0	37.0	2670	970	W 27×336	30	—	15.4	51.4	1920
12.2	44.4	2630	957	W 24×370	28	—	14.4	61.7	1890
14.8	21.9	2620	953	W 36×260	36¼	—	17.5	30.5	1890
12.0	53.8	2580	937	W 21×402	26	—	14.1	74.7	1860
13.7	29.5	2550	928	W 30×292	32	—	16.1	41.0	1840
14.2	24.0	2520	917	W 33×263	34½	—	16.7	33.3	1820
14.8	20.6	2460	895	W 36×245	36⅛	—	17.4	28.6	1770
10.9	18.8	2460	895	W 36×256	37⅜	—	12.9	26.2	1770
10.6	12.9	2440	889	W 44×224	43¼	—	12.5	17.9	1760
12.9	34.0	2430	884	W 27×307	29⅝	—	15.2	47.2	1750
12.1	40.7	2380	864	W 24×335	27½	—	14.3	56.5	1710
14.1	16.4	2360	858	W 40×215	39	—	16.6	22.8	1700
15.9	17.2	2360	858	W 40×221	38⅝	61.1	18.7	22.6	1700
11.9	49.8	2330	846	W 21×364	25½	—	14.0	69.1	1680
14.8	19.3	2300	837	W 36×230	35⅝	—	17.4	26.8	1660
14.2	21.6	2280	829	W 33×241	34⅛	—	16.7	30.1	1640
13.6	26.5	2270	827	W 30×261	31⅝	—	16.0	36.7	1640
12.9	31.4	2230	811	W 27×281	29¼	—	15.1	43.7	1610
10.9	17.1	2220	809	W 36×232	37⅛	—	12.8	23.7	1600
12.0	37.5	2170	789	W 24×306	27⅛	—	14.1	52.0	1560

ALLOWABLE STRESS DESIGN SELECTION TABLE
For shapes used as beams
S_x

F_y = 50 ksi			S_x	Shape	Depth d	F_y	F_y = 36 ksi		
L_c	L_u	M_n					L_c	L_u	M_n
Ft	Ft	Kip-ft	In.^{3}		In.	Ksi	Ft	Ft	Kip-ft
10.6	11.2	2130	776	W 44×198	42⅛	—	12.5	15.5	1540
14.1	15.2	2110	769	W 40×199	38⅛	—	16.6	20.0	1520
11.8	45.7	2110	769	W 21×333	25	—	13.9	63.4	1520
14.2	19.8	2080	757	W 33×221	33⅛	—	16.7	27.6	1500
13.5	24.0	2050	746	W 30×235	31¼	—	15.9	33.3	1480
12.8	29.0	2040	742	W 27×258	29	—	15.1	40.3	1470
10.9	15.1	1980	719	W 36×210	36¾	—	12.9	20.9	1420
11.9	34.7	1970	718	W 24×279	26¾	—	14.0	48.2	1420
12.8	16.7	1880	708	W 40×192	38¼	37.1	17.8	19.7	1400
11.6	42.7	1900	692	W 21×300	24½	—	13.7	59.4	1370
14.1	17.9	1880	684	W 33×201	33⅛	—	16.6	24.9	1350
10.6	12.3	1880	682	W 40×183	39	—	12.5	17.1	1350
12.7	26.7	1850	674	W 27×235	28⅛	—	15.0	37.0	1330
10.9	13.9	1830	664	W 36×194	36½	—	12.8	19.4	1310
13.5	21.4	1820	663	W 30×211	31	—	15.9	29.7	1310
11.8	31.4	1770	644	W 24×250	26⅜	—	13.9	43.7	1280
11.5	39.2	1740	632	W 21×275	24⅛	—	13.6	54.5	1250
12.6	24.9	1720	624	W 27×217	28⅛	—	14.9	34.5	1240
10.8	49.0	1720	624	W 18×311	22⅛	—	12.7	68.1	1240
10.8	13.1	1710	623	W 35×182	36⅛	—	12.7	18.2	1230
10.4	11.0	1650	599	W 40×167	38⅛	—	12.5	14.5	1190
13.5	19.4	1640	598	W 30×191	30⅛	—	15.9	26.9	1180
11.7	29.0	1620	588	W 24×229	26	—	13.8	40.3	1160
10.8	12.2	1600	580	W 36×170	36⅛	—	12.7	17.0	1150
11.4	35.5	1560	569	W 21×248	23¾	—	13.5	49.3	1130
10.6	45.0	1550	564	W 18×283	21⅞	—	12.6	62.6	1120
12.6	22.4	1530	556	W 27×194	28⅛	—	14.8	31.1	1100
10.3	13.8	1510	549	W 33×169	33⅛	—	12.1	19.2	1090
10.7	11.4	1490	542	W 36×160	35	—	12.7	15.7	1070
13.4	17.5	1480	539	W 30×173	30½	—	15.8	24.2	1070
11.7	26.5	1460	531	W 24×207	25¾	—	13.7	36.7	1050
10.5	42.2	1410	514	W 18×258	21½	—	12.4	58.6	1020
8.5	10.7	1410	512	W 40×149	38¼	—	11.9	12.6	1010
11.4	32.7	1400	510	W 21×223	23⅜	—	13.4	45.4	1010
10.5	11.3	1390	504	W 36×150	35⅞	—	12.6	14.6	998
12.6	20.1	1380	502	W 27×178	27¾	—	14.9	27.9	994
11.6	24.7	1350	491	W 24×192	25½	—	13.7	34.3	972
10.4	12.2	1340	487	W 33×152	33½	—	12.2	16.9	964
10.4	30.8	1280	466	W 18×234	21	—	12.3	53.8	923
11.3	29.8	1270	461	W 21×201	23	—	13.3	41.3	913
12.6	18.3	1250	455	W 27×161	27⅝	—	14.8	25.4	901
11.5	22.8	1240	450	W 24×176	25¼	—	13.6	31.7	891

The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2009
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 bridge construction project based on the following data: (40)

Volume ratio of sand to total aggregate = 0.40
Air Content = 2%
Specific gravity of cement = 3.0
Specific gravity of sand (SSD) = 2.65
Specific gravity of coarse aggregate (SSD) = 2.65
Design compressive strength (28 days) = 4000 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 table with necessary data.
(iii) Calculate the volume ratio of the mix (assume unit weights of cement, sand (SSD), and coarse aggregate (SSD) with void are 1350 kg/m^3, 1300 kg/m^3 and 1500 kg/m^3, respectively).
(iv) Calculate the cost of concrete per 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. 80.
(v) Estimate the materials in weight and volume (cement, water, sand, and coarse aggregate) required to cast three girders of 18 inch width 48 inch depth and 30 feet span.
(vi) Assume 3% of surplus water in sand over SSD condition and the amount of bulking of sand = 7%. What adjustments are necessary in mix design?

2 For a building construction project, the recommended FM was 2.6 for sand and 6.6 for stone chips. From a nearby market, sand and stone chips sample were collected and sent to the Concrete Laboratory of The University of Asia Pacific 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
1.0 inch	0	0
¾ inch	0	2000
½ inch	0	500
3/8 inch	0	1000
#4	0	1450
#8	70	0
#12	70	0
#16	70	0
#30	70	0
#40	70	0
#50	5	0
#100	5	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.

3 (a) Draw typical stress-strain curves of concrete with the variation of compressive strength (f'_c = 3000 psi, 4000 psi and 6000 psi). Comment on the curves. (2.5)

(b) Draw typical stress-strain curves of steel with the variation of tensile strength (f_y = 40,000 psi, 60,000 psi and 80,000 psi). Comment on the curves. (2.5)

(c) Define the following mechanical properties of a material: (5)
(i) Ductility
(ii) Fatigue strength
(iii) Malleability
(iv) Resilience
(v) Toughness

(d) Write the main steps of the brick manufacturing process. (3)

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

(f) Why is drying of bricks necessary before burning? (3)

(g) Explain the causes of efflorescence on bricks. (3)

4 (a) What is hydration of cement? Write the hydration reactions of silicates and aluminates. Explain the morphology and the significance of each cement hydration product. (7)

(b) Compare fly ash cement and ordinary Portland cement with respect to the followings: (7)

(i) Strength development of concrete at the early age
(ii) Strength development of concrete after long-term
(iii) Environmental benefits
(iv) Heat of hydration of cement
(v) Length of curing time of concrete
(vi) Microstructure of concrete
(vii) Durability of concrete

(c) Write the ASTM specifications for normal consistency, initial setting time, and final setting time of OPC. (3)

(d) Write the main steps of cement manufacturing process. (3)

(e) Discuss the role of gypsum in cement. (2)

5 (a) Explain the sulfate attack of concrete with chemical reactions. What kind of cement is to be used to reduce the sulfate attack of concrete? (8)

(b) During construction site visit of a residential project, the following points were noted: (10)

(i) Footing 1 – water is accumulated in the trench cut for the construction of Footing 1. Concrete is placed without removing the water.
(ii) Beam 1 - clear cover is 0.2 inch in one side and 3.8 inch at the other side
(iii) Beam 2 – construction joint is placed at the face of the beam
(iv) Column 1 – laitance is not removed
(v) Column 2 – over vibration is applied
(vi) Column 3 – zero-slump concrete is used.
(vii) Slab 1 – leakage of water with sand and cement was found in many locations of the formwork
(viii) Slab 2 - concrete is placed in the early morning of a hot day and the slab is kept without any cover for the whole day
(ix) Sand – a lot of dust was present in the sand
(x) Coarse aggregate – a significant amount of particles less than 4.75 mm is found

Comment on each of the above points considering durability, strength, and ACI guideline.

(c) Define workability of concrete. How is it measured? (2)

(d) "Permeability is a key parameter related to durability of concrete" – explain briefly. (2)

6 (a) Discuss the changes of workability of concrete for the following situations: (5)

(i) W/C is reduced at site
(ii) A coarser sand is used
(iii) Water reducing admixture is not used which was specified in the mix proportion
(iv) Shingles are used instead of stone chips
(v) Sand-to-aggregate volume ratio is increased.

(b) "Cube strength of concrete is higher than the cylinder strength of concrete" – why? (3)

(c) Write short notes on the followings: (7)

(i) Self compacting concrete
(ii) High performance concrete
(iii) Drying shrinkage
(iv) Ferrocement
(v) Construction joint
(vi) Superplasticizer
(vii) Functions of accelerator and retarder

(d) Explain how concrete industry pollutes the environment and also explain the ways to reduce the pollution from the concrete industries. (5)

(e) What is maturity of concrete? Write some factors related to maturity of concrete. (2)

7 (a) What points are to be taken into account to improve the durability of concrete structures during construction works near the sea? Discuss briefly. (5)

(b) Discuss the common causes of deterioration of concrete structures in Bangladesh. (4)

(c) Explain the corrosion of steel in concrete with chemical reactions. (3)

(d) How are steel bars protected from corrosion in concrete? Explain briefly the chloride-induced and carbonation-induced corrosion of steel in concrete. (5)

(e) Write a short note on bulking of sand. (3)

(f) Discuss the effect of excess lime in brick earth. (2)

8 (a) Write short notes on three industrial forms of timber. (3)

(b) Write the names of five market forms of timber. (2)

(c) Explain the following defects of timber: (3)

(i) Twisted fiber
(ii) Heart shake and star shake
(iii) Knot

(d) Write short notes on the followings: (14)

(i) Uses of rubber in Civil Engineering works
(ii) Manufacturing of natural rubber
(iii) Ingredients of a varnish
(iv) Hexagonal closed packed unit cell
(v) Atomic radius for the face centered cubic unit cell
(vi) Atomic packing factor for the body centered cubic unit cell
(vii) Electroplating

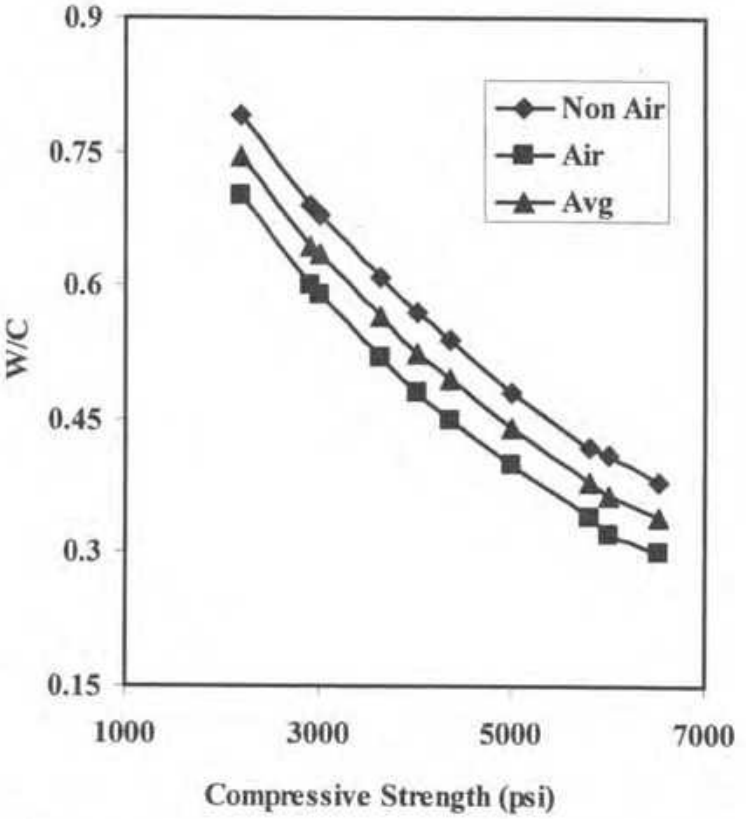


Fig. W/C versus Compressive Strength (aggregate type = stone chips)

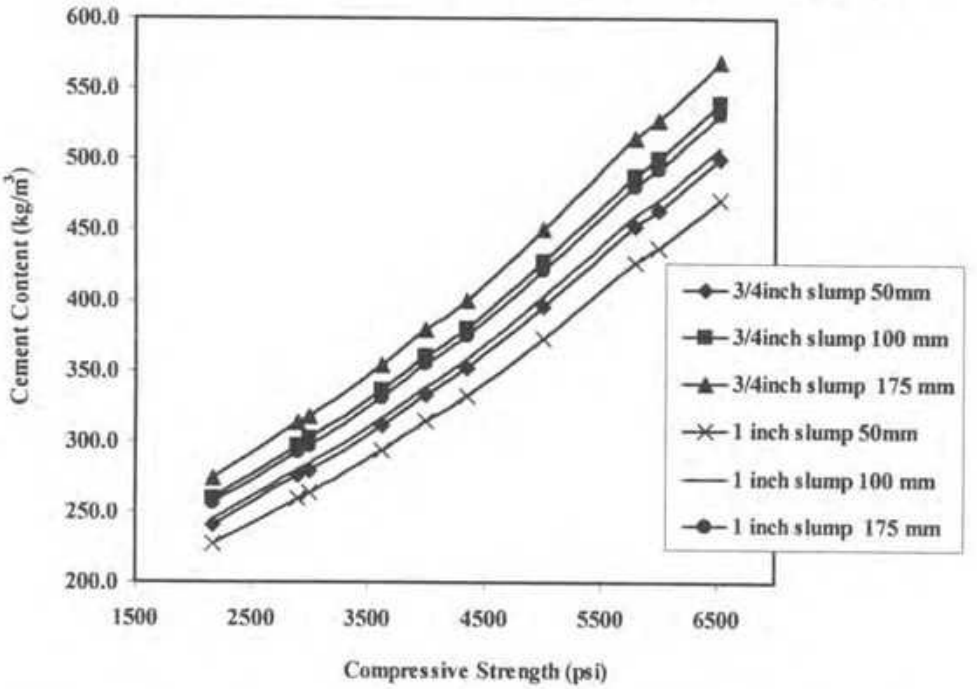
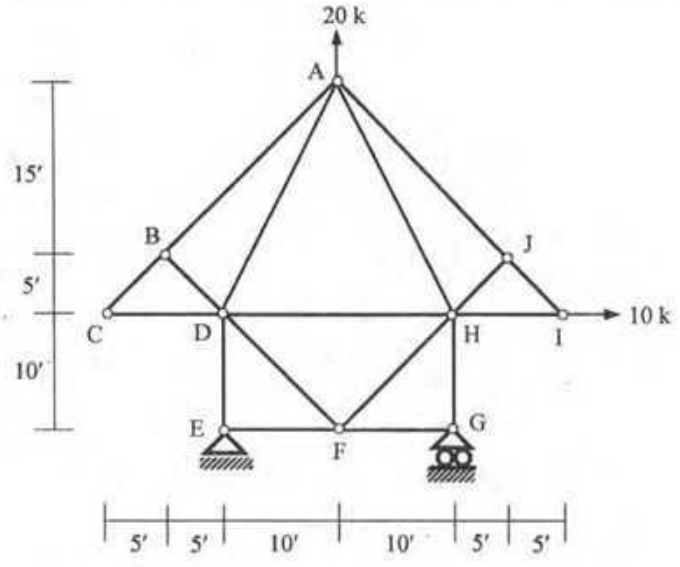
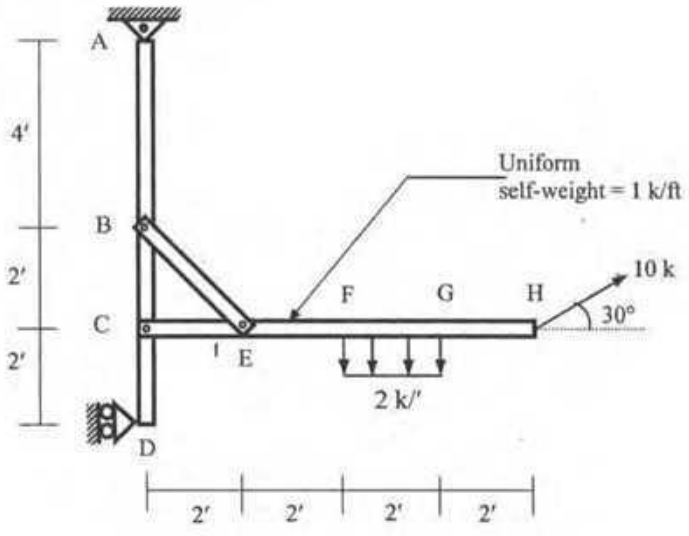


Fig. Cement Content versus Compressive Strength (aggregate type = stone chips)

4. For the truss shown below, calculate the reactions at the supports. Identify the Zero-Force- Members without any calculation. Calculate the forces in members DF and HF using method of joint.

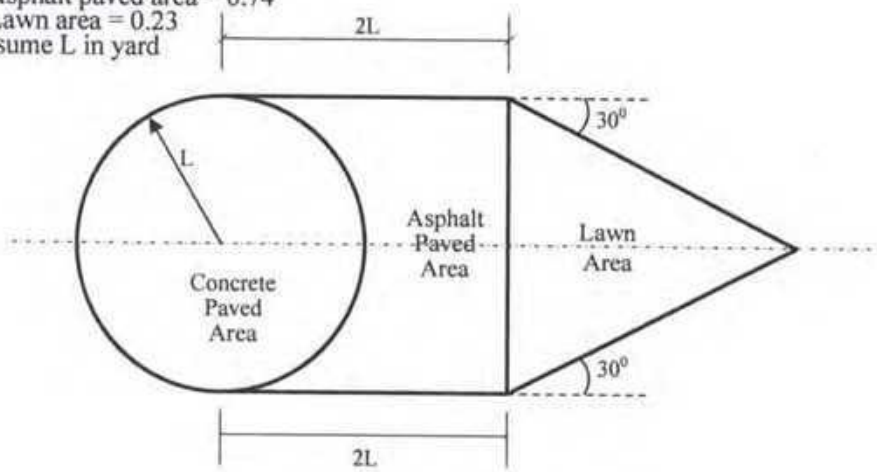


5. In the figure shown below, calculate the reactions at supports A and D and pin reactions at C.



(c) Calculate the Peak runoff (Q) for the following facility under the following conditions: 7

- Rainfall Intensity for the whole area = 2.05n/hr
- Co-efficient of runoff for-----
  Concrete paved area = 0.82
  Asphalt paved area = 0.74
  Lawn area = 0.23
- Assume L in yard



2. (a) What are the major causes of river erosion? 1.5

(b) Prove that $d \propto v^2$; where symbols carry their usual meanings. 7.5

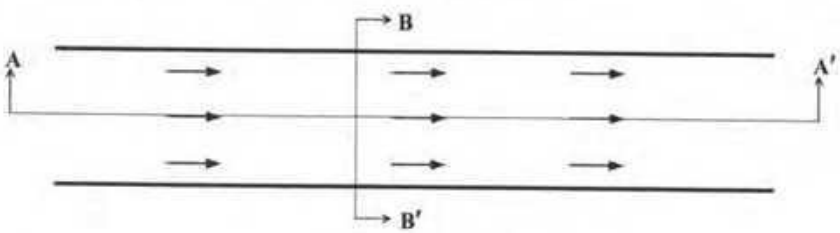
(c) For a stream having triangular X-section and D <<<<< B, prove that --- $\tau \propto D$ 4

where------

τ = tractive pressure along the stream B = width of stream

D = depth of stream

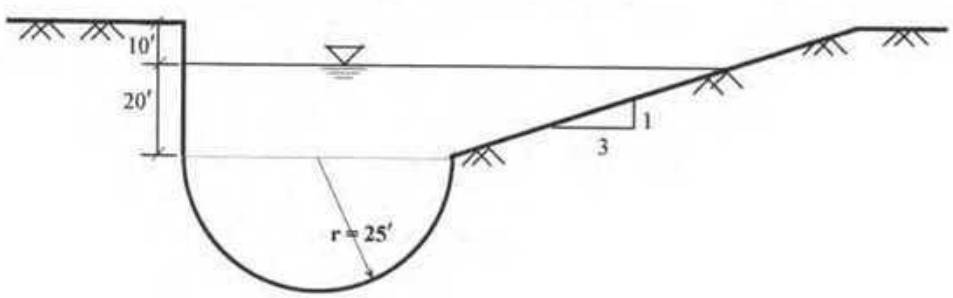
(d) The Plan, longitudinal and cross-sectional profiles of a channel are shown below. Calculate the tractive pressure along the channel. 7



Plan of Channel Course

Section A-A'

(Longitudinal Profile of Channel Course)



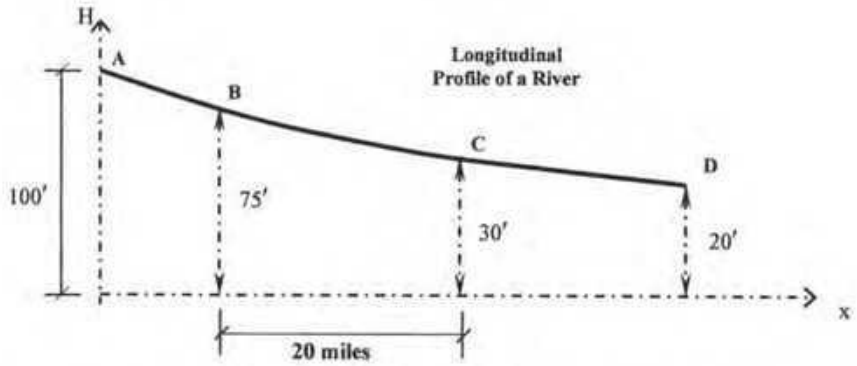
Section B-B'

(X-Sectional Profile of Channel Course)

3. (a) Define river transportation, load, capacity and competence. Categorize (mention names only) load of a river. 4

(b) Mention the major factors affecting the longitudinal profile of a river. 2

(c) From the figure shown below, calculate the horizontal distance between locations A and D along the longitudinal profile of a river. 7



(d) The number and stream ranks of a catchment area of 1,025 square miles are calculated and the results of the survey are summarized in the table below. 7

Stream Rank	No. of Streams	Average Length (mile)
1	21	1.3
2	8	2.2
3	3	6.9
4	1	18.2

Calculate the following parameters from the above survey data:
(i) Average Bifurcation Ratio (ABR)
(ii) Average Length Ratio (ALR)
(iii) Drainage Density (DD)
(iv) Stream Frequency

4. (a) Classify and discuss, in brief, different types of drainage patterns. 10

(b) What is a river valley? Sketch a typical cross-section of a river/stream valley. Classify (mention names only) valley according to the stage, genesis and controlling structures. 4

(c) Discuss, in brief, how the valleys are deepened. 6

The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2009
Program: B. Sc. Engineering (Civil)

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

Section A

There are **four (4)** questions in this section, answer **any three (3)**

1. (a) Describe, in short, different geomorphic processes that change the landform of the earth. **14**

(b) Draw a schematic diagram of rock cycle (with one example of each type of rock) in geologic point of view. **6**

2. (a) Classify and describe major minerals. Distinguish between Ferromagnesian and Non-Ferromagnesian Silicates. **10**

(b) Write short notes on folds, faults, joints and rock cleavage. **4**

(c) Classify (mention names only) and draw sketches of different types of faults. **6**

3. (a) Classify and discuss briefly (with neat sketches) various types of folds based on geometry. **8**

(b) Discuss liquefaction phenomenon (with basic mechanism) due to earthquake. **6**

(c) Classify and discuss, in short (no sketch is required), various earthquake waves. **6**

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

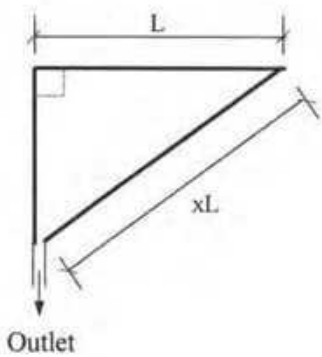
(i) Principal zones of earth
(ii) Typical geometry of a fold (with neat sketch)
(iii) Neat sketches of Horst and Graben
(iv) Major earthquake parameters (geometric)
(v) Modified Mercalli Intensity Scale of earthquakes (VIII to XII)

Section B

There are **four (4)** questions in this section, answer **any three (3)**

1. (a) Discuss, in brief, the factors affecting runoff. **6**

(b) For the following basin, x is a constant factor. For what value of x, the flow rate (Q) will be the maximum for the basin? Find the FF and CC of the basin for maximum runoff. **7**



The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2009
Program: B.Sc. Engineering (Civil)

Course Title: Mechanics of Solids I
Time: 3.0 hours

Course Code: CE 211
Full Marks: 100=(10X10)

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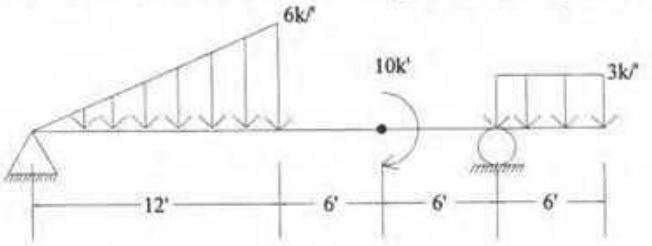
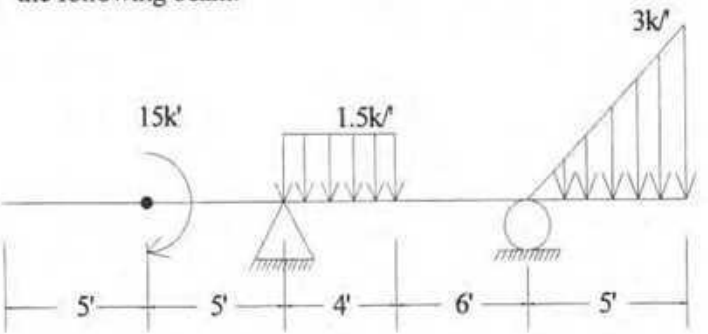
*There are **Fourteen** questions. Answer any **Ten***

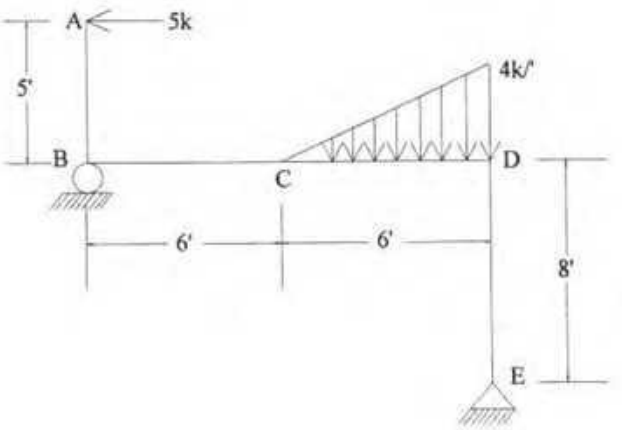
1. Draw the Shear Force and Bending Moment Diagram of the following beam.



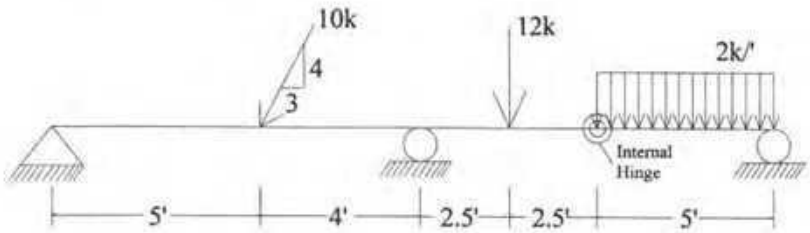
2. Derive the equation of Shear Force and Bending Moment using singularity function for the following beam.



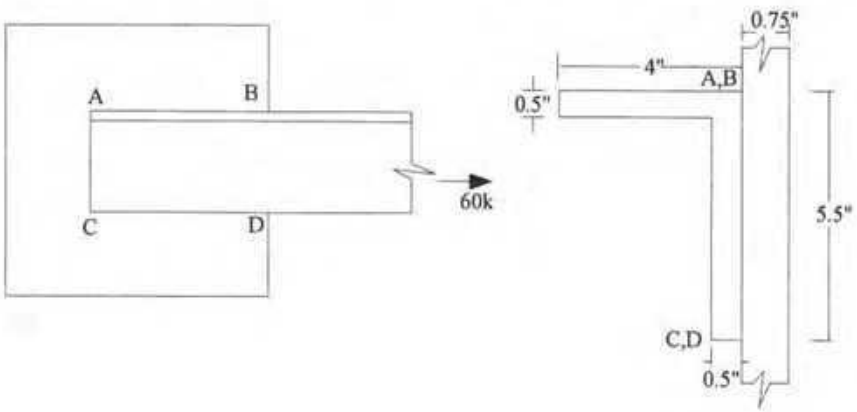
3. Draw the Shear Force and Bending Moment Diagram for the portion BCD of the frame ABCDE.



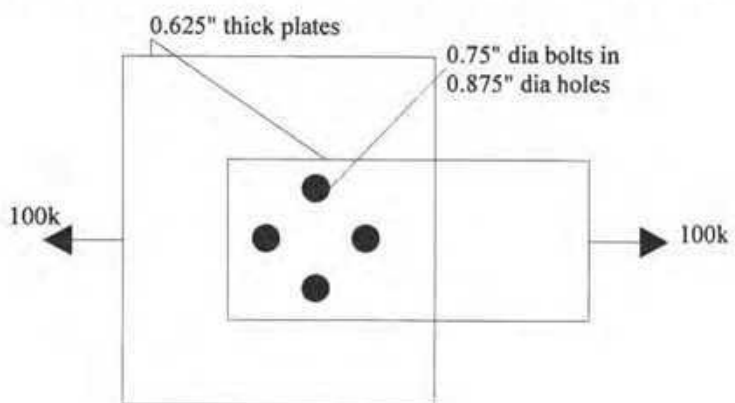
4. Draw the Shear Force, Axial Force and Bending Moment Diagrams for the following beam.



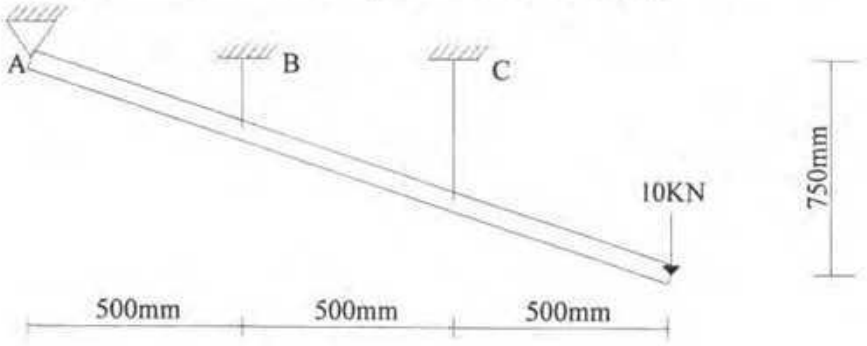
5. Calculate the lengths of 3/8" weld joints required on sides AB and CD of the angle section shown in the figure. Allowable shear stress for weld = 20 ksi.



6. Check the adequacy of the bolted joint with respect to shearing, tearing and bearing. Allowable shearing, tearing and bearing stresses are 20, 25 and 30 ksi respectively.

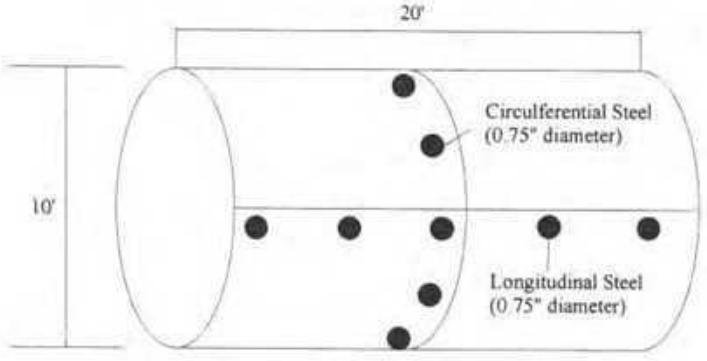


7. A rigid bar is supported by a pin at A and two linearly elastic wires at B and C. The area of the wires at B and C are 60 mm^2 and 80 mm^2 respectively. Determine the reactions at A, B and C caused by the applied force of 10 kN. Also find the elongations of the wires. Given, Modulus of Elasticity of the wires = 200 GPa.

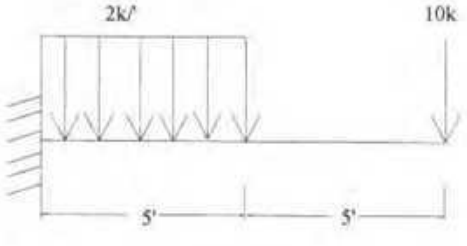


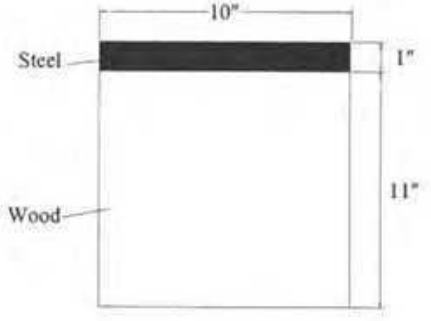
8. The figure below shows a gas cylinder of 10' diameter and 20' length. Wall thickness is 0.25". Calculate the:
   i) Maximum internal pressure that the cylinder can be subjected to.
   ii) Corresponding tangential and longitudinal stresses in the wall of the cylinder.
   iii) Required spacing of 0.75" diameter bolts to resist the wall stresses.

   [Given: Allowable tensile stress in the wall = 20 ksi, Allowable shear stress in bolts =16ksi Modulus of Elasticity of steel = $30x10^3$ ksi, Poisson's ratio = 0.25].

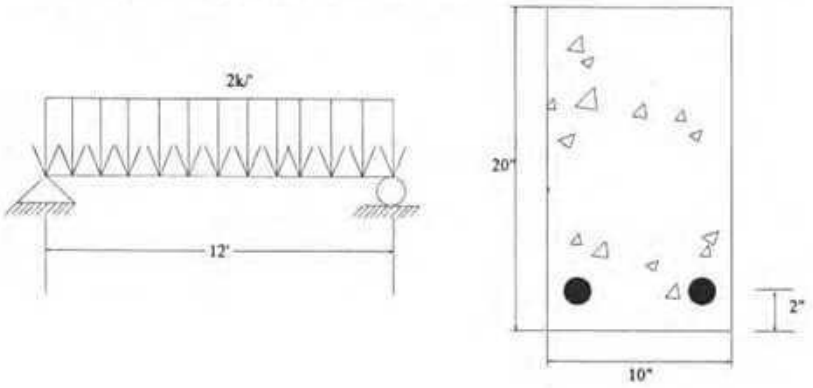


9. For the composite beam loaded as shown in the figure, draw the flexural stress diagram at the section where bending moment is maximum. Given, E_{wood} = 1500ksi, E_{steel} = 30,000 ksi

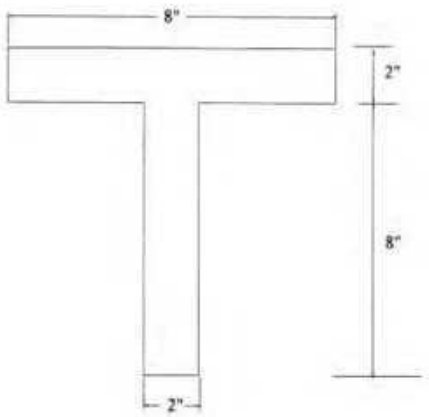




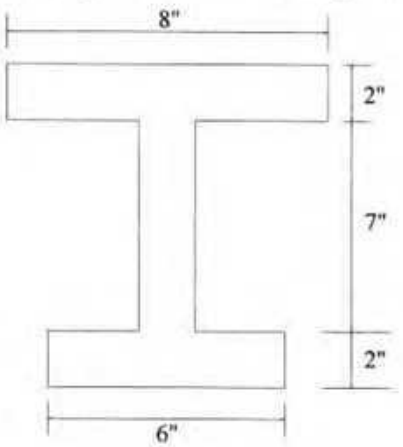
10. For the R.C. beam loaded as shown in the figure determine the maximum compressive stress in concrete and tensile stress in steel. Assume concrete to be cracked due to tension Given, n = 10 and area of steel = 2 in^2.



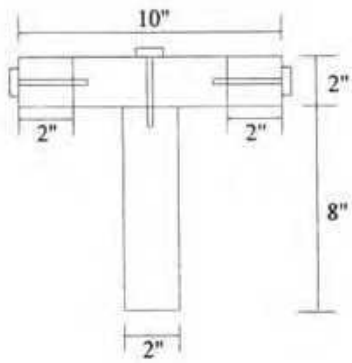
11. Determine the plastic section modulus and shape factor for the following section



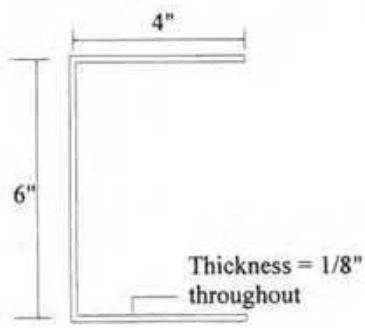
12. Draw the shear stress diagram for the following section if shear force is 100 kip.



13. Find the spacing of all the nails for the following beam section, if transmitted shear is 10 kips and allowable shear per nail = 1800 lb.



14. Locate the shear centre of the following area.



The University of Asia Pacific
Department of Civil Engineering
Mid Term Examination Spring 2009
Program: B.Sc. Engineering (Civil)

Course Title: Mechanics of Solids I | Course Code: CE 211 | Credit: 3.00
Time: 1.0 hour | Full Marks: 60

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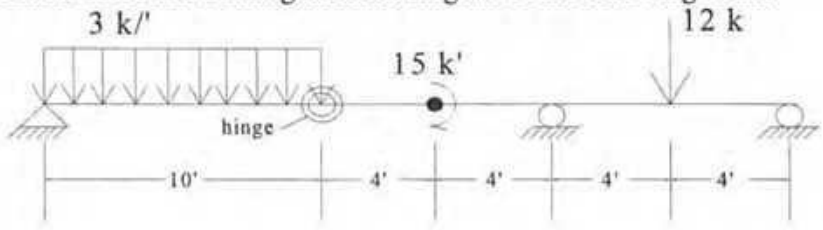
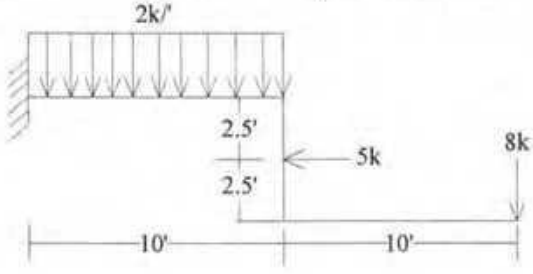
*There are **Four** questions Answer any **Three***

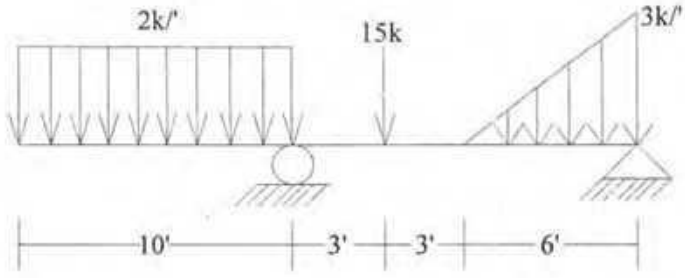
Q.1) Draw the shear force and bending moment diagram of the following beam. 20



Q.2) Draw the shear force and bending moment diagram for the following frame. 20



Q.3) Using singularity function, derive the equations for shear force and bending moment for the following beam. 20



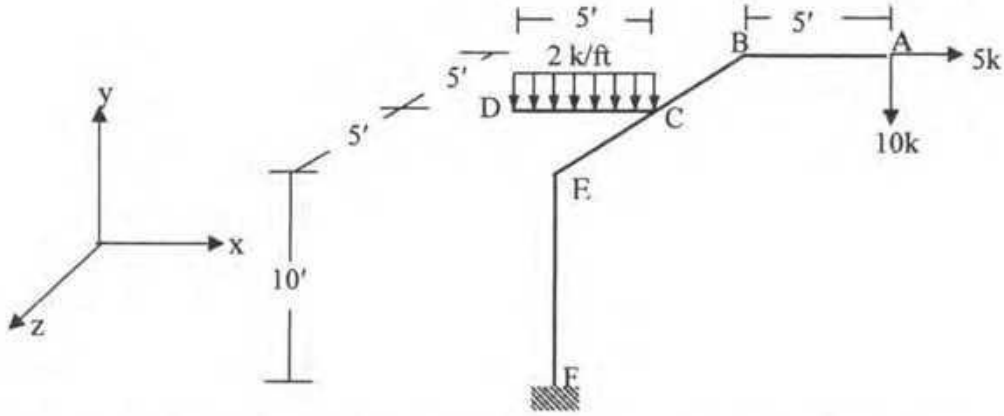
Q.4) Draw shear force and bending moment diagram for the beam in **Q.3.** 20

The University of Asia Pacific
Department of Architecture
Final Examination Spring 2009
Program: B. Sc Engineering (Civil)

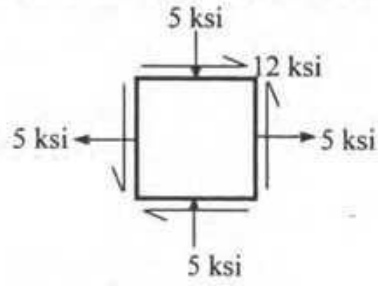
Course Title: Mechanics of Solids II Course Code: CE 213 Credit: 3.00
Time: 3.00 Hours Full Marks:100

[QUESTION 1 IS COMPULSORY. Answer **Question 1** and **any SEVEN** of the other **TEN** questions]

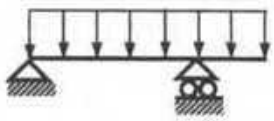
1(a). For the structure shown below, draw the torsional moment diagram and bending moment diagram of member BCE. **[06]**

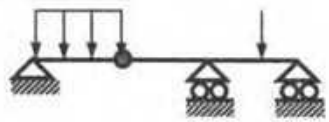


(b). Draw the Mohr's circle of stress for the state of stresses shown in the figure below. **[06]**



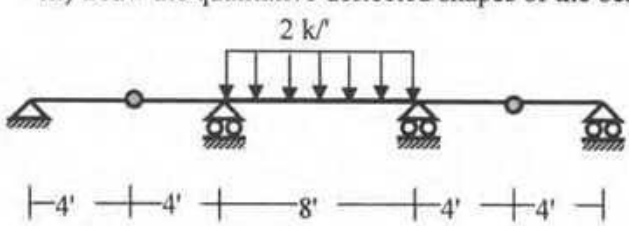
(c). Draw Qualitative BMDs for the following beams. **[03]**

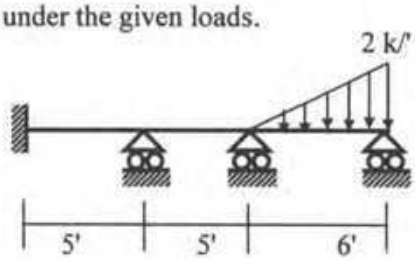
i. 

ii. 

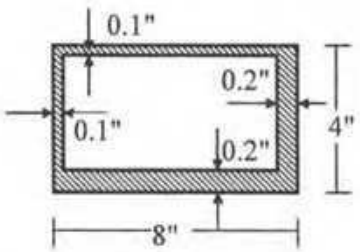
(d). For the beams shown below **[09]**

(i) Write down the expressions for loading function w(x) using singularity functions.
(ii) Write down the corresponding boundary conditions.
iii) Draw the qualitative deflected shapes of the beams under the given loads.



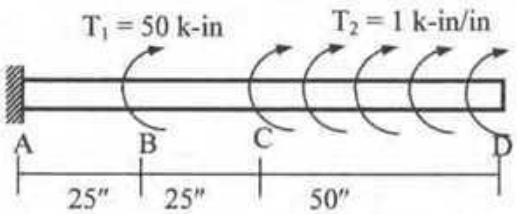


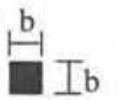
(e). For member having the cross section shown in the figure, find the maximum torsional shear stress and angle of twist per unit length when subjected to a torque of 10 k-ft [Given G=12000 ksi]. **[06]**



2. (i) Calculate the required dimension 'b' of the rectangular rod ABCD shown in the figure below if the allowable maximum shear stress in the rod is 15 ksi. **[10]**

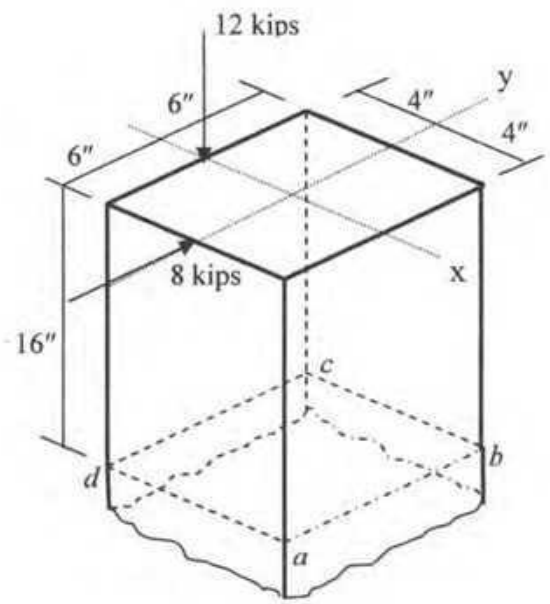
(ii) For the value of 'b' calculated in (i), calculate the maximum angle of twist in the rod [Given: G = 12000 ksi].





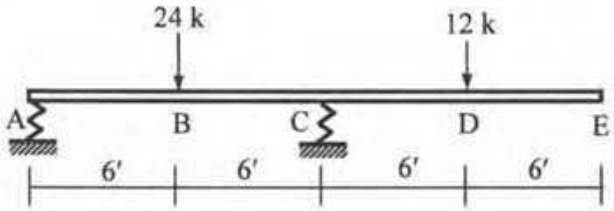
Cross-section

3. A cast iron block is loaded as shown in the following figure. Neglecting the weight of the block, determine the normal stresses acting at section *abcd* and locate the line of zero stress. **[10]**

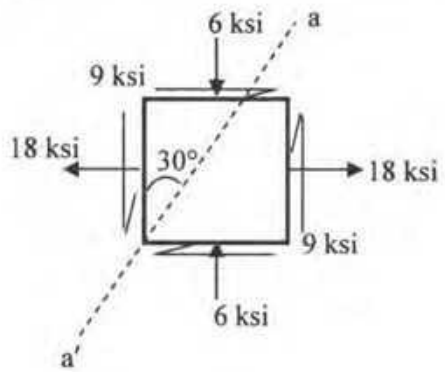


4. The figure below shows a rigid weightless beam ABCDE loaded as shown, being supported by helical springs A and C. If both the springs deflect equally due to the applied loads, calculate the **[10]**

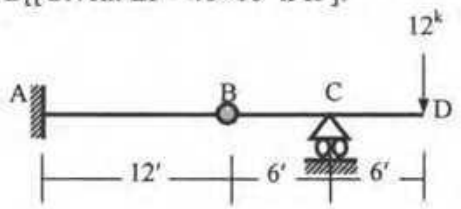
(i) deflections and (ii) maximum shear stresses at spring A and C
[Given: Both springs have coil diameter = 1″, number of coils = 6 and shear modulus = 12000 ksi, average spring diameter of spring C = 4″].



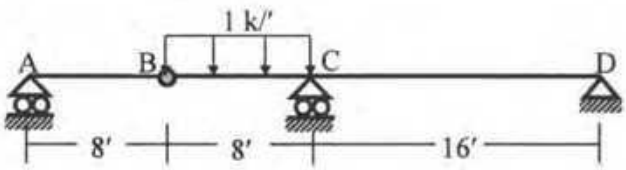
5. Use the Mohr's circle to calculate the normal stress and shear stress on the plane a-a′ shown in the element below. Show the plane of maximum and minimum normal stress on Mohr's circle. **[10]**



6. For the beam shown below, use the Singularity Functions to calculate the deflection at B and rotation at left and right of B[[Given: EI = 40×10^3 k-ft^2]. **[10]**

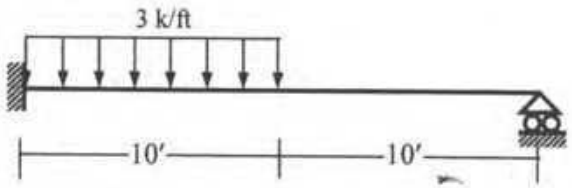


7. For the beam shown below, use the Moment-Area Theorems to calculate the deflection at B [Given: EI = 40×10^3 k-ft^2]. **[10]**

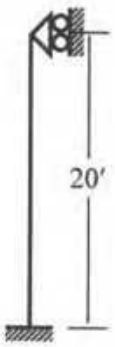


8. Answer Question 7 using the Conjugate Beam Method. **[10]**

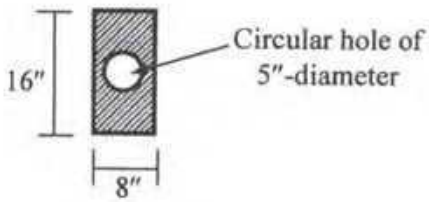
9. Draw the shear force and bending moment diagram of the statically indeterminate beam shown below [Given: EI = constant]. **[10]**



10. A 20-ft long Fixed-Hinged column has a symmetric cross-sectional area as shown below and is made of a nonlinear material with stress-strain relationship given by $\sigma = \sigma_0 \sin(\pi\varepsilon/\varepsilon_0)$, where σ is the stress (ksi) and ε is the strain. If $\sigma_0 = 3$ ksi and $\varepsilon_0 = 0.004$, calculate the critical load for the column. **[10]**

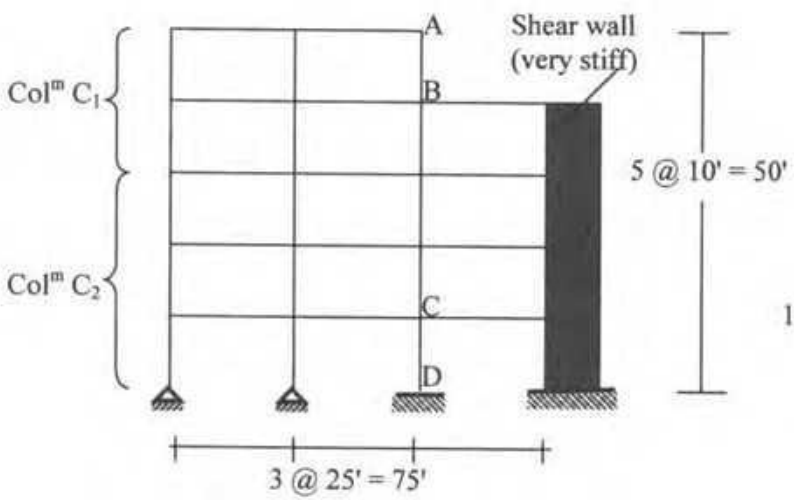


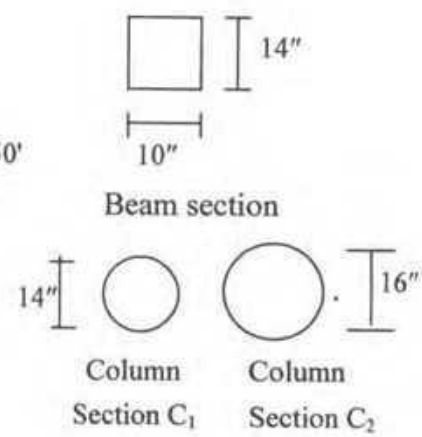
Fixed-Hinged Column



Cross-section

11. Calculate the allowable loads for columns AB and CD using AISC-ASD criteria in the frame shown below [Given: E=2000 ksi]. **[10]**





List of Useful Formulae for CE 213

* Torsional Rotation $\phi_B - \phi_A = \int (T/J_{eq}G)\, dx$, and $= (TL/J_{eq}G)$, if T, J_{eq} and G are constants

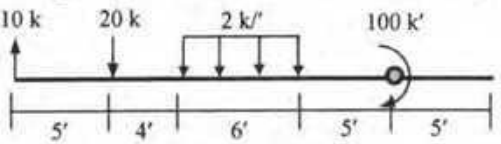
Section	Torsional Shear Stress	J_{eq}
Circular	$\tau = Tc/J$	$\pi d^4/32$
Thin-walled	$\tau = T/(2A\,t)$	$4A^2/(\int ds/t)$
Rectangular	$\tau = T/(\alpha bt^2)$	βbt^3

b/t	1.0	1.5	2.0	3.0	6.0	10.0	∞
α	0.208	0.231	0.246	0.267	0.299	0.312	0.333
β	0.141	0.196	0.229	0.263	0.299	0.312	0.333

* Biaxial Bending Stress: $\sigma_x(z, y) = M_z\, y/I_z + M_y\, z/I_y$
* Combined Axial Stress and Biaxial Bending Stress: $\sigma_z(x,y) = -P/A - M_x\, y/I_x - M_y\, x/I_y$
* Corner points of the kern of a Rectangular Area are (b/6, 0), (0, h/6), (–b/6, 0), (0, –h/6)
* Maximum shear stress on a Helical spring: $\tau_{max} = \tau_{direct} + \tau_{torsion} = P/A + Tr/J = P/A\,(1 + 2R/r)$
* Stiffness of a Helical spring is $k = Gd^4/(64R^3N)$

* $\sigma_{xx}' = (\sigma_{xx} + \sigma_{yy})/2 + \{(\sigma_{xx} - \sigma_{yy})/2\} \cos 2\theta + (\tau_{xy}) \sin 2\theta = (\sigma_{xx} + \sigma_{yy})/2 + \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]} \cos(2\theta - \alpha)$
  $\tau_{xy}' = -\{(\sigma_{xx} - \sigma_{yy})/2\} \sin 2\theta + (\tau_{xy}) \cos 2\theta = \tau_{xy}' = -\sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]} \sin(2\theta - \alpha)$
  where $\tan\alpha = 2\,\tau_{xy}/(\sigma_{xx} - \sigma_{yy})$
* $\sigma_{xx(max)} = (\sigma_{xx} + \sigma_{yy})/2 + \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2,\ \alpha/2 + 180°$
  $\sigma_{xx(min)} = (\sigma_{xx} + \sigma_{yy})/2 - \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2 \pm 90°$
* $\tau_{xy(max)} = \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2 - 45°,\ \alpha/2 + 135°$
  $\tau_{xy(min)} = -\sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2 + 45°,\ \alpha/2 - 135°$
* Mohr's Circle: Center (a, 0) = $[(\sigma_{xx} + \sigma_{yy})/2, 0]$ and radius $R = \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$
* Maximum Normal Stress Theory (Rankine): $|\sigma_1| \geq Y$, or $|\sigma_2| \geq Y$.
* Maximum Normal Strain Theory (St. Venant): $|\sigma_1 - \nu\sigma_2| \geq Y$, or $|\sigma_2 - \nu\sigma_1| \geq Y$.
* Maximum Shear Stress Theory (Tresca): $|\sigma_1 - \sigma_2| \geq Y$, $|\sigma_1| \geq Y$, or $|\sigma_2| \geq Y$
* Maximum Distortion-Energy Theory (Von Mises): $\sigma_1^2 + \sigma_2^2 - \sigma_1\sigma_2 = Y^2$

* $M(x) = EI\,\kappa \equiv EI\, d^2v/dx^2$
* $w(x) \equiv EI\, d^4v/dx^4$, $V(x) = \int w(x)\, dx \equiv EI\, d^3v/dx^3$, $M(x) = \int V(x)\, dx \equiv EI\, d^2v/dx^2$
  $S(x) = \int M(x)\, dx \equiv EI\, dv/dx \equiv EI\,\theta(x)$, $D(x) = \int S(x)\, dx \equiv EI\, v(x)$
* Singularity Functions for Common Loadings

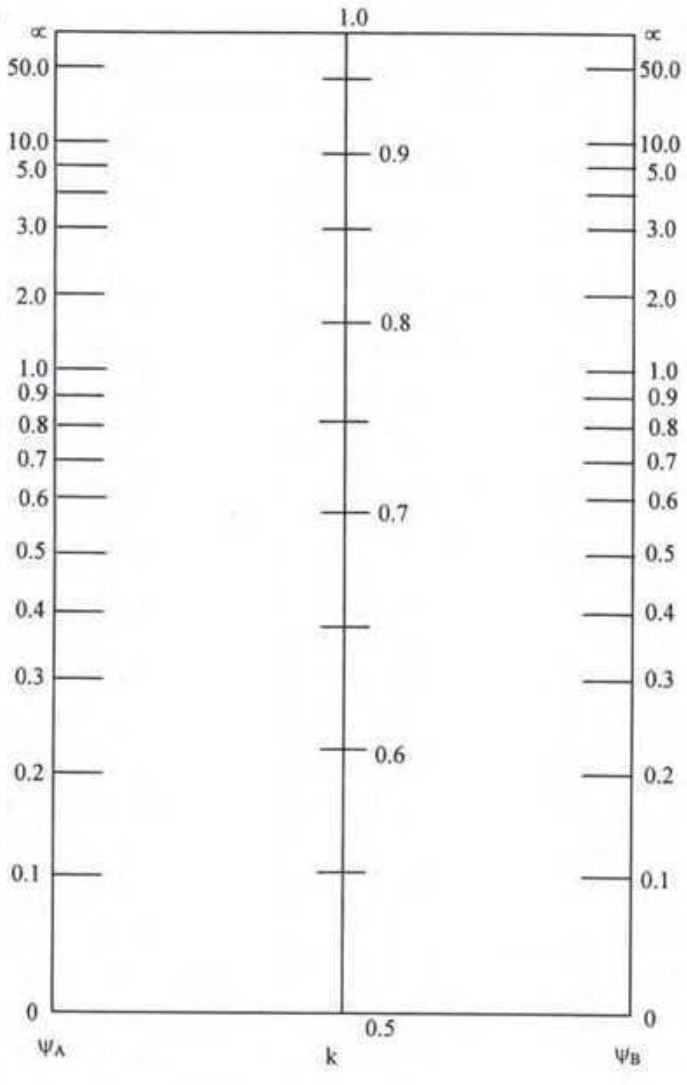


$$w(x) = 10\langle x-0\rangle^{-1} - 20\langle x-5\rangle^{-1} - 2\langle x-9\rangle^{0} + 2\langle x-15\rangle^{0} + 100\langle x-20\rangle^{-2} + C_6\langle x-20\rangle^{-3}$$

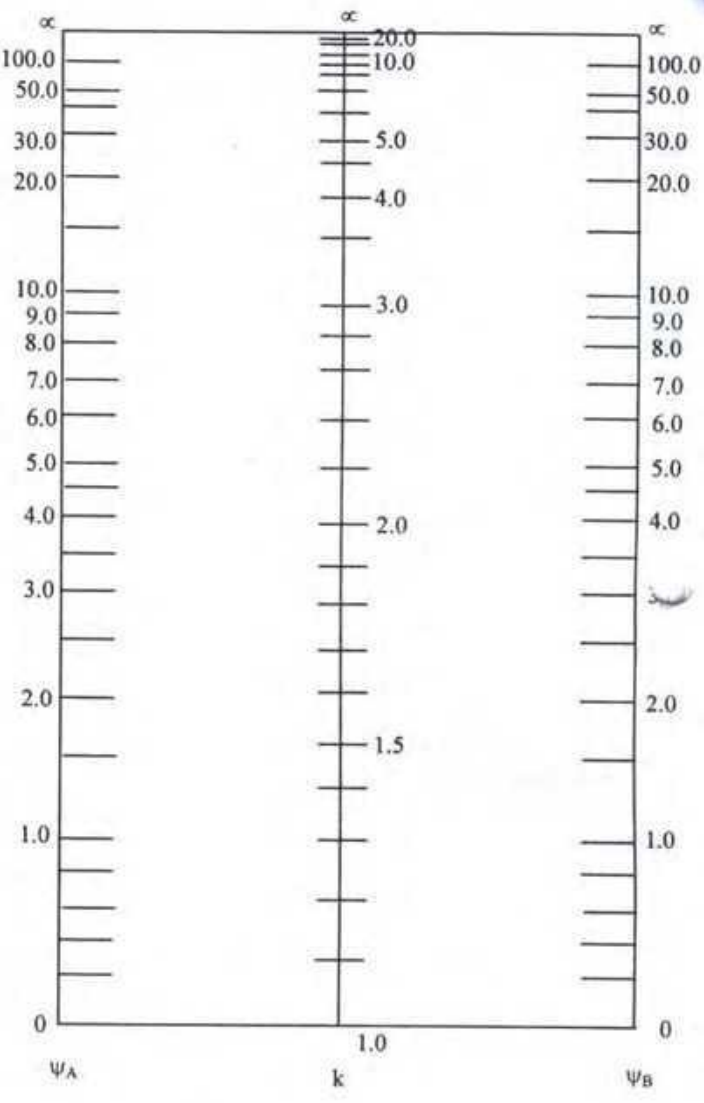
* First Moment-Area Theorem: $\theta_B - \theta_A = \int (M/EI)\, dx$
* Second Moment-Area Theorem: $(x_B - x_A)\,\theta_B - v_B + v_A = \int x\,(M/EI)\, dx$
* Conjugate Beam Method

Original Beam	Free End	Fixed End	Hinge/Roller End	Internal Support	Internal Hinge
Conjugate Beam	Fixed End	Free End	Hinge/Roller End	Internal Hinge	Internal Support

* Euler Buckling Load: $P_{cr} = \pi^2\, EI_{min}/(kL)^2$
* Effect of Initial Imperfection: $v(x) = v_0/[1 - P/P_{cr}] \sin(\pi x/L) \Rightarrow v(L/2) = v_0/[1 - P/P_{cr}]$
* Effect of Load Eccentricity: $\lambda^2 = P/EI \Rightarrow v(L/2) = e\,[\sec \lambda L/2 - 1] = e\,[\sec\{(\pi/2)\sqrt{(P/P_{cr})}\} - 1]$
* Effect of Material Nonlinearity: $P_{cr} = \pi^2\, E_t I/L^2 \Rightarrow \sigma_{cr} = \pi^2\, E_t/\eta^2$
* Eccentric Loading with Elasto-plastic Material:
  $v(L/2) = e\,[\sec\{(\pi/2)\sqrt{(P/P_{cr})}\} - 1]$ for the elastic range; and $v(L/2) = M_p/P - e$, for the plastic range
* k = 1.0 for Hinge-Hinged Beam, 0.7 for Hinge-Fixed Beam, 0.5 for Fixed-Fixed Beam, 2.0 for Cantilever Beam
  In general, k is obtained from ψ_A and ψ_B for braced and unbraced frames
* AISC-ASD Method, $\eta = L_e/r_{min}$, and $\eta_c = \pi\sqrt{(2E/f_y)}$
  If $\eta \leq \eta_c$, $\sigma_{all} = f_y\,[1 - 0.5\,(\eta/\eta_c)^2]/FS$, where $FS = [5/3 + 3/8\,(\eta/\eta_c) - 1/8\,(\eta/\eta_c)^3]$
  If $\eta > \eta_c$, $\sigma_{all} = (\pi^2\, E/\eta^2)/FS$, where FS = Factor of safety = 23/12 = 1.92
* Moment magnification factor for a Simply Supported Beam
  for concentrated load at midspan of = $[\tan(\lambda L/2)/(\lambda L/2)]$, subjected to end moments only = $[\sec(\lambda L/2)]$
  under UDL = $2\,[\sec(\lambda L/2) - 1]/(\lambda L/2)^2$, according to AISC code = $1/(1 - P/P_{cr})$



Braced Frames



Unbraced Frames

Alignment Charts for Effective Length Factors k

ψ = Ratio of $\sum EI/L$ of compression members to $\sum EI/L$ of flexural members in a plane at one end of a compression member.

k = Effective length factor.

The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2009
Program: B.Sc. Engineering Civil

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

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

1 a. Differentiate between, (i) Lagrangian Method and Eulerian Method 6
(ii) Pathlines and Streamlines
(iii) Steady Flow And Unsteady Flow

b. A space of 8.0 cm between two large plane surfaces is filled with glycerine as shwon in Figure 1. Determine the force (F) required to drag vertically a very thin plate 0.90 m^2 in area between the plane surfaces at a constant speed of 0.9 m/s, if the plate is at a distance of 4.25 cm from one of the surfaces. Take dynamic viscosity 0.06 N-s/m^2 and weight of the plate 5 N. 9

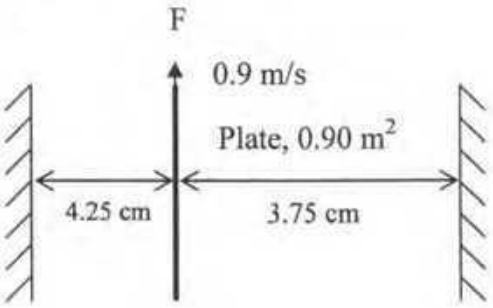


Figure 1

c. A clean glass tube 0.025 cm diameter contains mercury at 20^0C (σ= 0.50 N/m). What will be the capillary depression? Take angle of contact 140^0. 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. If the atmospheric pressure is 101.00 kN/m^2. Calculate, 5
(i) gauge pressure of a point whose absolute pressure is 150 kN/m^2. and,
(ii) vacuum pressure of a point whose absolute pressure is 50 kN/m^2.

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

c. Compute "y" in Figure 2 if the pressure difference between points A and B is 150.00 kN/m^2. ($P_A > P_B$) 8

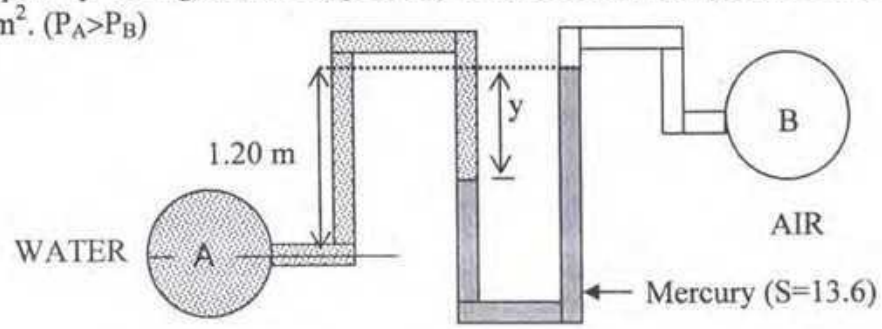


Figure 2

d. Determine the reading of gauge A in Figure 3. 8

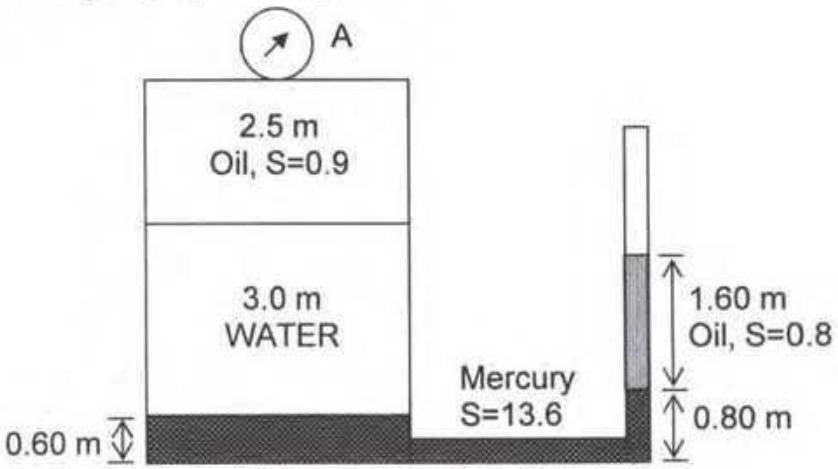


Figure 3

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. 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 4. 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. 13

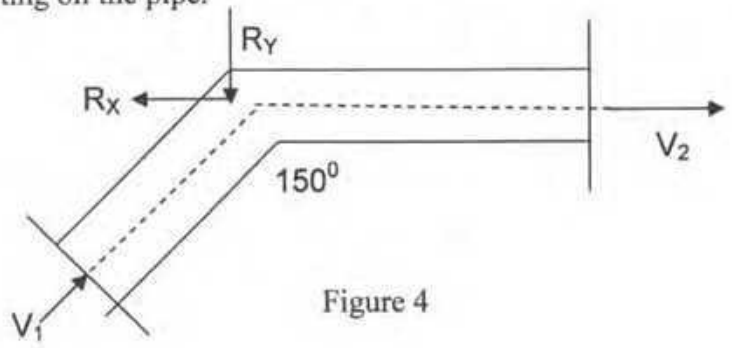


Figure 4

4 a. Determine the horizontal and vertical forces acting on the curved surface CD on the cylinder in Figure 6. 6

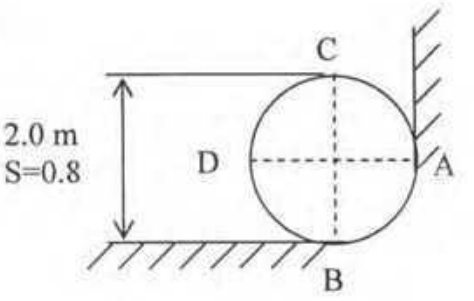


Figure 6

b. Determine the horizontal and vertical forces acting on the curved surface DB on the cylinder in Figure 6. 7

c. The following Figure 7 shows a gate AB hinged at the end A. If the gate is 1.5 m wide, calculate the horizontal force required at B to keep the gate in equilibrium. 12

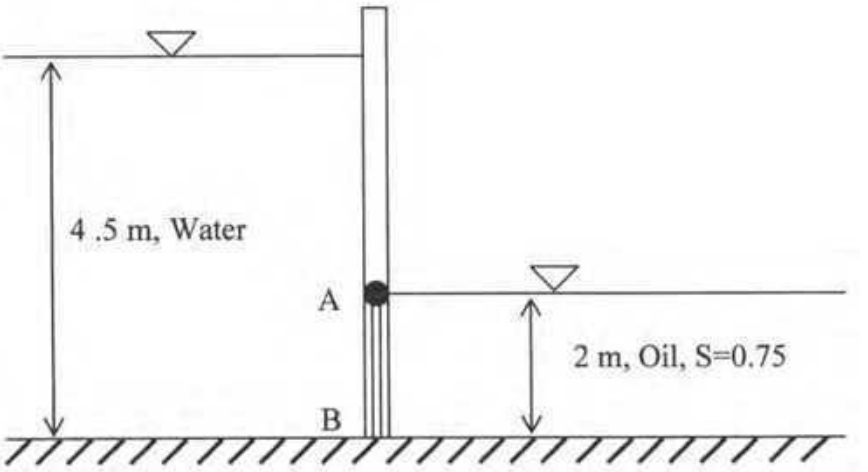


Figure 7

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

b. A circular orifice, 3.5 cm diameter, is made in the vertical wall of a tank. The jet falls vertically through 0.5 m while moving horizontally through a distance of 1.5 m. Calculate the coefficient of velocity if the head causing flow is 1.2 meters. If the discharge is 1.80×10^{-3} m^3/s, calculate C_c and C_d. 5

c. Water is discharging through an external mouthpiece of 30 cm^2 area, under a head of 4.0 m. Find the discharge through the mouthpiece. Take C_c=0.62. 5

d. The inlet and the throat diameter of a horizontal venturimeter shown in Figure 8 are 12 cm and 8 cm, respectively. Calculate the pressure difference between inlet and the throat. The velocity of water in the pipe is 4 m/s. Ignore losses. 9

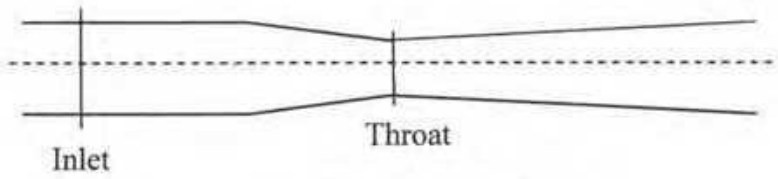


Figure 8: Venturimeter

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

b. A rectangular channel 1.50 m wide has a rectangular weir at the end. If the length of the weir is 1.20 m, and its sill is 0.2 m from the bottom, find the discharge when the measured head over the crest is 0.30 m. Take C_d=0.62. 7

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

d. The rate of flow of water over a V-notch with apex angle $\theta=60^0$ is 0.05 m^3/s. Find the head over the crest if C_d =0.62. 4

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 homogeneous: 9

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

c. A sluice gate spans a channel 10 m wide. If the upstream depth is 3 m and the gate is raised by 0.3 m, determine the discharge. Take C_d =0.58. 5

d. An ogee-shaped spillway 40 m long has a discharge coefficient of 2.25 and permits a maximum discharge of 100 m^3/s. Determine the head over the crest. 5

8 a. What do you understand by 'minor losses' in pipes? Mention the places with neat sketches where minor losses may occur. 6

b. A pipe of 1 m diameter connects two reservoirs having a difference of level of 6 m as shown in Figure 9. The total length of the pipe is 1000 m and rises to a maximum height of 3 m above the level of water in the higher reservoir at a distance of 200 m from the entrance. Find the discharge in the pipe and the pressure at the highest point. Take f= 0.04, and neglect minor losses. 12

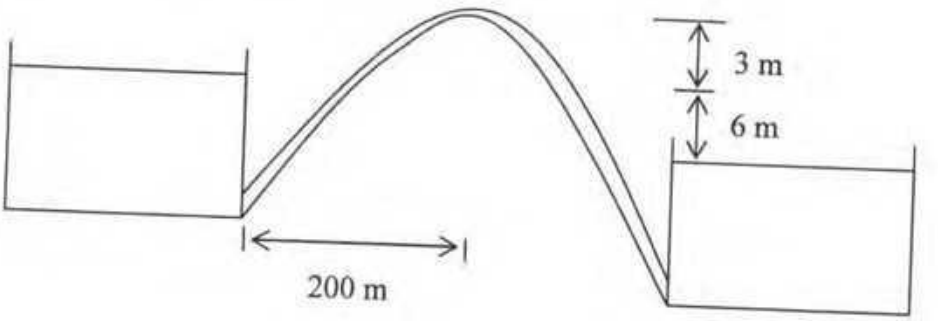


Figure 9

c. Find out the total losses in the pipe AB shown in Figure 10. Take f=0.04 7

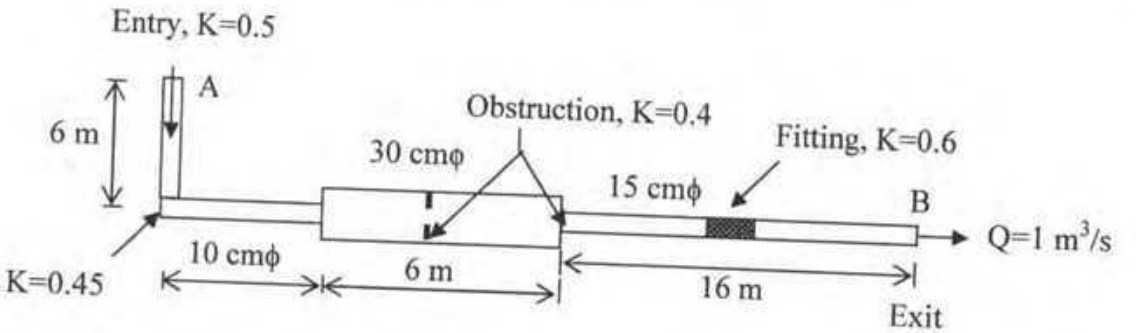


Figure 10

$$\tau = \mu \frac{dv}{dy} \qquad P_i - P_o = \sigma\left(\frac{1}{R_1} + \frac{1}{R_2}\right) = \frac{2\sigma}{R} = \frac{4\sigma}{R} = \frac{\sigma}{R} \qquad h = \frac{4\sigma\cos\theta}{\gamma d}$$

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

$$P_H = \gamma \bar{h} A_V \qquad P_V = \gamma V = W \qquad P = \sqrt{P_H{}^2 + P_V{}^2} \qquad \sum M_o = \rho Q(\Delta V)$$

$$V_0 = \sqrt{2gh} \qquad Q = C_d a\sqrt{2gH} \qquad C_d = C_C \times C_V \qquad C_V = \sqrt{\frac{x^2}{4yH}}$$

$$Q = 0.855a\sqrt{2gH} \qquad Q = 0.707a\sqrt{2gH} \qquad Q = \frac{2}{3} C_d b\sqrt{2g} H^{\frac{3}{2}} \qquad b' = b - 0.1 \times n \times H$$

$$H_a = \frac{V_a{}^2}{2g} \qquad Q = \frac{2}{3} C_d \left[b - 0.1n(H + H_a)\right]\sqrt{2g}\left[(H + H_a)^{\frac{3}{2}} - H_a{}^{\frac{3}{2}}\right] \qquad Q = 1.705 C_d b H^{\frac{3}{2}}$$

$$Q = CbH_s{}^{\frac{2}{3}} \qquad Q = C_d A\sqrt{2gy_1} \qquad Q = \frac{8}{15} C_d \sqrt{2g}\tan\frac{\theta}{2} H^{\frac{5}{2}} \qquad Q = CbH^n$$

$$h_f = f\frac{L}{D}\frac{V^2}{2g} \qquad V = C\sqrt{RS} \qquad C = \sqrt{\frac{8g}{f}} \qquad V = \frac{1}{n} R^{\frac{2}{3}}\sqrt{S}$$

$$C = \frac{1}{n} R^{\frac{1}{6}} \qquad H_L = \frac{(V_1 - V_2)^2}{2g} \qquad H_L = K\frac{V^2}{2g}$$

$$\tau = \mu \frac{dv}{dy} \qquad P_i - P_o = \sigma\left(\frac{1}{R_1} + \frac{1}{R_2}\right) = \frac{2\sigma}{R} = \frac{4\sigma}{R} = \frac{\sigma}{R} \qquad h = \frac{4\sigma\cos\theta}{\gamma d}$$

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

$$P_H = \gamma \bar{h} A_V \qquad P_V = \gamma V = W \qquad P = \sqrt{P_H{}^2 + P_V{}^2} \qquad \sum M_o = \rho Q(\Delta V)$$

$$V_0 = \sqrt{2gh} \qquad Q = C_d a\sqrt{2gH} \qquad C_d = C_C \times C_V \qquad C_V = \sqrt{\frac{x^2}{4yH}}$$

$$Q = 0.855a\sqrt{2gH} \qquad Q = 0.707a\sqrt{2gH} \qquad Q = \frac{2}{3} C_d b\sqrt{2g} H^{\frac{3}{2}} \qquad b' = b - 0.1 \times n \times H$$

$$H_a = \frac{V_a{}^2}{2g} \qquad Q = \frac{2}{3} C_d \left[b - 0.1n(H + H_a)\right]\sqrt{2g}\left[(H + H_a)^{\frac{3}{2}} - H_a{}^{\frac{3}{2}}\right] \qquad Q = 1.705 C_d b H^{\frac{3}{2}}$$

$$Q = CbH_s{}^{\frac{2}{3}} \qquad Q = C_d A\sqrt{2gy_1} \qquad Q = \frac{8}{15} C_d \sqrt{2g}\tan\frac{\theta}{2} H^{\frac{5}{2}} \qquad Q = CbH^n$$

$$h_f = f\frac{L}{D}\frac{V^2}{2g} \qquad V = C\sqrt{RS} \qquad C = \sqrt{\frac{8g}{f}} \qquad V = \frac{1}{n} R^{\frac{2}{3}}\sqrt{S}$$

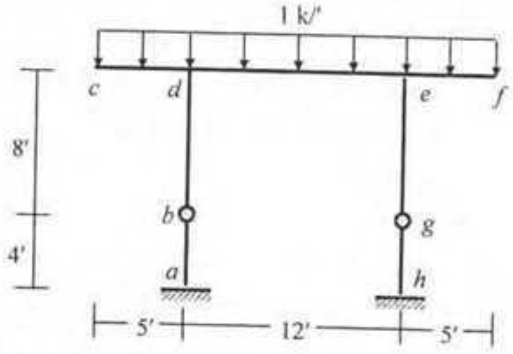
$$C = \frac{1}{n} R^{\frac{1}{6}} \qquad H_L = \frac{(V_1 - V_2)^2}{2g} \qquad H_L = K\frac{V^2}{2g}$$

The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2009
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)

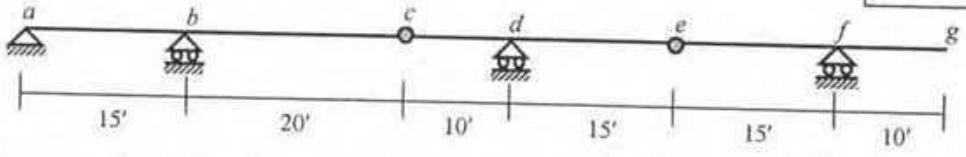
[Answer **any 10 (ten)** of the following 14 questions]

1. Determine the degree of statical indeterminacy (dosi) of the frame shown below.
Also draw the AFD, SFD and BMD of the frame assuming the horizontal reaction at support *a* is zero.



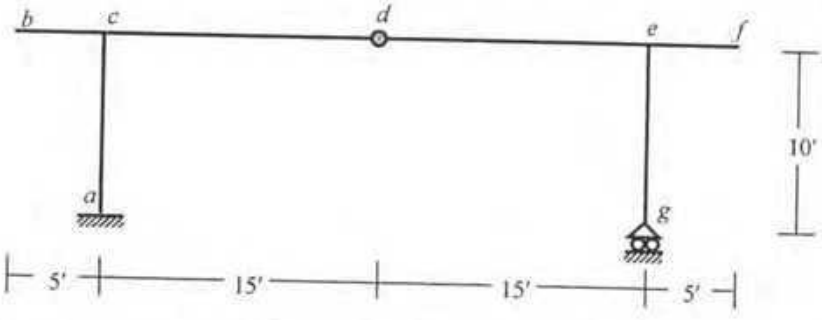
b and *g* are Internal Hinges

2. Show that the beam *abcdefg* shown below is statically determinate.
Also draw the influence lines of (i) R_a, R_d, R_f, (ii) $V_{b(Left)}$, $V_{d(Right)}$, (iii) M_d.



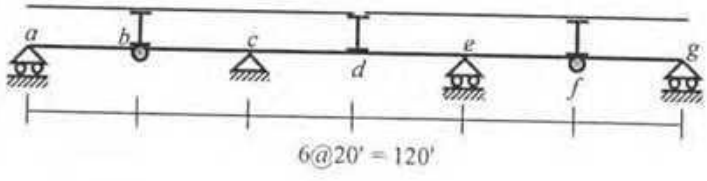
c and *e* are Internal Hinges

3. Determine the degree of statical indeterminacy (dosi) of the frame *abcdefg* shown below, and draw the influence lines of X_a, Y_a and M_a, if the unit load moves over (i) beam *bf*, (ii) column *eg*.



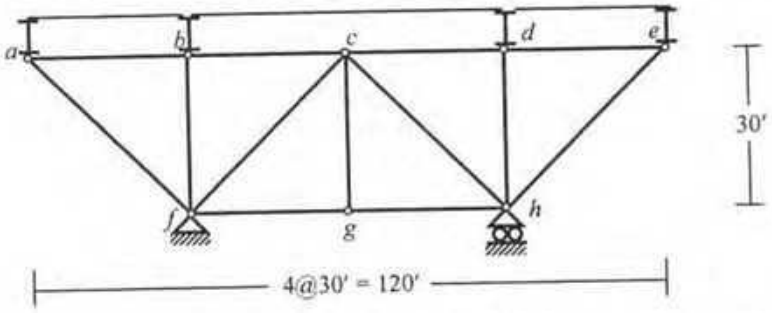
d is an Internal Hinge

4. Draw the influence lines of R_c, $V_{e(Left)}$, $V_{e(Right)}$ and M_d for the plate girder *abcdefg* shown below.



b and *f* are Internal Hinges

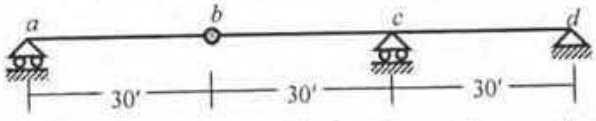
5. Determine the degree of statical indeterminacy (dosi) of the truss shown below and also draw the influence lines for the forces in members *ab*, *bc*, *fg* and *dh*.



6. Calculate the maximum positive and negative values of R_b (reaction at support *b*) and M_b (bending moment at *b*) for the beam *abcdefg* shown in Question 2, for a uniformly distributed dead load of 1 k/ft, a moving uniformly distributed load of 1 k/ft and a moving concentrated load of 10 k.

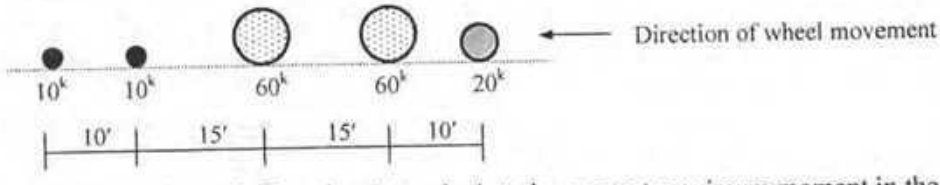
7. Calculate the maximum tensile and compressive forces in the members *af* and *cf* for the truss *abcdefgh* described in Question 5, for a uniformly distributed dead load of 1 k/ft, a moving uniformly distributed load of 1 k/ft and a moving concentrated load of 10 k.

8. Draw the design shear force diagram of the beam *abcd* shown below [based on influence lines of $V_{c(Right)}$ and V_d] for a uniformly distributed dead load of 1 k/ft and moving uniformly distributed load of 1 k/ft.



b is an Internal Hinge

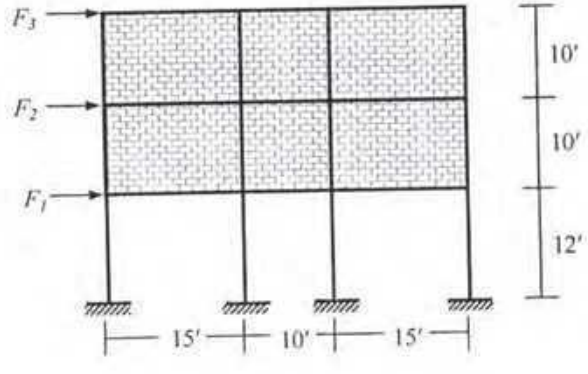
9. For the moving wheel loads shown below, calculate the maximum value of R_a (reaction at support *a*) for the beam *abcd* shown in Question 8.



10. Use the moving wheel loads shown in Question 9 to calculate the greatest maximum moment in the span *ab* of the beam *abcd* shown in Question 8.

11. The figure below shows a three-storied RCC hospital building frame situated on a flat terrain, carrying brick walls at the upper floors.

    If the areas of beams and columns are negligible compared to the walls', and first story force due to wind is $F_1 = 10$ kips, calculate the
    (i) story forces F_2 and F_3 (if the frame is subjected to Exposure B)
    (ii) design wind speed (Given: $C_p = 1.1$, and frame width = 20').



12. The three-storied RCC hospital building frame described in Question 11 is supported on dense or stiff soil and carries slabs (weighing 1 k/ft) at all three floors and brick walls (weighing 1 k/ft) on the first and second floors only.

    If the weight of the beams and columns are negligible compared to the slabs and walls, and the first story force due to earthquake is $F_1 = 10$ kips, calculate the

    (i) story forces F_2 and F_3

    (ii) zone coefficient Z (Given: $R = 5.0$, and frame width = 20′).

13. A damped SDOF system with stiffness (k) = 50 k/ft, weight (W) = 500 k, and damping ratio (ξ) = 5% is subjected to ground acceleration (a_g) equal to

    (i) 10 ft/sec^2, (ii) 10 $Cos(2t)$ [ft/sec^2], (iii) 10 $Cos(10t)$ [ft/sec^2]

    In each case, calculate the steady-state (after infinite time) relative displacement amplitude of the system. Also comment on the results.

14. A cylindrical hydraulic structure of height (L) = 10 ft, diameter (D) = 5 ft is a damped SDOF system with stiffness (k) = 50 k/ft, weight (W) = 500 k, and damping ratio (ξ) = 5%. If the structure is subjected to water-driven vortex induced vibration (VIV), calculate the

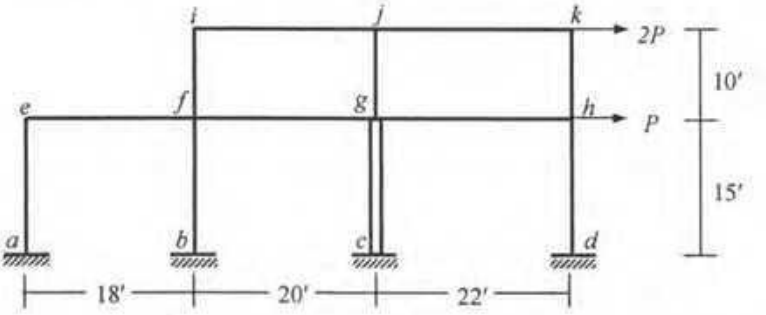
    (i) fluid velocity, (ii) added damping, (iii) dynamic force amplitude, (iv) displacement amplitude considering Lock-in phenomenon [Given: Unit weight of water = 62.5 lb/ft^3].

The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2009
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)

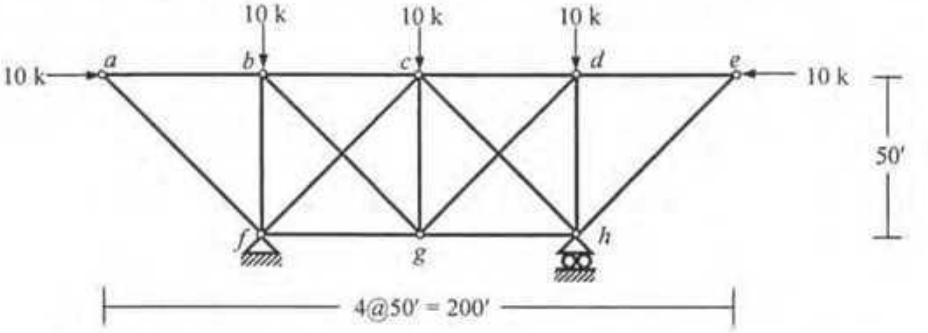
[Answer **any 10 (ten)** of the following 14 questions]

1. For the frame loaded as shown below, calculate the value of P if the
   (i) maximum bending moment in column *cg* is 50 k-ft (use the *Portal Method*),
   (ii) axial force in column *cg* is 10 kip (use the *Cantilever Method*, assuming column *cg* to have twice the cross-sectional area of the other columns).

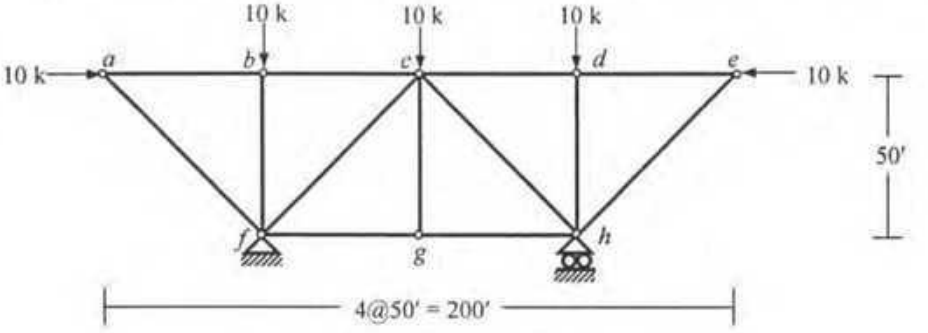


2. For the structure described in Question 1, draw the BMD of beams *ef*, *fg*, *gh* and columns *ae*, *bf*, *cg*, *dh* for a uniformly distributed vertical load of 1.5 k/ft (horizontal load $P = 0$) on beams *ijk* and *efgh* using (i) approximate locations of inflection points, (ii) ACI coefficients.

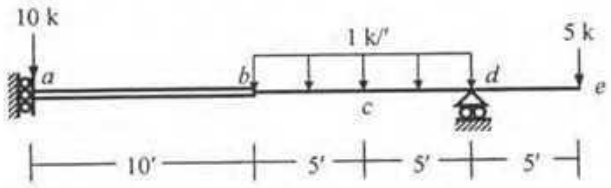
3. In the truss shown below, calculate the forces in members *cd*, *ch*, *gd* and *gh*, assuming diagonal members to take (i) equal share of the sectional shear force, (ii) tension only.



4. Use the Unit Load Method to calculate the vertical deflection at joint *c* of the truss shown below due to (i) the applied loads, (ii) temperature drop of 20°F in the bottom cords
   [Given: EA/L = constant = 1000 kip/ft, Coefficient of thermal expansion $\alpha = 5.5 \times 10^{-6}$/°F].

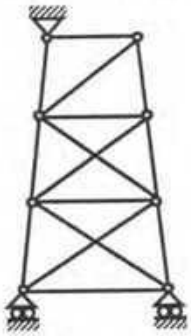


5. Use the Unit Load Method (considering flexural and shear deformations) to calculate the vertical deflection at a of the beam loaded as shown below [Given: $EI_{ab} = 40 \times 10^3$ k-ft^2, $EI_{bcde} = 20 \times 10^3$ k-ft^2, GA* = constant = 120×10^3 k].

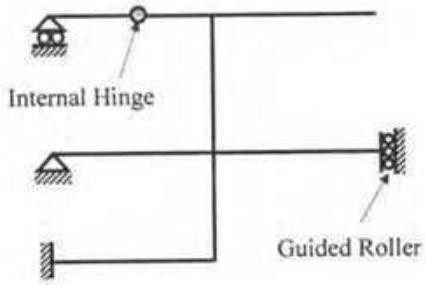


a is a Guided Roller Support

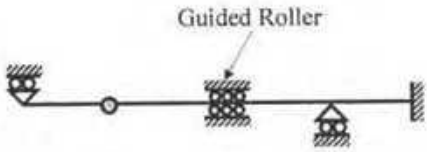
6. Determine the size of the flexibility matrix for the structures shown below.
Also convert them to statically determinate structures to be used in 'Case 0' of the Flexibility Method.



2D Truss

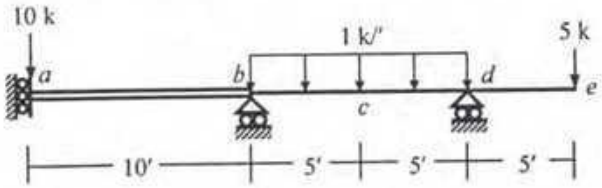


2D Frame



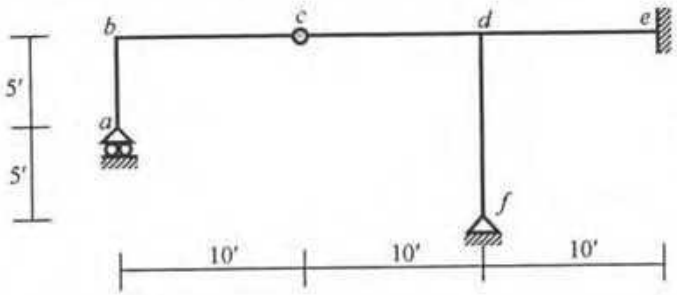
Beam

7. Use the Flexibility Method (considering flexural and shear deformations) to draw the bending moment diagram of the beam loaded as shown below
[Given: $EI_{ab} = 40 \times 10^3$ k-ft^2, $EI_{bcde} = 20 \times 10^3$ k-ft^2, GA* = constant = 120×10^3 k].



a is a Guided Roller Support

8. Use Flexibility Method (considering flexural deformations only) to draw the bending moment diagram of the frame shown below, if support *f* settles 0.05' downward [Given: EI = constant = 40×10^3 k-ft^2].



c is an Internal Hinge

9. Use the Flexibility Method to calculate the forces in all the members of the truss described in Question 3 [Given: EA/L = constant = 1000 kip/ft].

10. Use the Moment Distribution Method to calculate the joint moments and draw the bending moment diagram of the beam *abcde* described in Question 7 [*Use symmetry to extend the structure about 'a'*].

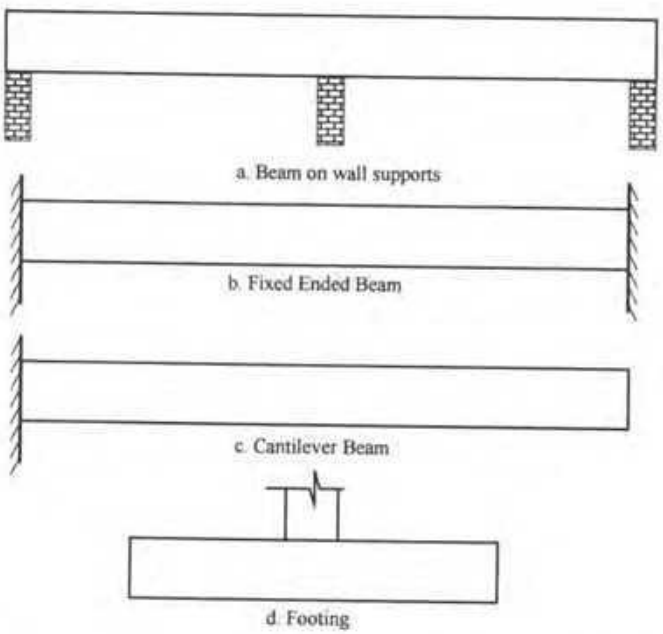
11. Use the Moment Distribution Method to calculate the joint moments and draw the bending moment diagram of the frame *abcdef* described in Question 8.

12. For the beam *abcde* described in Question 7, draw the qualitative influence lines of support reactions R_b, R_d, shear forces $V_{b(\text{Right})}$, $V_{d(\text{Left})}$ and bending moments M_a, M_b, M_d.

13. For the beam *abcde* described in Question 7, calculate the maximum value of M_c (bending moment at *c*) for a uniformly distributed dead load of 1 k/ft, a moving uniformly distributed load of 0.5 k /ft and a moving concentrated load of 5 k.

14. (i) Explain why a guided roller can be used in modeling one-half of a symmetric structure.
    (ii) What is the difference between statically determinate and indeterminate structures in terms of the effect of support settlement?
    (iii) Explain the terms moment distribution factor and carry over factor in the Moment Distribution Method.
    (iv) What is the advantage of using modified stiffness in the Moment Distribution Method?
    (v) Explain why the influence lines of statically determinate structures are straight while the influence lines of statically indeterminate structures are curved.

2(b) Draw the schematic sketch of the flexural reinforcement for the following structures: **(8)**

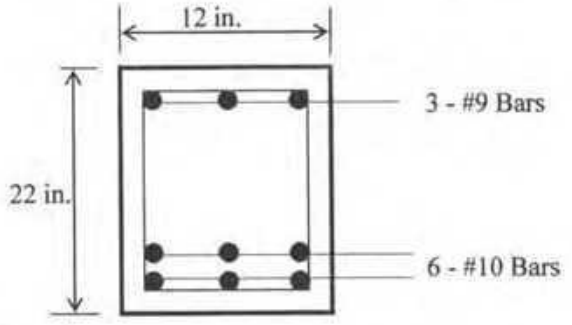


3(a) Design the shear reinforcement for the simply supported beam of Question 2(a) by WSD. Draw the layout of the stirrups in a neat sketch. **(19)**

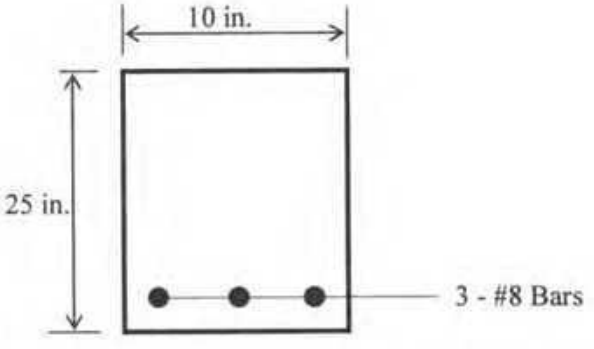
3(b) Draw the strain and stress variation across the section of a beam due to the pure flexure for the following conditions: **(6)**

I. Elastic stress-strain behavior, Very low strain level, Tensile stress of concrete is less than the tensile strength of concrete
II. Tensile stress is higher than the tensile strength of concrete, elastic stress-strain behavior of concrete, stress in steel is less than the yield strength of steel
III. Tensile stress is higher than the tensile strength of concrete, inelastic stress-strain behavior of concrete, stress in steel is equal to the yield strength of steel

4(a) Calculate the design positive moment capacity of the following beam section. Use USD. Given: $f_y = 50{,}000$ psi, $f'_c = 4000$ psi. **(15)**



4(b) The cross-section of a reinforced concrete beam is given below. Determine the positive moment that will cause cracking of concrete. Determine the maximum compressive stress in concrete and stress in steel at this condition. What will happen to the location of the neutral axis if the bending moment is increased further? Given: $f'c = 4000$ psi, $f_t = 475$ psi, $f_y = 60{,}000$ psi, $E_s = 29{,}000{,}000$ psi. **(10)**



5(a) Due to the architectural requirement the section of a beam is limited to 13 inch by 24 inch. For the design working moment of 2530 kip-inch, determine the required steel area. Use WSD. Use $f_s = 20{,}000$ psi, $f'_c = 4000$ psi. **(15)**

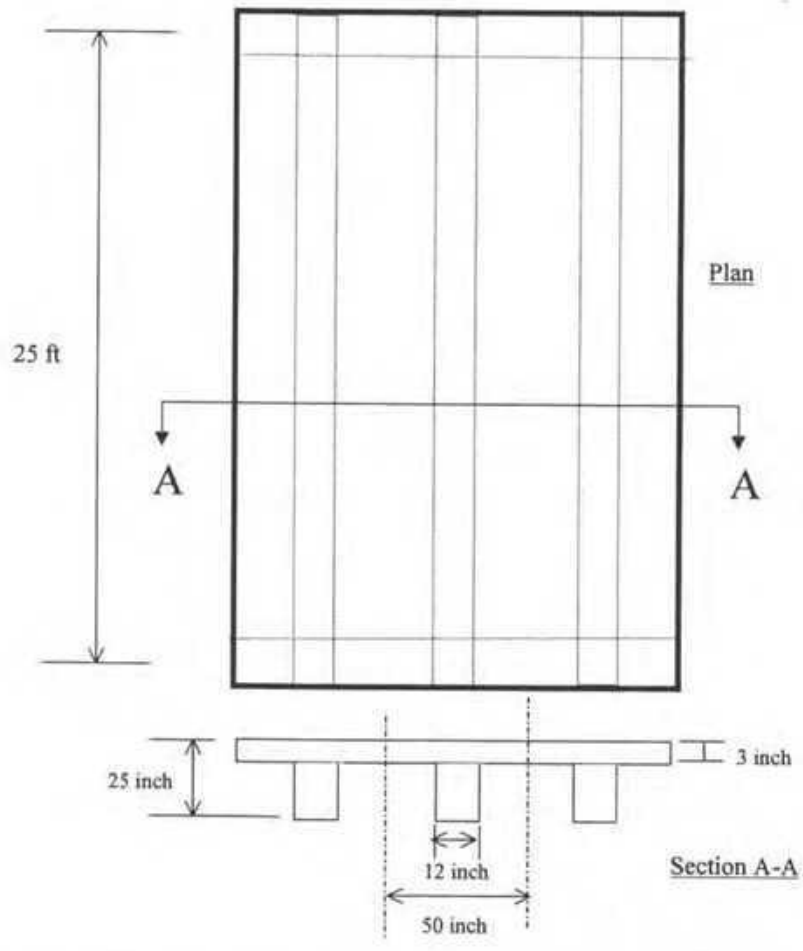
5(b) Define balanced steel ratio. Derive the following equation: **(10)**

$$\rho_b = \alpha \frac{0.003}{\frac{f_y}{E_s} + 0.003} \frac{f_c'}{f_y}$$

The symbols carry the usual meanings.

6 The layout of the slab and beams of a floor is given below. The slab was made monolithically with the beams. Calculate the steel area necessary for the beam located at the center. An architect decides the dimensions as shown. Use WSD. **(25)**

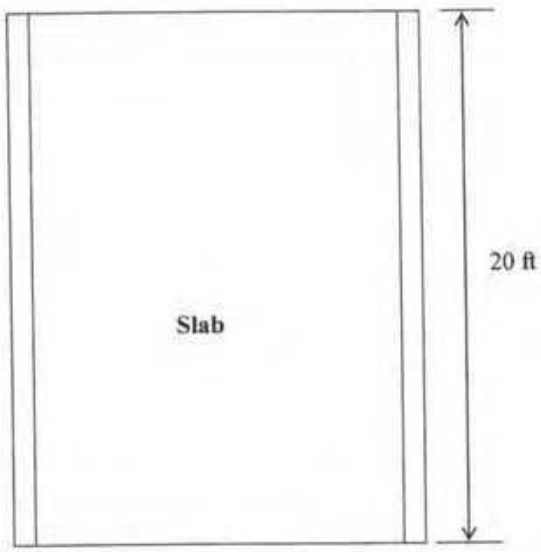
Given: $f_s = 16{,}000$ psi, $f'c = 3500$ psi, LL = 2.4 k/ft.



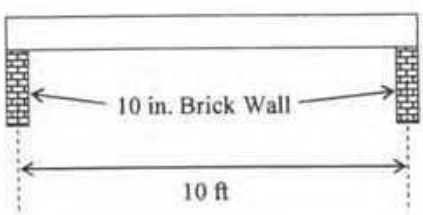
7(a) What are the critical sections to be checked for bond stress? The working design shear at the face of a support is 35.5 kips. The beam has 4 - #10 bars (at top) at the face of the support. Effective depth of the beam is 23.5 inch. Check the bond stress at the face of the support using WSD. Assume f'c = 3000 psi. **(5)**

7(b) Design the following simply supported slab by USD. **(20)**

Given: $f_s = 20{,}000$ psi, $f'_c = 3000$ psi, LL = 70 psf, Floor Finish = 25 psf, Partition Wall = 45 psf.

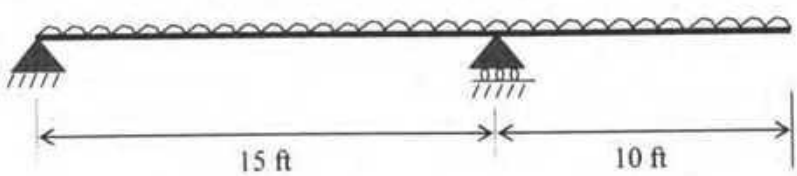


Plan



Section

8 Refer to the following beam. Design the beam for moment by WSD. Draw a neat sketch showing the longitudinal reinforcements. **(25)**



Given: LL = 1 k/ft, DL = 0.7 k/ft (excluding self-weight of the beam)
$f_y = 40{,}000$ psi, $f_s = 16{,}000$ psi, $f'_c = 3500$ psi.

Hints: For the maximum design positive moment, LL is to be considered on the 15 feet span only.

For the maximum design negative moment, LL is to be considered over the entire beam.

The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2009
Program: B. Sc. Engineering (Civil)

Course Title: Design of Concrete Structures I | Course Code: CE 315
Time: 3 Hours | Full Marks: 150

There are EIGHT questions. Answer SIX Questions including Question No. 1. Question No. 1 is Compulsory.

1(a) "Steel is good for reinforcing concrete members" – explain briefly. **(25)**

(b) Draw the crack pattern of a simply supported beam subjected to two-point loading with identification of the shear cracks and the bending cracks.

(c) Compare WSD and USD.

(d) "Tensile yielding of steel is preferable to compression failure of concrete"- why?

(e) "The design shear force is considered at a distance equal to the effective depth of the beam from the face of the support but not at the face of the support"- why?

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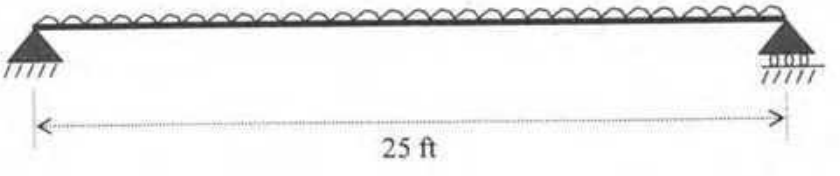
(i) "Deformed bars have more bond stress compared to plain bars" – Explain.

(j) Compare doubly reinforced and singly reinforced concrete beams.

2(a) Design the following simply supported beam for moment by USD. Given: LL = 1 k/ft, DL = 1 k/ft (excluding self-weight), Width of the beam = 12 in., f_y = 40,000 psi, f'_c = 3500 psi. **(17)**



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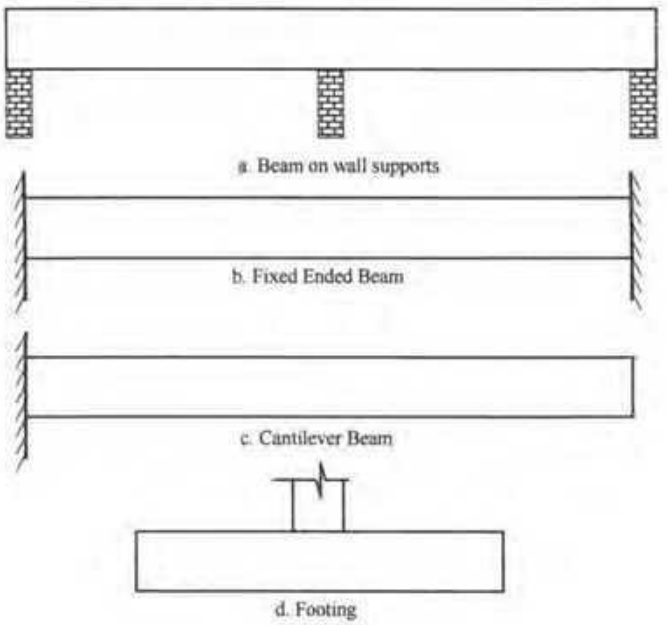

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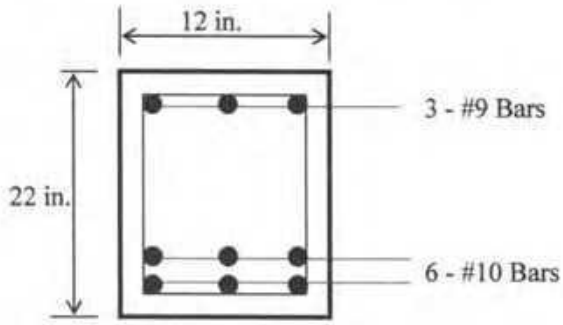

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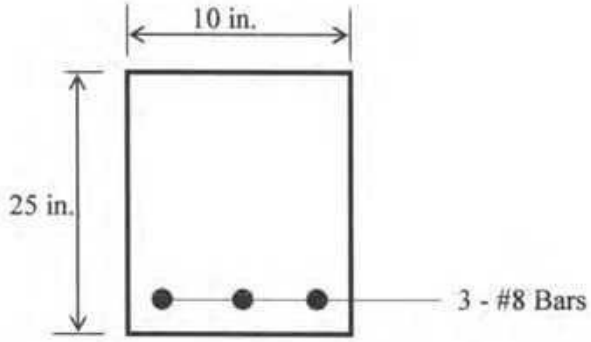

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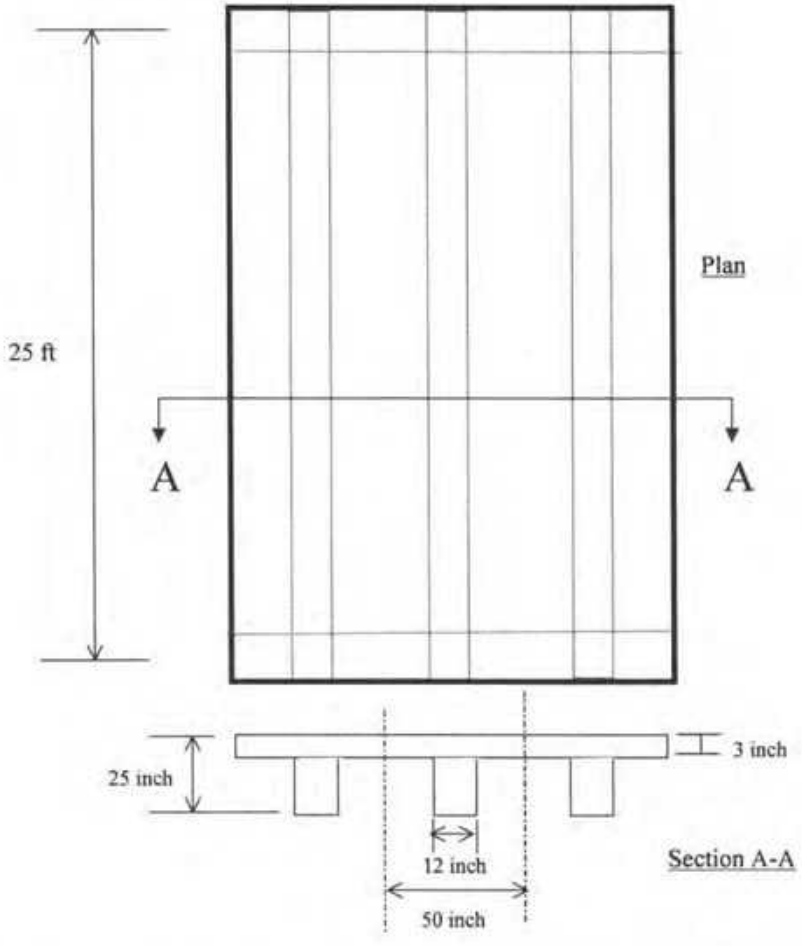

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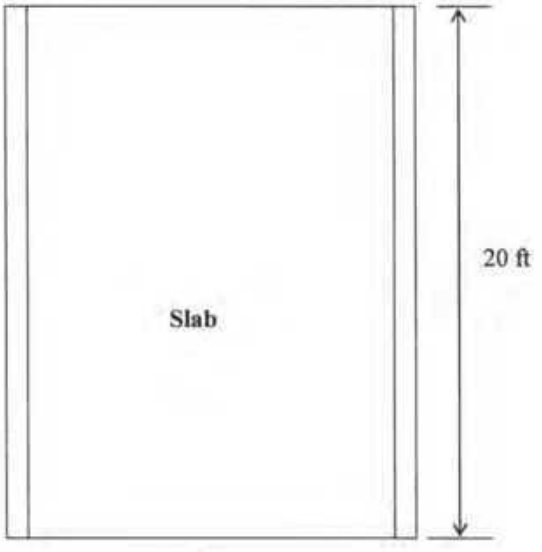
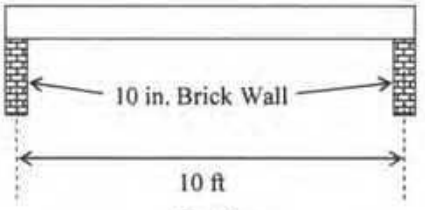


Plan



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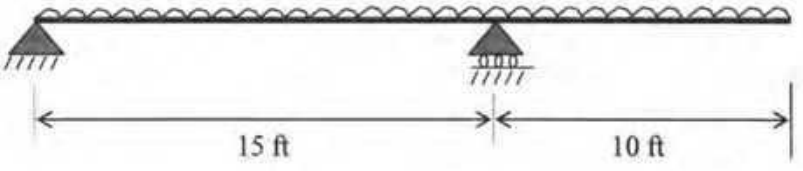

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$f_y = 40{,}000$ psi, $f_s = 16{,}000$ psi, $f'_c = 3500$ psi.

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The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2009
Program: B. Sc. Engineering (Civil)

Course Title: Design of Concrete Structures I | Course Code: CE 315
Time: 3 Hours | Full Marks: 150

There are EIGHT questions. Answer SIX Questions including Question No. 1. Question No. 1 is Compulsory.

1(a) "Steel is good for reinforcing concrete members" – explain briefly. **(25)**

(b) Draw the crack pattern of a simply supported beam subjected to two-point loading with identification of the shear cracks and the bending cracks.

(c) Compare WSD and USD.

(d) "Tensile yielding of steel is preferable to compression failure of concrete"- why?

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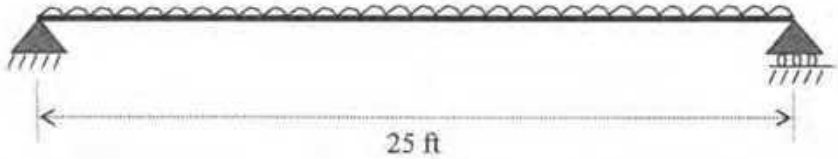
2(a) Design the following simply supported beam for moment by USD. Given: LL = 1 k/ft, DL = 1 k/ft (excluding self-weight), Width of the beam = 12 in., f_y = 40,000 psi, f'_c = 3500 psi. **(17)**



The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2009
Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering II Course Code: CE 333 Credit: 3.00
Time: 3.0 hours Full Marks: 100

There are **SIX** questions. Answer any **FOUR**.
Assume reasonable value for missing data (if any)

1.(a) What are the general types of sanitation system? Give examples of each system. **5**

(b) In which situations pour-flush pit latrines are recommended? What are the advantages of a pour-flush pit latrine? **10**

(c) Design leach pits for both single and alternate twin pit off-set pit pour-flush latrines serving a family of nine members living in a peri-urban area. Consider wastewater flow rate of 8 lpcd and soil infiltration rate of 28 l/m^2-day. **10**

2.(a) Define the terms – (i) Sullage (ii) Sanitary sewage (iii) Sewer (iv) Sewerage (v) Sanitary sewer. **5**

(b) What are the conditions to be fulfilled for an ideal drain section? Draw the typical cross sections of a inclined bottomed and a trapezoidal round bottomed drain. **5**

(c) Determine the rate of discharge in a 25 cm circular sewer laid on a slope of 0.004. The roughness coefficient of sewer material is 0.013 and the depth of flow through the sewer is 9 cm. Also determine the velocity of flow through the sewer. Use the Hydraulic Elements Diagram (Figure 1) attached with the question. **15**

3.(a) What are the advantages and disadvantages of separate and combined sewerage systems? What are the suitable conditions for the installation of separate sewerage system? **10**

(b) Determine the peak runoff from a catchment area having the land use pattern of 25% area is covered by roof (C = 0.8), 30 % area covered by paved roads (C = 0.85) , 10% area covered by concrete roads (C = 0.32), 10% area covered by gravel roads (C = 0.20), 20 % area covered by unpaved roads (C = 0.13) and rest 5 % area covered by open lands (C = 0.15). The catchment area is 10 km^2, the mainstream length is 4 km and mainstream slope is 4 m/km. Assume recurrence interval 5 years. **15**
Also determine the diameter of a storm sewer carrying the discharge from the above catchment area. The roughness coefficient is 0.013 and the sewer is to be laid on a slope of 0.003.

4.(a) Define the suspended and attach growth processes. Give examples of these treatment processes. 5

(b) What is the role of microorganism in biological treatment processes? Why log growth phase of bacteria is not desirable for sewage treatment though the waste removal rate is the maximum in this phase? 10

(c) Calculate the effluent BOD from a trickling filter having a depth of 1.2 m and a recirculated rate of 90% of the inflow. The influent BOD is 180 mg/l following the primary treatment. Assume, k = 0.49. 10

5.(a) What are the methods of disposal of sewage effluent on land by irrigation? What are the advantages of the effluent disposal by irrigation? 5

(b) A system of waste stabilization ponds is to be designed to treat a waste water stream having the discharge of 1000 m^3/day. The ultimate BOD of the waste stream is 350 mg/l. Assume the temperature of the waste water is 22 °C. Design the system of waste stabilization ponds. 20

6.(a) What are the stages in water pollution and self-purification process in a stream? What are the factors that influence pollution and self-purification process in a stream? 5

(b) A city discharges 1.50 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. 20
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.

Formulae:

1. $Q = A_i I$

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

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

4. $t_c = \frac{FL}{A^{0.1} S^{0.2}}$

5. $Q = FCIA$

6. $C_e = \left(\frac{C_i + rC_e}{1+r} \right) e^{-kD}$

7. $\frac{L_e}{L_i} = \frac{1}{1+k_1 t}, \quad k_{1(T)} = 0.3(1.05)^{T-20}$

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

9. $\lambda_v = L_i / t$

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

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

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

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

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

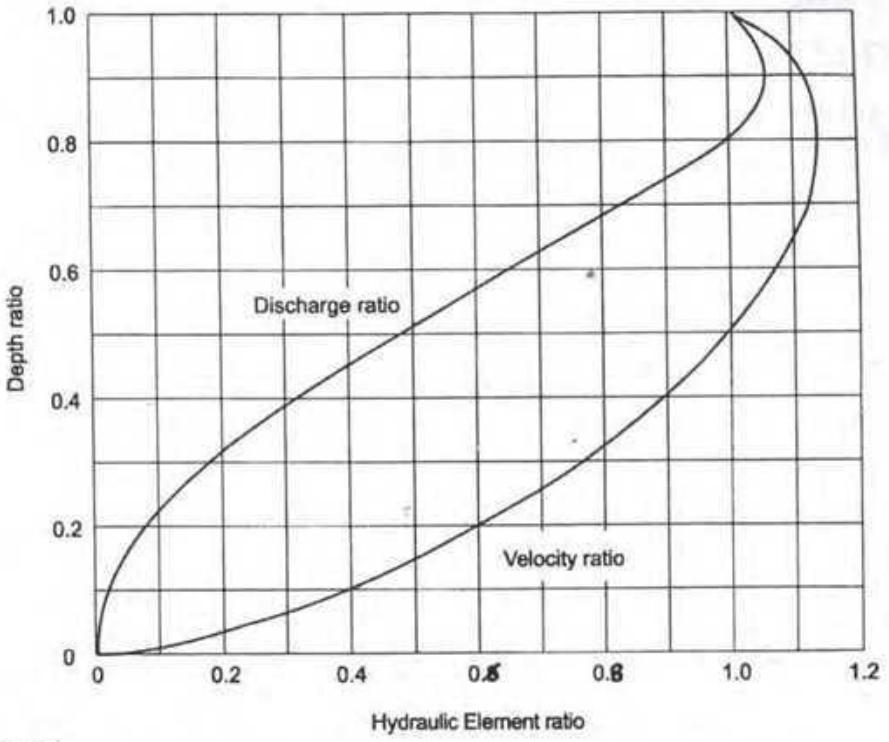


Figure 1: Hydraulic Element Diagram for Circular Sewer

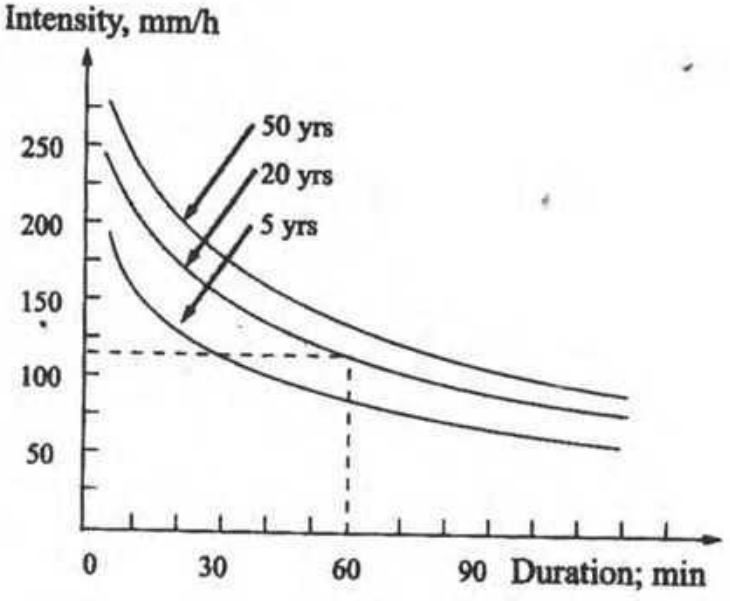


Figure 2: Rainfall Intensity-Duration-Frequency Curves

Table: Equilibrium concentrations (mg/l) of DO as a function of temperature and chloride concentration

Temperature, °C	Chloride concentration, mg/L				
	0	5,000	10,000	15,000	20,000
0	14.62	13.79	12.97	12.14	11.32
1	14.23	13.41	12.61	11.82	11.03
2	13.84	13.05	12.28	11.52	10.76
3	13.48	12.72	11.98	11.24	10.50
4	13.13	12.41	11.69	10.97	10.25
5	12.80	12.09	11.39	10.70	10.01
6	12.48	11.79	11.12	10.45	9.78
7	12.17	11.51	10.85	10.21	9.57
8	11.87	11.24	10.61	9.98	9.36
9	11.59	10.97	10.36	9.76	9.17
10	11.33	10.73	10.13	9.55	8.98
11	11.08	10.49	9.92	9.35	8.80
12	10.83	10.28	9.72	9.17	8.62
13	10.60	10.05	9.52	8.98	8.46
14	10.37	9.85	9.32	8.80	8.30
15	10.15	9.65	9.14	8.63	8.14
16	9.95	9.46	8.96	8.47	7.99
17	9.74	9.26	8.78	8.30	7.84
18	9.54	9.07	8.62	8.15	7.70
19	9.35	8.89	8.45	8.00	7.56
20	9.17	8.73	8.30	7.86	7.42
21	8.99	8.57	8.14	7.71	7.28
22	8.83	8.42	7.99	7.57	7.14
23	8.68	8.27	7.85	7.43	7.00
24	8.53	8.12	7.71	7.30	6.87
25	8.38	7.96	7.56	7.15	6.74
26	8.22	7.81	7.42	7.02	6.61
27	8.07	7.67	7.28	6.88	6.49
28	7.92	7.53	7.14	6.75	6.37
29	7.77	7.39	7.00	6.62	6.25
30	7.63	7.25	6.86	6.49	6 13

3a) Derive the following relationships

(i) $\gamma_d = (1-n)G_s\gamma_w$ 4

(ii) $\gamma_{sat} = \dfrac{(G_s+e)\gamma_w}{(1+e)}$ 4

b) Define void ratio, porosity and degree of saturation of soil. 3

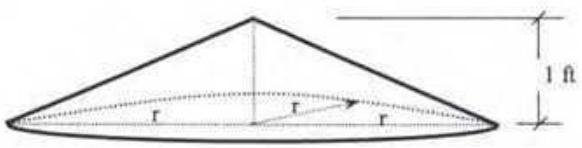
c) As shown in figure below, moist sand having moisture content of 13.1% and specific gravity (Gs) of 2.68, was stockpiled on the ground (left) forming a cone before compaction to prepare a portion of a pavement subgrade (right). 9

Assume that no moisture was lost due to evaporation or gained due to rain during this process. The void ratio attained after compaction was 1.06.

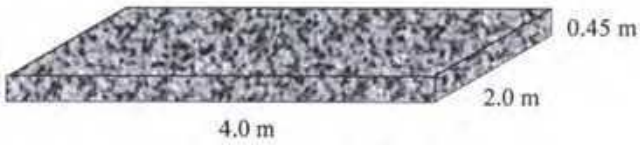
Determine:

(i) total weight of moist sand.

(ii) diameter of the stockpile if the void ratio of the stockpiled sand was found to be 2.0 before compaction.



Stockpiled moist sand before compaction



Portion of pavement subgrade after compaction

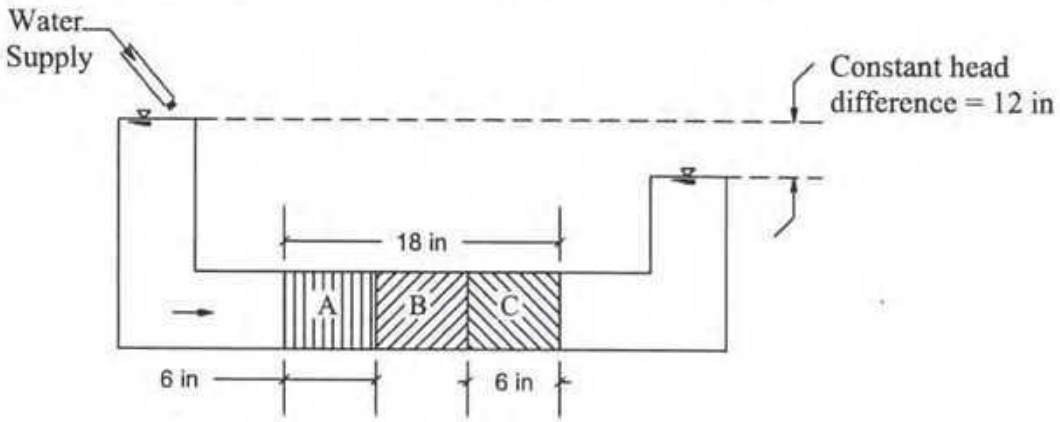
4a) Laboratory test results of the following inorganic soil samples are summarized in the following table. Classify the soils (Use Attachments Chart-1, Chart-2, Chart-5, Chart-6 and Simplified Plasticity Chart as needed) according to ASTM D-2487 (Unified Soil Classification System). 9

Soil Sample No.	Atterberg Limits		% **passing** through # 200 sieve	% **retained** on # 200 sieve	% **retained** on # 4 sieve
	Liquid Limit	**Plastic Limit**			
1	50	20	60	---	15
2	20	17	51	24	---
3 ($C_u = 6.5$ $C_c = 2.9$)	20	15	11	45	---

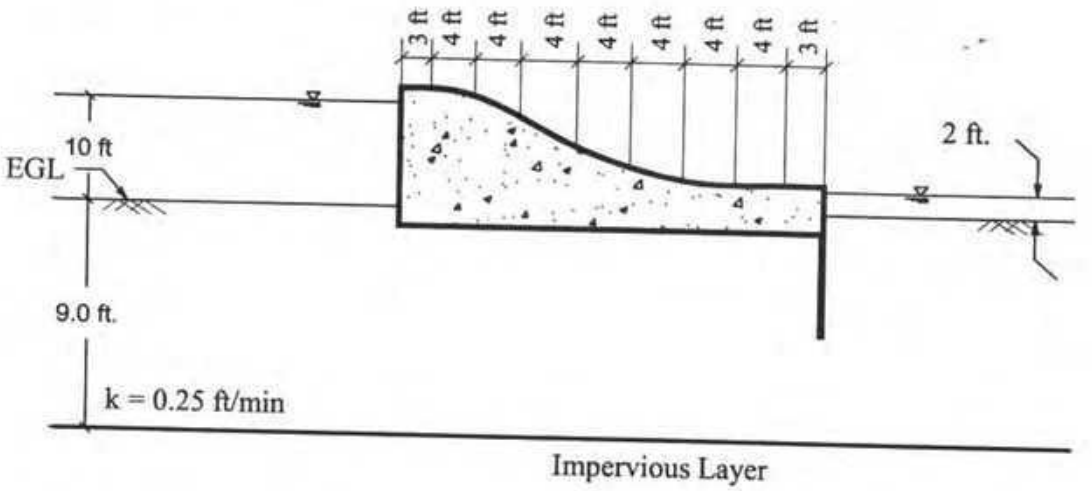
b) Define permeability. Mention the major factors affecting the permeability of soil. 4

c) The following figure shows the layers of soil in tube 4 inch x 4 inch in cross section. Water is supplied to maintain a constant head difference of 12 inches across the sample. Find the rate of supply in litre/hour. The co-efficient of permeability of the soils in the direction of flow through them are: 7

Soil A = 4×10^{-2} ft/s; Soil B = 1.2×10^{-3} ft/s; Soil C = 1.96×10^{-4} ft/s

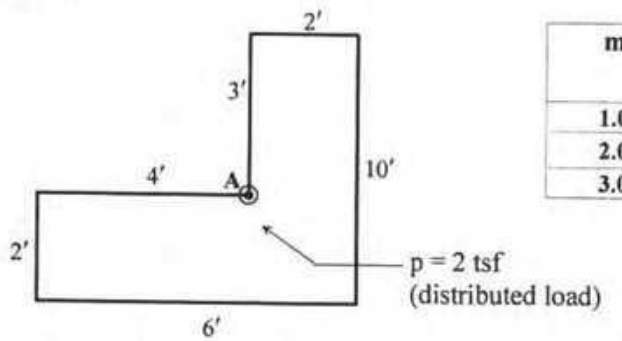


5a) Draw a flow net for the following weir. Calculate the seepage loss per meter width. Also calculate the seepage loss through a single channel. 10



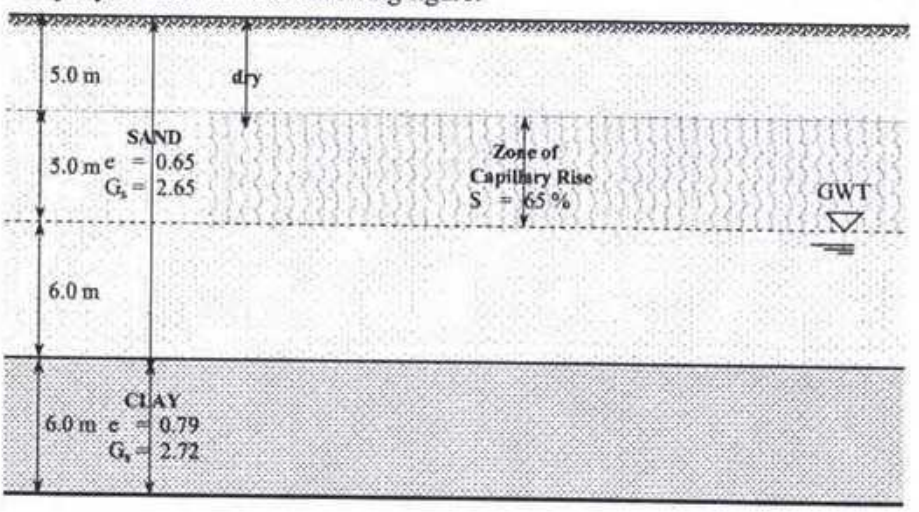
b) Draw the uplift pressure diagram for the weir shown in question 5 a) and calculate the uplift force (only magnitude; location is not required) per unit width of the weir along its axis. 10

6a) A distributed load of 2 ton/ft^2 is acting on the flexible composite rectangular area as shown in the following figure. Determine the vertical stress increment at 2 ft below (existing ground surface) point A. 6

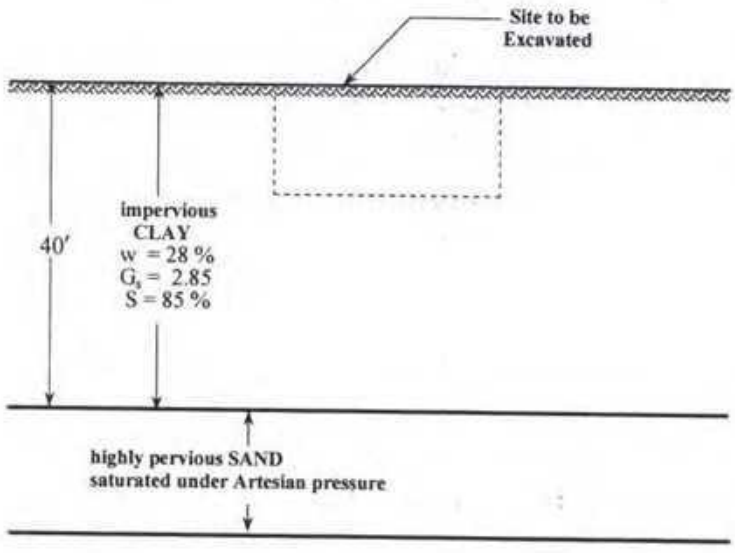


m	N		
	1.0	2.0	3.0
1.0	0.1752	0.1999	0.2034
2.0	0.1999	0.2358	0.2378
3.0	0.2034	0.2378	0.2439

b) Plot the variations of total stress, pore water pressure and effective stresses with depth for the sand and clay layers shown in the following figure. 10



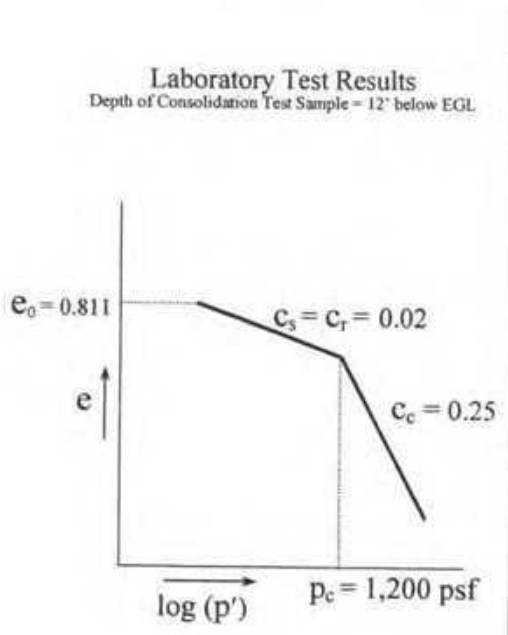
c) The sand layer as shown in the following figure underlying the clay layer is under Artesian pressure. Heaving condition was observed at this site when an excavation was proceeded up to a depth of 10.75 ft below EGL. Estimate the Artesian pressure of the sand layer? 4

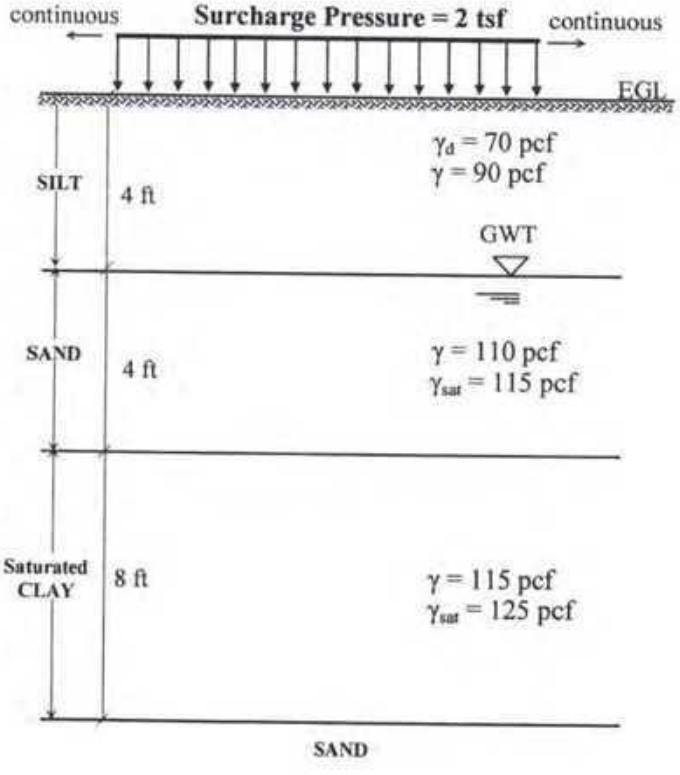


7a) Write short notes on normally consolidated (NC) soil and over-consolidated (OC) soil. 3

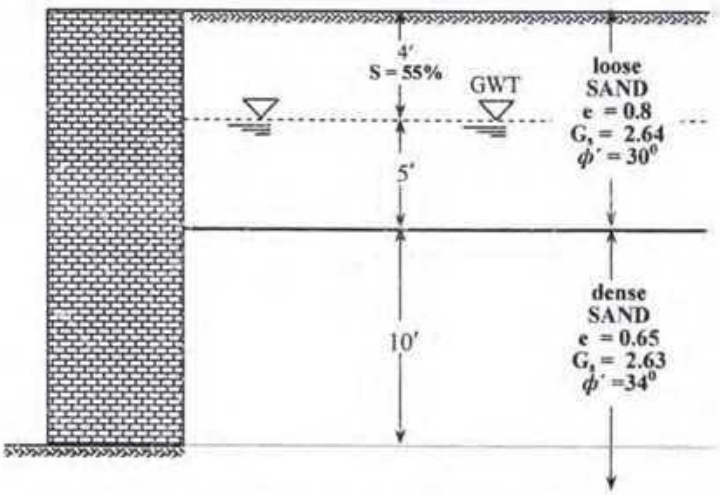
b) Applied (induced) surcharge pressure as shown in the figure below is 2 tsf. Calculate the settlement due to primary consolidation for the 8-ft saturated clay layer due to the applied pressure. 8.5

During the sub-soil exploration, a consolidation test was conducted in the laboratory on a clay sample that was obtained from the middle of the clay layer (i.e. about 12 ft below the EGL). The results of the consolidation test are also summarized.





c) Calculate the lateral force (magnitude, direction and location) per unit width of the structure shown below for at rest condition. 8.5



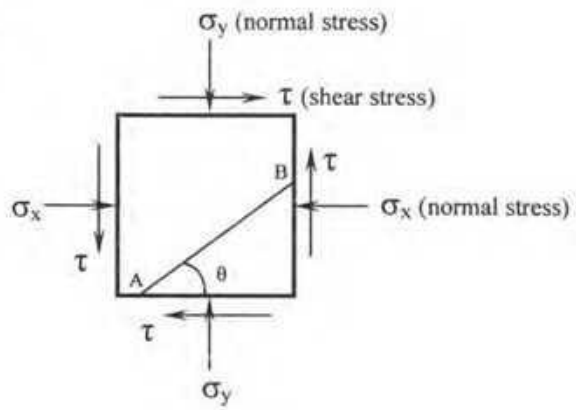
8a) For an over-consolidated clay soil derive the expression for the estimation of primary consolidation settlement as: 12

$$S = \frac{C_s H_0}{1+e_0}\left[\log(p_0 + \Delta p) - \log(p_0)\right]$$

b) For a soil element under normal and shearing stresses as shown below, derive expressions for the normal and shearing stresses along plane AB. 8

$$\sigma_n = \frac{(\sigma_y + \sigma_x)}{2} + \frac{(\sigma_y - \sigma_x)}{2}\cos 2\theta + \tau \sin 2\theta$$

$$\tau_n = \frac{(\sigma_y - \sigma_x)}{2}\sin 2\theta - \tau \cos 2\theta$$



The University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring-2009
Program: B. Sc. Engineering (Civil)

Course Title: Geotechnical Engineering I — Course Code: CE 341
Time: 3 hours — Full Marks: 120 (6 x20 =120)

There are eight (8) questions below. Answer any Six (6).

1a) Discuss, in brief, various types of soils based on their origin and transportation agents. 10

b) Mention and sketch various shapes of coarse-grained soil particles found in nature based on their angularity. 4

c) Mention and sketch different types of soil structures. 6

2a) From the following sieve analysis data, determine C_u and C_c of the soil. Comment on the gradation of the soil with proper justification. What is the effective size of this soil? 9

Sieve No./ Opening	Amount Retained (gm)	% Retained	Cumulative % Retained	% Finer
# 4 (4.75 mm)	0.0	0.0	0.0	100.00
# 8 (2.36 mm)	30.0	6.00	6.00	94.00
# 16 (1.18 mm)	48.7	9.74	15.74	84.26
# 30 (0.6 mm)	127.3	---	---	---
# 50 (0.3 mm)	136.8	---	---	---
# 100 (0.15 mm)	91.8	---	---	---
# 200 (0.075 mm)	43.3	8.66	95.58	4.42
Pan	22.1			
Total =	**500 gm**			**--- To be calculated**

b) Define Atterberg limits. What is flow index? For what reason flow curve is used? 5

c) A soil sample was collected from **SITE A**. The following data were obtained: 6

Moisture content at 25 blows was obtained to be 60% from the laboratory Atterberg limit test.
Wt. of wet sample (when the sample was changing from plastic to semi-solid state) = 70 gm
Dry wt. of the sample = 56 gm
This soil has natural moisture content of 34%.

Another soil sample was collected from another adjacent site, **SITE B** that has natural moisture content of 35% and Liquid and Plastic limits of 82 and 32, respectively.

Determine with proper justification which soil will exhibit higher strength.

Use the following information for comparison of strength.

Range of Liquidity Index, I_L (%)	Consistency (degree of firmness)
0 <	Hard
0 - 20	Very Stiff
20 - 40	Stiff
40 - 60	Medium Stiff (Firm)
60 -80	Soft
80 - 100	Very Soft

The University of Asia Pacific
Department of Civil Engineering
Mid-Term Examination Spring, 2009

Course # 341 | Course Title: Geotechnical Engineering I
Full Marks: 60 (4 x15 = 60) | Time: 1 hour

Answer any Four (4) questions:-

1a) Classify soil (mention names only) based on origin and transportation agent. Write a short note on alluvial soil. 2+3=5

1b) Categorize soil (no description required) based on size limits. 2

1c) Show with sketches different shapes of soil particles. 3

1d) Classify soil structures (mention names only). Write short note on honey-comb structure. 2+3=5

2a) Laboratory test results of the following inorganic soil samples are summarized in the following table. Classify the soils (Use Attachments Chart-1, Chart-2, Chart-5, Chart-6 and Simplified Plasticity Chart as needed) according to ASTM D-2487 (Unified Soil Classification System). 3x2=6

Soil Sample No.	Atterberg Limits		% **passing** through # 200 sieve	% **retained** on # 200 sieve	% **retained** on # 4 sieve
	Liquid Limit	**Plastic Limit**			
1	50	20	60	---	15
2	20	17	51	24	---
3 (C_u = 6.5 C_c = 2.9)	20	15	11	45	---

2b) Define liquid limit and plastic limit of soil. 2x1=2

2c) A soil sample was collected from **SITE A**. The following data were obtained: 7

Moisture content at 25 blows was obtained to be 60% from the laboratory Atterberg limit test.
Wt. of wet sample (when the sample was changing from plastic to semi-solid state) = 70 gm
Dry wt. of the sample = 56 gm
This soil has natural moisture content of 34%.

Another soil sample was collected from another adjacent site, **SITE B** that has natural moisture content of 35% and Liquid and Plastic limits of 82 and 32, respectively.

Determine with proper justification which soil will exhibit higher strength.

Use the following information for comparison of strength.

Range of Liquidity Index, I_L (%)	Consistency (degree of firmness)
0 <	Hard
0 - 20	Very Stiff
20 - 40	Stiff
40 - 60	Medium Stiff (Firm)
60 -80	Soft
80 - 100	Very Soft

3a) Define well-graded and poorly-graded soils. 3

3b) From the following sieve analysis data, determine C_u and C_c of the soil. Comment on the gradation of the soil with proper justification. What is the effective size of this soil? 12

Sieve No./ Opening	Amount Retained (gm)	% Retained	Cumulative % Retained	% Finer
# 4 (4.75 mm)	0.0	0.0	0.0	100.00
# 8 (2.36 mm)	30.0	6.00	6.00	94.00
# 16 (1.18 mm)	48.7	9.74	15.74	84.26
# 30 (0.6 mm)	127.3	---	---	---
# 50 (0.3 mm)	136.8	---	---	---
# 100 (0.15 mm)	91.8	---	---	---
# 200 (0.075 mm)	43.3	8.66	95.58	4.42
Pan	22.1			
Total =	**500 gm**			**--- To be calculated**

4a) For the following compaction test data generate the compaction curve and determine the maximum dry unit weight and optimum moisture content from the curve. Also calculate the moist (total) unit weight and theoretical maximum dry unit weight (unit weight at Zero-Air-Void, ZAV, condition) of the soil at its optimum moisture content. Given that $G_s = 2.65$ for this soil. 8

Volume of the mold = 0.033 ft^3

Weight of Wet Soil in Mold (lb)	Moisture content (%)	Dry Unit Weight (lb/ft^3)
2.904	10	80
3.327	12	---
3.637	16	---
3.310	18	85

--- To be calculated

4b) Derive the following relationships

(i) $\gamma_d = (1-n)G_s\gamma_w$ 3

(ii) $\gamma_{sat} = \dfrac{(G_s + e)\gamma_w}{(1+e)}$ 4

5a) Define void ratio, porosity and degree of saturation of soil. 3

5b) For a moist soil, given porosity (n) = 0.31; volume occupied by soil solids (V_s) = 5.0 m^3; moisture content (w) = 15 %; specific gravity of soil solids (G_s) = 2.64; e_{max} = 0.85 and e_{min} = 0.38. 12

Determine the following parameters:-

(i) void ratio
(ii) total volume
(iii) total weight
(iv) dry unit weight and moist unit weight
(v) volume occupied by water
(vi) degree of saturation
(vii) relative density, maximum and minimum dry unit weights

Also determine the amount of water, in kN, needed to saturate the soil.

The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2009
Program: B.Sc. Engineering (Civil)

Course Title : Professional Practices and Communications **Course No: CE 403** **Credit: 2.0**

Time : 2.0 hours **Full marks: 40**

There are six questions. Answer any **FOUR.**

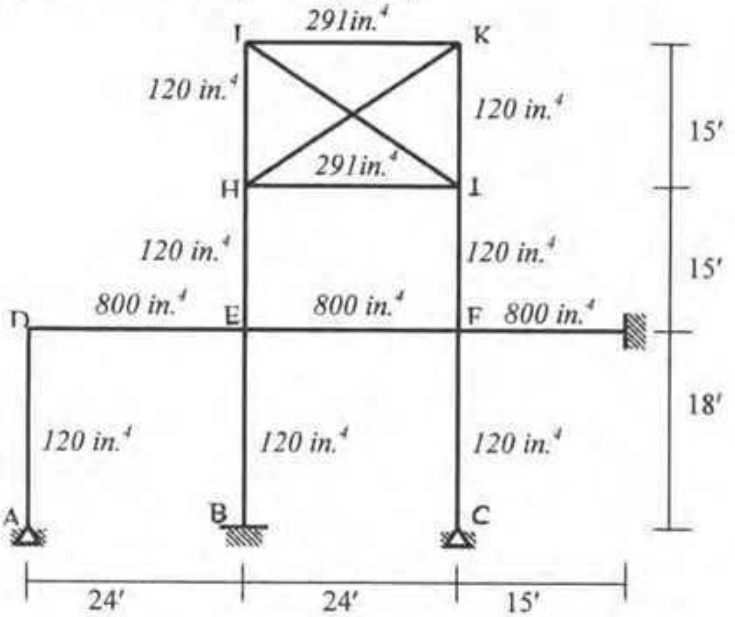
1 (a)	Make a comparison between oral and written form of communication.	2.5
(b)	Briefly explain with an example how the environment affects the communication process?	3.5
(c)	What is the main difference between an interpretative and an informational report?	2
(d)	What is a report? What are the general characteristics of a report?	2
2 (a)	What is prequalification of tenderers? Why is it required?	2
(b)	What is the difference between 'Result' and 'Conclusion' section of a report? Give an example.	3
(c)	Draw the flowchart for communication process.	5
3 (a)	You are not supposed to compete unfairly against fellow engineers, yet you can sometimes make formal complaints against fellow engineers. When?	2
(b)	What are the 7 C's of communication?	2.5
(c)	What are the different delivery styles for oral presentations? Which one will you choose to make a presentation in a conference?	2.5
(d)	What organizational plan shall you use to deny a request made by a client?	1.5
(e)	We have mentioned that personal focus (you) in letters is a generally a good idea. Give an example when is it better not to focus on the individual.	1.5
4 (a)	Say, you are the Chief Engineer at the PWD. Write a memo to your colleagues encouraging enhanced use of e-mails for communication.	7
(b)	Name the various stages of the tender procedure.	1
(c)	What is the purpose of tender procedure?	2
5 (a)	What is a project?	1
(b)	Draw a project life cycle curve showing the phases of a project.	4
(c)	Name the five types of contracting for a project.	2
(d)	What are the fundamental principles of ASCE code of ethics for engineers?	3
6	Say, you are the Director of Dhaka Transport Coordination Board (DTCB). DTCB is planning to construct an underground metro rail system for Dhaka and you have to decide a specific type of contract for the project. Write a memo to the Minister of Communication justifying your choice of contract type. (emphasis on content, not memo style)	10

The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2009
Program: B. Sc Engineering (Civil)

Course Title: Structural Engineering VI Course Code: CE 417 Credit: 2.00
Time : 2.00 Hours Full Marks:100 (= 10 × 5)

[Answer **any 05 (five)** of the following 07 questions]

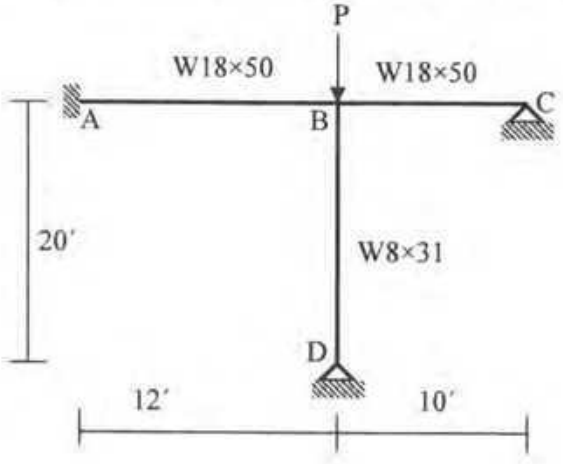
1(a). Determine the effective lengths for column CF, FI and BE of the following frame. The moments of inertia for the columns and beams are shown in the figure **[14]**
[Use nomograph provided with the question paper].



1(b). Define (i) Stiffened element (ii) Lateral torsional buckling and (iii)Compact section **[06]**

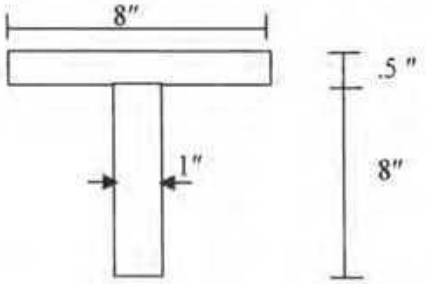
2(a). For the frame shown in figure, determine the critical load P. All members are made of A36 steel. **[15]**

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

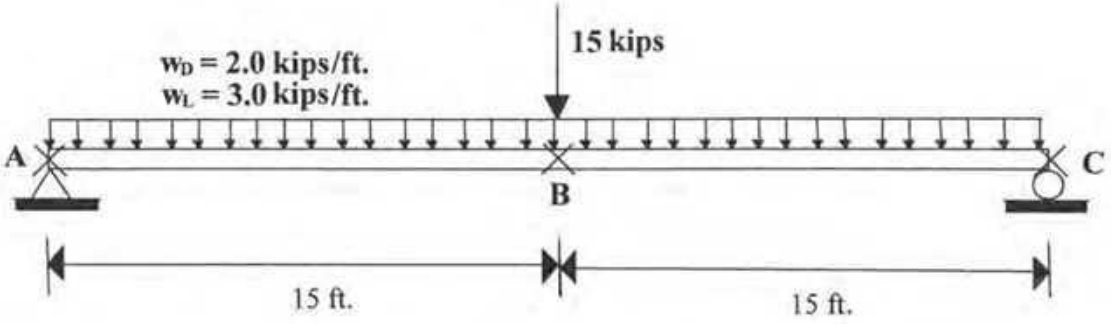


Beam	Column
W18×50	W8×31
I_x= 800 in^4	I_x= 110 in^4
A=14.7 in.^{2}	A=9.13 in.^{2}
r_x= 7.38 in.	r_x=3.47 in.

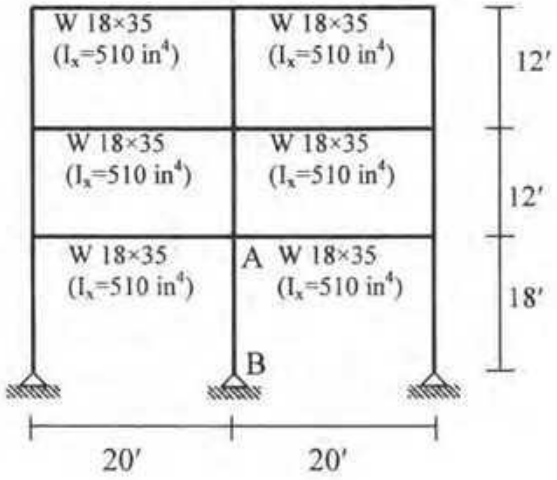
2(b). The section shown in the following figure is selected to be used as beam. Find the value of Plastic moment, (M_p) of this section about major axis. Use F_y= 36 ksi **[05]**



3. Select the lightest W section to carry the uniformly distributed dead load (excluding self wt.) of 2 kips/ft. and the uniformly distributed live load of 3 kips/ft on a 24 ft span simply supported beam as shown in the following figure. A concentrated live load of 15 kips acts at the mid-span. Lateral supports are provided at the end reactions and at the mid-span. Use steel with F_y=65 ksi and AISC/ASD method of design. **[20]**



4. Select the lightest W section (F_y=50 ksi) for Column AB. Use AISC/LRFD method of design. **[20]**
Given: DL=50^k and LL=150^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.



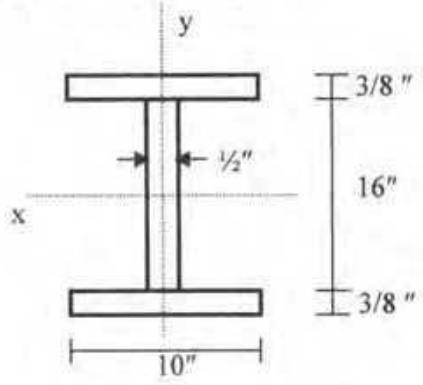
5(a). A simply supported beam of span 20' long having an I section as shown in figure is subjected to transverse load acting through the shear center. Determine the critical intensity of load w in lb/ft for lateral torsional buckling of the beam. **[15]**

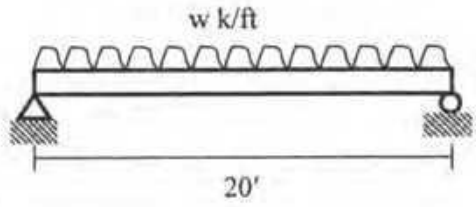
Given: Effective length co-efficient=1, Poisson's ratio=0.25, C_b=1.13, E=30,000 ksi

Critical moment for lateral torsional buckling is given by

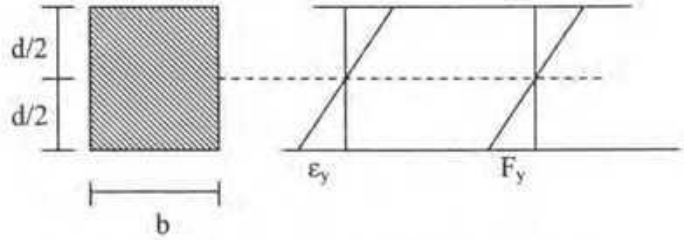
$$M_{x_{cr}}^2 = C_b^2 \left[\frac{\pi^2}{(KL)^2} EI_y GJ + \frac{\pi^4}{(KL)^4} EI_y EC_w \right]$$

here, $C_w = I_y d^2/4$ and $J = \sum(bt^3/3)$





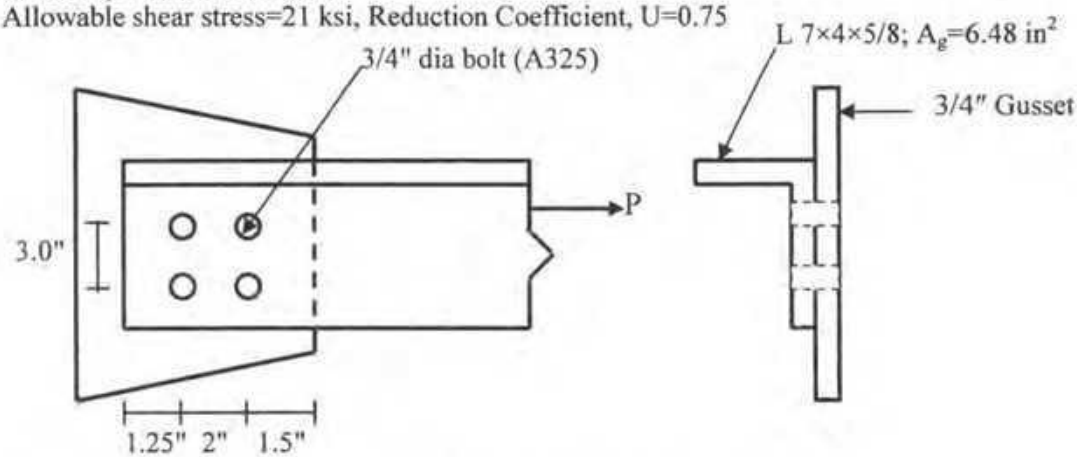
5(b). For a rectangular cross section of a steel member shown in figure., strain and stress diagrams at yield are given. Yield moment capacity for the section is given by $M_y = F_y S$, where, section modulus, $S = bd^2/6$. If the section is strained 5 times its yield strain ε_y, what will be its bending moment in terms of M_y ? **[05]**



6. Determine the capacity of the connection using AISC/ASD method. **[16]**

Given: F_y= 36 ksi, F_u=58 ksi

Allowable shear stress=21 ksi, Reduction Coefficient, U=0.75



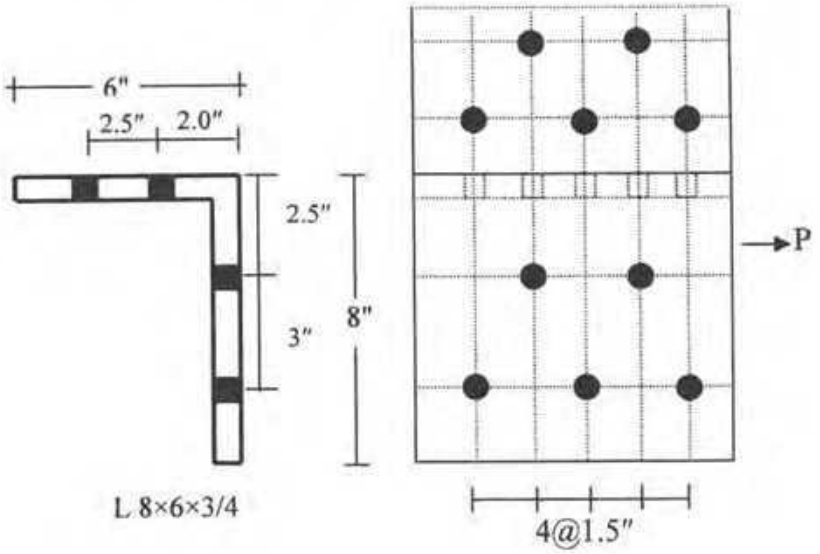
Allowable stress on gross area= $0.6F_y$ and on effective net area =$0.5F_u$

Allowable load on block shear= $0.3F_uA_{nv} + 0.5F_uA_{nt}$

7(a). Write short notes on [06]
(i) Weathering steel and (ii) Slip critical connection in bolted connection

7(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]

7(c). Find the design tensile strength of the angle shown in the following figure. [10]
Assume F_y=36 ksi, F_u=58 ksi and holes are for ¾ in. diameter bolt.



ALLOWABLE STRESS DESIGN SELECTION TABLE
For shapes used as beams

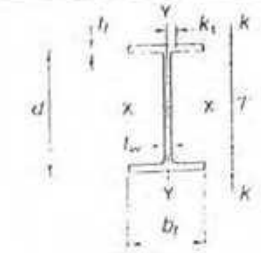
S_x

F_y = 50 ksi			S_x	Shape	Depth d	F_y'	F_y = 36 ksi		
L_c	L_u	M_R					L_c	L_u	M_R
Ft	Ft	Kip-ft	$In.^3$		In.	Ksi	Ft	Ft	Kip-ft
10.3	11.1	1230	448	W 33×141	33¼	—	12.2	15.4	887
8.8	11.0	1210	439	W 36×135	35½	—	12.3	13.0	869
9.4	13.4	1200	436	W 30×140	30⅝	—	11.1	18.7	863
10.3	35.5	1150	419	W 18×211	20⅝	—	12.2	49.3	830
11.2	27.1	1150	417	W 21×182	22¼	—	13.2	37.6	826
11.6	21.1	1140	414	W 24×162	25	—	13.7	29.3	820
12.5	16.6	1130	411	W 27×146	27⅜	—	14.7	23.0	814
9.9	10.8	1120	406	W 33×130	33¼	—	12.1	13.8	804
9.4	11.6	1050	380	W 30×132	30¼	—	11.1	16.1	752
11.1	25.1	1050	380	W 21×166	22½	—	13.1	34.8	752
10.3	32.7	1050	380	W 18×192	20⅜	—	12.1	45.4	752
11.6	18.9	1020	371	W 24×146	24¾	—	13.6	26.3	735
8.6	10.7	987	359	W 33×118	32⅞	—	12.0	12.6	711
9.4	10.8	976	355	W 30×124	30⅛	—	11.1	15.0	703
9.0	13.3	949	345	W 27×129	27⅝	—	10.6	18.4	683
10.2	30.0	948	344	W 18×175	20	—	12.0	41.7	681
9.4	9.9	905	329	W 30×116	30	—	11.1	13.8	651
11.5	16.8	905	329	W 24×131	24½	—	13.6	23.4	651
11.2	21.8	905	329	W 21×147	22	—	13.2	30.3	651
10.1	27.5	853	310	W 18×158	19¼	—	11.9	38.3	614
8.9	9.8	822	299	W 30×108	29⅞	—	11.1	12.3	592
9.0	11.5	822	299	W 27×114	27¼	—	10.6	15.9	592
11.1	19.6	811	295	W 21×132	21⅞	—	13.1	27.2	584
11.5	14.9	800	291	W 24×117	24¼	—	13.5	20.8	576
10.0	25.3	776	282	W 18×143	19½	—	11.8	35.1	558
11.1	18.3	751	273	W 21×122	21⅛	—	13.1	25.4	541
7.9	9.7	740	269	W 30× 99	29¾	—	10.9	11.4	533
9.0	10.2	734	267	W 27×102	27⅛	—	10.6	14.2	529
11.4	13.2	710	258	W 24×104	24	58.5	13.5	18.4	511
10.0	23.1	704	256	W 18×130	19¼	—	11.8	32.2	507
11.1	16.8	685	249	W 21×111	21½	—	13.0	23.3	493
7.2	9.6	674	245	W 30× 90	29½	58.1	10.0	11.4	485
8.1	12.0	674	245	W 24×103	24½	—	9.5	16.7	485
8.9	9.5	668	243	W 27× 94	26⅞	—	10.5	12.8	481
10.1	21.0	635	231	W 18×119	19	—	11.9	29.1	457
11.0	15.4	624	227	W 21×101	21⅜	—	13.0	21.3	449
8.1	10.9	611	222	W 24× 94	24¼	—	9.6	15.1	440
8.0	9.4	586	213	W 27× 84	26¾	—	10.5	11.0	422
10.0	18.7	561	204	W 18×106	18¾	—	11.8	26.0	404
8.1	9.6	539	196	W 24× 84	24⅛	—	9.5	13.3	388
7.5	12.1	528	192	W 21× 93	21⅝	—	8.9	16.8	380
13.1	31.7	523	190	W 14×120	14½	—	15.5	44.1	376
10.0	17.4	517	188	W 18× 97	18⅝	—	11.8	24.1	372

ALLOWABLE STRESS DESIGN SELECTION TABLE
For shapes used as beams

S_x

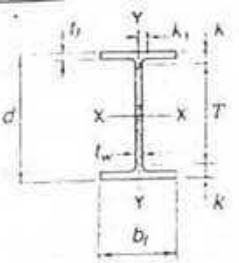
F_y = 50 ksi			S_x	Shape	Depth d	F_y'	F_y = 36 ksi		
L_c	L_u	M_R					L_c	L_u	M_R
Ft	Ft	Kip-ft	$In.^3$		In.	Ksi	Ft	Ft	Kip-ft
8.1	8.6	484	176	W 24× 76	23⅞	—	9.5	11.8	348
9.3	20.2	481	175	W 16×100	17	—	11.0	28.1	347
13.1	29.2	476	173	W 14×109	14⅜	58.6	15.4	40.6	343
7.5	10.9	470	171	W 21× 83	21⅜	—	8.8	15.1	339
9.9	15.5	457	166	W 18× 86	18⅜	—	11.7	21.5	329
13.0	26.7	432	157	W 14× 99	14⅛	48.5	15.4	37.0	311
9.3	18.0	426	155	W 16× 89	16¾	—	10.9	25.0	307
7.4	8.5	424	154	W 24× 68	23¾	—	9.5	10.2	305
7.4	9.6	415	151	W 21× 73	21¼	—	8.8	13.4	299
9.9	13.7	402	146	W 18× 76	18¼	64.2	11.6	19.1	289
13.0	24.5	393	143	W 14× 90	14	40.4	15.3	34.0	283
7.4	8.9	385	140	W 21× 68	21⅛	—	8.7	12.4	277
9.2	15.8	369	134	W 16× 77	16½	—	10.9	21.9	265
5.8	6.4	360	131	W 24× 62	23¾	—	7.4	8.1	259
7.4	8.1	349	127	W 21× 62	21	—	8.7	11.2	251
6.8	11.1	349	127	W 18× 71	18½	—	8.1	15.5	251
9.1	20.2	338	123	W 14× 82	14¼	—	10.7	28.1	244
10.9	26.0	325	118	W 12× 87	12½	—	12.8	36.2	234
6.8	10.4	322	117	W 18× 65	18⅜	—	8.0	14.4	232
9.2	13.9	322	117	W 16× 67	16⅜	—	10.8	19.3	232
5.0	6.3	314	114	W 24× 55	23⅝	—	7.0	7.5	226
9.0	18.6	308	112	W 14× 74	14⅛	—	10.6	25.9	222
5.9	6.7	305	111	W 21× 57	21	—	6.9	9.4	220
6.8	9.6	297	108	W 18× 60	18¼	—	8.0	13.3	214
10.8	24.0	294	107	W 12× 79	12⅜	62.6	12.8	33.3	212
9.0	17.2	283	103	W 14× 68	14	—	10.6	23.9	204
6.7	8.7	270	98.3	W 18× 55	18⅛	—	7.9	12.1	195
10.8	21.9	268	97.4	W 12× 72	12¼	52.3	12.7	30.5	193
5.6	6.0	260	94.5	W 21× 50	20⅞	—	6.9	7.8	187
6.4	10.3	254	92.2	W 16× 57	16⅜	—	7.5	14.3	183
9.0	15.5	254	92.2	W 14× 61	13⅞	—	10.6	21.5	183
6.7	7.9	244	88.9	W 18× 50	18	—	7.9	11.0	176
10.7	20.0	238	87.9	W 12× 65	12⅛	43.0	12.7	27.7	174
4.7	5.9	224	81.6	W 21× 44	20⅝	—	6.6	7.0	162
6.3	9.1	223	81.0	W 16× 50	16¼	—	7.5	12.7	160
5.4	6.8	217	78.8	W 18× 46	18	—	6.4	9.4	156
9.0	17.5	215	78.0	W 12× 58	12¼	—	10.6	24.4	154
7.2	12.7	214	77.8	W 14× 53	13⅞	—	8.5	17.7	154
6.3	8.2	200	72.7	W 16× 45	16⅛	—	7.4	11.4	144
9.0	15.9	194	70.6	W 12× 53	12	55.9	10.6	22.0	140
7.2	11.5	193	70.3	W 14× 48	13¾	—	8.5	16.0	139



W SHAPES
Dimensions

Designation	Area A	Depth d		Web Thickness t_w		$\frac{t_w}{2}$	Flange Width b_f		Flange Thickness t_f		Distance T	Distance k	Distance k_1
	In.²	In.		In.		In.	In.		In.		In.	In.	In.
W 21×402*	118.0	26.02	26	1.730	1¾	⅞	13.405	13⅜	3.130	3⅛	18¼	3⅛	1⁹⁄₁₆
×364*	107.0	25.47	25½	1.590	1⅝	¹³⁄₁₆	13.265	13¼	2.850	2⅞	18¼	3⅛	1⅝
×333*	97.9	25.00	25	1.460	1⅜	¾	13.130	13⅛	2.620	2⅝	18¼	3⅛	1⁹⁄₁₆
×300*	88.2	24.53	24½	1.320	1⅜	¹¹⁄₁₆	12.990	13	2.380	2⅜	18¼	3⅛	1¼
×275*	80.8	24.13	24⅛	1.220	1¼	⅝	12.890	12⅞	2.190	2³⁄₁₆	18¼	3	1³⁄₁₆
×248*	72.8	23.74	23¾	1.100	1⅛	⁹⁄₁₆	12.775	12¾	1.990	2	18¼	2¾	1⅛
×223	65.4	23.35	23⅜	1.000	1	½	12.675	12⅝	1.790	1¹³⁄₁₆	18¼	2⁹⁄₁₆	1⅛
×201	59.2	23.03	23	0.910	⅞	½	12.575	12⅝	1.630	1⅝	18¼	2⅜	1
×182	53.6	22.72	22¾	0.830	¹³⁄₁₆	⁷⁄₁₆	12.500	12½	1.480	1½	18¼	2¼	1
×166	48.8	22.48	22½	0.750	¾	⅜	12.420	12⅜	1.360	1⅜	18¼	2⅛	⁹⁄₁₆
×147	43.2	22.06	22	0.720	¾	⅜	12.510	12½	1.150	1⅛	18¼	1⅞	1⁹⁄₁₆
×132	38.8	21.83	21⅞	0.650	⅝	⁵⁄₁₆	12.440	12½	1.035	1¹⁄₁₆	18¼	1¹³⁄₁₆	1
×122	35.9	21.68	21⅝	0.600	⅝	⁵⁄₁₆	12.390	12⅜	0.960	¹⁵⁄₁₆	18¼	1¹³⁄₁₆	1
×111	32.7	21.51	21½	0.550	⁹⁄₁₆	⁵⁄₁₆	12.340	12⅜	0.875	⅞	18¼	1¾	⁹⁄₁₆
×101	29.8	21.36	21⅜	0.500	½	¼	12.290	12¼	0.800	¹³⁄₁₆	18¼	1¾₁₆	⁹⁄₁₆
W 21× 93	27.3	21.62	21⅝	0.580	⁹⁄₁₆	⁵⁄₁₆	8.420	8⅜	0.930	¹⁵⁄₁₆	18¼	1¹³⁄₁₆	1
× 83	24.3	21.43	21⅜	0.515	½	¼	8.355	8⅜	0.835	¹³⁄₁₆	18¼	1⁹⁄₁₆	⁹⁄₁₆
× 73	21.5	21.24	21¼	0.455	⁷⁄₁₆	¼	8.295	8¼	0.740	¾	18¼	1½	⁹⁄₁₆
× 68	20.0	21.13	21⅛	0.430	⁷⁄₁₆	¼	8.270	8¼	0.685	¹¹⁄₁₆	18¼	1⁷⁄₁₆	⅝
× 62	18.3	20.99	21	0.400	⅜	³⁄₁₆	8.240	8¼	0.615	⅝	18¼	1⅜	⅝
W 21× 57	16.7	21.06	21	0.405	⅜	³⁄₁₆	6.555	6½	0.650	⅝	18¼	1⅜	⅝
× 50	14.7	20.83	20⅞	0.380	⅜	³⁄₁₆	6.530	6½	0.535	⁹⁄₁₆	18¼	1⁵⁄₁₆	⅝
× 44	13.0	20.66	20⅝	0.350	⅜	³⁄₁₆	6.500	6½	0.450	⁷⁄₁₆	18¼	1³⁄₁₆	⅝

*For application refer to Notes in Table 2.
Shapes in shaded rows are not available from domestic producers.



W SHAPES
Properties

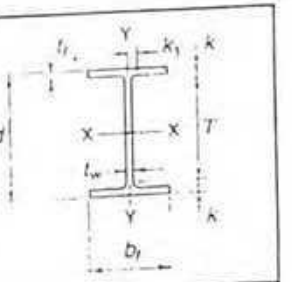
Nominal Wt. per Ft	Compact Section Criteria $\frac{b_f}{2t_f}$	Compact Section Criteria F_y	Compact Section Criteria $\frac{d}{t_w}$	Compact Section Criteria F_y	r_T	$\frac{d}{A_f}$	Elastic Properties Axis X-X I	Axis X-X S	Axis X-X r	Axis Y-Y I	Axis Y-Y S	Axis Y-Y r	Plastic Modulus Z_x	Plastic Modulus Z_y
Lb.		Ksi		Ksi	In.		In.⁴	In.³	In.	In.⁴	In.³	In.	In.³	In.³
402	2.1	—	15.0	—	3.63	0.62	12200	937	10.2	1270	189	3.27	1130	296
364	2.3	—	16.0	—	3.59	0.67	10800	846	10.0	1120	168	3.23	1010	263
333	2.5	—	17.1	—	3.55	0.73	9610	769	9.91	994	151	3.19	915	237
300	2.7	—	18.6	—	3.51	0.78	8480	692	9.81	873	134	3.15	816	210
275	2.9	—	19.8	—	3.48	0.85	7620	632	9.71	785	122	3.12	741	189
248	3.2	—	21.6	—	3.45	0.94	6760	569	9.63	694	109	3.09	663	169
223	3.5	—	23.4	—	3.41	1.02	5950	510	9.54	609	96.1	3.05	589	149
201	3.9	—	25.3	—	3.38	1.12	5310	461	9.47	542	86.1	3.02	530	133
182	4.2	—	27.4	—	3.36	1.23	4730	417	9.40	483	77.2	3.00	476	119
166	4.6	—	30.0	—	3.34	1.33	4280	380	9.36	435	70.1	2.98	432	108
147	5.4	—	30.6	—	3.34	1.53	3630	329	9.17	376	60.1	2.95	373	92.6
132	6.0	—	33.6	58.6	3.31	1.70	3220	295	9.12	333	53.5	2.93	333	82.3
122	6.5	—	36.1	50.6	3.30	1.82	2960	273	9.09	305	49.2	2.92	307	75.6
111	7.1	—	39.1	43.2	3.28	1.99	2670	249	9.05	274	44.5	2.90	279	68.2
101	7.7	—	42.7	36.2	3.27	2.17	2420	227	9.02	246	40.3	2.89	253	61.7
93	4.5	—	37.3	47.5	2.17	2.76	2070	192	8.70	92.9	22.1	1.84	221	34.7
83	5.0	—	41.6	38.1	2.15	3.07	1830	171	8.67	81.4	19.5	1.83	196	30.5
73	5.6	—	46.7	30.3	2.13	3.46	1600	151	8.64	70.6	17.0	1.81	172	26.6
68	6.0	—	49.1	27.4	2.12	3.73	1480	140	8.60	64.7	15.7	1.80	160	24.4
62	6.7	—	52.5	24.0	2.10	4.14	1330	127	8.54	57.5	13.9	1.77	144	21.7
57	5.0	—	52.0	24.4	1.64	4.94	1170	111	8.36	30.6	9.35	1.35	129	14.8
50	6.1	—	54.8	22.0	1.60	5.96	984	94.5	8.18	24.9	7.64	1.30	110	12.2
44	7.2	—	59.0	19.0	1.57	7.06	843	81.6	8.06	20.7	6.36	1.26	95.4	10.2

W SHAPES
Dimensions

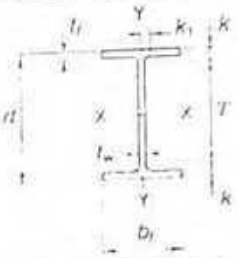
	Area	Depth		Web			Flange				Distance		
				Thickness		$\frac{t_w}{2}$	Width		Thickness		T	k	k_1
	A	d		t_w			b_f		t_f				
	In.²	In.		In.		In.	In.		In.		In.	In.	In.
W 18×311*	91.5	22.32	22⅜	1.520	1½	¾	12.005	12	2.740	2¾	15½	3⅞	1⅞
×283*	83.2	21.85	21⅞	1.400	1⅜	¹¹⁄₁₆	11.890	11⅞	2.500	2½	15½	3⅛	1¾
×258*	75.9	21.46	21½	1.280	1¼	⅝	11.770	11¾	2.300	2⅜	15½	3	1⅛
×234*	68.8	21.06	21	1.160	1⅛	⅝	11.650	11⅝	2.110	2⅛	15½	2¾	1
×211*	62.1	20.67	20⅝	1.060	1⅛	⅝	11.555	11½	1.910	1¹⁵⁄₁₆	15½	2⅝	1
×192	56.4	20.35	20⅜	0.960	1	½	11.455	11½	1.750	1¾	15½	2½	¹⁵⁄₁₆
×175	51.3	20.04	20	0.890	⅞	⅞	11.375	11⅜	1.590	1⅝	15½	2¼	⅞
×158	46.3	19.72	19¾	0.810	¹³⁄₁₆	⅞	11.300	11¼	1.440	1⅜	15½	2	¹³⁄₁₆
×143	42.1	19.49	19½	0.730	¾	⅜	11.220	11¼	1.320	1⅜	15½	1⅞	¹³⁄₁₆
×130	38.2	19.25	19¼	0.670	¹¹⁄₁₆	⅜	11.160	11⅛	1.200	1³⁄₁₆	15½	1¾	¹³⁄₁₆
W 18×119	35.1	18.97	19	0.655	⅝	⅜	11.265	11¼	1.060	1⅛	15½	1¼	¹³⁄₁₆
×106	31.1	18.73	18¾	0.590	⅝	⅜	11.200	11¼	0.940	¹⁵⁄₁₆	15½	1⅛	¹³⁄₁₆
× 97	28.5	18.59	18⅝	0.535	½	⅜	11.145	11⅛	0.870	⅞	15½	1¹⁄₁₆	⅞
× 86	25.3	18.39	18⅜	0.480	½	¼	11.090	11⅛	0.770	¾	15½	1	⅞
× 76	22.3	18.21	18¼	0.425	⅜	¼	11.035	11	0.680	¹¹⁄₁₆	15½	1	¹³⁄₁₆
W 18× 71	20.8	18.47	18½	0.495	½	¼	7.635	7⅝	0.810	¹³⁄₁₆	15½	1½	⅝
× 65	19.1	18.35	18⅜	0.450	⅜	¼	7.590	7⅝	0.750	¾	15½	1⅜	⅝
× 60	17.6	18.24	18¼	0.415	⅜	¼	7.555	7½	0.695	¹¹⁄₁₆	15½	1⅜	¹³⁄₁₆
× 55	16.2	18.11	18⅛	0.390	⅜	⅜	7.530	7½	0.630	⅝	15½	1¼	¹³⁄₁₆
× 50	14.7	17.99	18	0.355	⅜	⅜	7.495	7½	0.570	⅝	15½	1¼	¹³⁄₁₆
W 18× 46	13.5	18.06	18	0.360	⅜	⅜	6.060	6	0.605	⅝	15½	1¼	¹³⁄₁₆
× 40	11.8	17.90	17⅞	0.315	⅜	⅜	6.015	6	0.525	½	15½	1¹⁄₁₆	¹³⁄₁₆
× 35	10.3	17.70	17¾	0.300	⅜	⅜	6.000	6	0.425	⅜	15½	1⅛	¾
W 16×100	29.4	16.97	17	0.585	⅝	⅜	10.425	10⅜	0.985	1	13⅜	1¹⁵⁄₁₆	¹³⁄₁₆
× 89	26.2	16.75	16¾	0.525	½	⅜	10.365	10⅜	0.875	⅞	13⅜	1¹³⁄₁₆	⅞
× 77	22.6	16.52	16½	0.455	⅜	⅜	10.295	10¼	0.760	¾	13⅜	1⅝	⅞
× 67	19.7	16.33	16⅜	0.395	⅜	⅜	10.235	10¼	0.665	¹¹⁄₁₆	13⅜	1⅜	¹³⁄₁₆
W 16× 57	16.8	16.43	16¾	0.430	⅜	¼	7.120	7⅛	0.715	¹¹⁄₁₆	13⅜	1⅜	⅞
× 50	14.7	16.26	16¼	0.380	⅜	⅜	7.070	7⅛	0.630	⅝	13⅜	1¹⁄₁₆	¹³⁄₁₆
× 45	13.3	16.13	16⅛	0.345	⅜	⅜	7.035	7	0.565	⅝	13⅜	1⅛	¹³⁄₁₆
× 40	11.8	16.01	16	0.305	⅜	⅜	6.995	7	0.505	½	13⅜	1⅛	¹³⁄₁₆
× 36	10.6	15.86	15⅞	0.295	⅜	⅜	6.985	7	0.430	⅜	13⅜	1⅛	¾

*For application refer to Notes in Table 2.

W SHAPES
Properties



Nominal Wt. per Ft	Compact Section Criteria				r_T	$\frac{d}{A_f}$	Elastic Properties						Plastic Modulus	
							Axis X-X			Axis Y-Y			Z_x	Z_y
	$\frac{b_f}{2t_f}$	F_y^*	$\frac{d}{t_w}$	F_y^{**}			I	S	r	I	S	r		
Lb.		Ksi		Ksi	In.		In.⁴	In.³	In.	In.⁴	In.³	In.	In.³	In.³
311	2.2	—	14.7	—	3.26	0.68	9960	624	8.72	795	132	2.95	753	207
283	2.4	—	15.6	—	3.23	0.74	6160	564	8.61	704	118	2.91	676	185
258	2.6	—	16.8	—	3.19	0.79	5510	514	8.53	628	107	2.88	611	166
234	2.8	—	18.2	—	3.16	0.86	4900	466	8.44	558	95.8	2.85	549	149
211	3.0	—	19.5	—	3.13	0.94	4330	419	8.35	493	85.3	2.82	490	132
192	3.3	—	21.2	—	3.10	1.02	3870	380	8.28	440	76.8	2.79	442	119
175	3.6	—	22.5	—	3.07	1.11	3450	344	8.20	391	68.8	2.76	393	106
158	3.9	—	24.3	—	3.05	1.21	3060	310	8.12	347	61.4	2.74	355	94.8
143	4.2	—	26.7	—	3.03	1.32	2750	282	8.09	311	55.5	2.72	322	85.4
130	4.6	—	28.7	—	3.01	1.44	2460	256	8.03	278	49.9	2.70	291	76.7
119	5.3	—	29.0	—	3.02	1.59	2100	231	7.90	253	44.9	2.69	261	69.1
106	6.0	—	31.7	—	3.00	1.78	1910	204	7.84	220	39.4	2.66	230	60.5
97	6.4	—	34.7	54.7	2.99	1.92	1750	188	7.82	201	36.1	2.65	211	55.3
86	7.2	—	38.3	45.0	2.97	2.15	1530	166	7.77	175	31.6	2.63	185	48.4
76	8.1	64.2	42.8	36.0	2.95	2.43	1330	146	7.73	152	27.6	2.61	163	42.2
71	4.7	—	37.3	47.4	1.98	2.99	1170	127	7.50	60.3	15.8	1.70	145	24.7
65	5.1	—	40.8	39.7	1.97	3.22	1070	117	7.49	54.8	14.4	1.69	133	22.5
60	5.4	—	44.0	34.2	1.96	3.47	984	108	7.47	50.1	13.3	1.69	123	20.6
55	6.0	—	46.4	30.6	1.95	3.82	890	98.3	7.41	44.9	11.9	1.67	112	18.5
50	6.6	—	50.7	25.7	1.94	4.21	800	88.9	7.38	40.1	10.7	1.65	101	16.6
46	5.0	—	50.2	26.2	1.54	4.93	712	78.8	7.25	22.5	7.43	1.29	90.7	11.7
40	5.7	—	56.8	20.5	1.52	5.67	612	68.4	7.21	19.1	6.35	1.27	78.4	9.95
35	7.1	—	59.0	19.0	1.49	6.94	510	57.6	7.04	15.3	5.12	1.22	66.5	8.06
100	5.3	—	29.0	—	2.81	1.65	1490	175	7.10	186	35.7	2.51	198	54.9
89	5.9	—	31.9	64.9	2.79	1.85	1300	155	7.05	163	31.4	2.49	175	48.1
77	6.8	—	36.3	50.1	2.77	2.11	1110	134	7.00	138	26.9	2.47	150	41.1
67	7.7	—	41.3	38.6	2.75	2.40	954	117	6.96	119	23.2	2.46	130	35.5
57	5.0	—	38.2	45.2	1.86	3.23	758	92.2	6.72	43.1	12.1	1.60	105	18.9
50	5.6	—	42.8	36.1	1.84	3.65	659	81.0	6.68	37.2	10.5	1.59	92.0	16.3
45	6.2	—	46.8	30.2	1.83	4.06	586	72.7	6.65	32.8	9.34	1.57	82.3	14.5
40	6.9	—	52.5	24.0	1.82	4.53	518	64.7	6.63	28.9	8.25	1.57	72.9	12.7
36	8.1	64.0	53.8	22.9	1.79	5.28	448	56.5	6.51	24.5	7.00	1.52	64.0	10.6

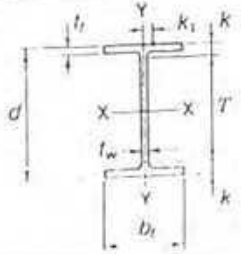


W SHAPES
Dimensions

Designation	Area A	Depth d		Web Thickness t_w		$\frac{t_w}{2}$	Flange Width b_f		Flange Thickness t_f		Distance T	Distance k	Distance k_1
	In.^{2}	In.		In.		In.	In.		In.		In.	In.	In.
W 14 × 132	38.8	14.66	14⅝	0.645	⅝	5/16	14.725	14¾	1.030	1	11¼	1 1/16	1 5/16
× 120	35.3	14.48	14½	0.590	9/16	5/16	14.670	14⅝	0.940	15/16	11¼	1⅛	1 5/16
× 109	32.0	14.32	14⅜	0.525	½	¼	14.605	14⅝	0.860	⅞	11¼	1 1/16	⅛
× 99	29.1	14.16	14⅛	0.485	½	¼	14.565	14⅝	0.780	¾	11¼	1 1/16	⅛
× 90	26.5	14.02	14	0.440	7/16	¼	14.520	14½	0.710	11/16	11¼	1⅛	⅛
W 14 × 82	24.1	14.31	14¼	0.510	½	¼	10.130	10⅛	0.855	⅞	11	1⅛	1
× 74	21.8	14.17	14⅛	0.450	7/16	¼	10.070	10⅛	0.785	13/16	11	1 1/16	1 5/16
× 68	20.0	14.04	14	0.415	7/16	¼	10.035	10	0.720	¾	11	1½	1 5/16
× 61	17.9	13.89	13⅞	0.375	⅜	3/16	9.995	10	0.645	⅝	11	1 3/16	1 5/16
W 14 × 53	15.6	13.92	13⅞	0.370	⅜	3/16	8.060	8	0.660	11/16	11	1 3/16	1 5/16
× 48	14.1	13.79	13¾	0.340	5/16	3/16	8.030	8	0.595	⅝	11	1⅛	⅞
× 43	12.6	13.66	13⅝	0.305	5/16	3/16	7.995	8	0.530	½	11	1 1/16	⅞
W 14 × 38	11.2	14.10	14⅛	0.310	5/16	3/16	6.770	6¾	0.515	½	12	1 1/16	⅝
× 34	10.0	13.98	14	0.285	5/16	3/16	6.745	6¾	0.455	7/16	12	1	⅝
× 30	8.85	13.84	13⅞	0.270	¼	⅛	6.730	6¾	0.385	⅜	12	15/16	⅝
W 14 × 26	7.69	13.91	13⅞	0.255	¼	⅛	5.025	5	0.420	7/16	12	15/16	9/16
× 22	6.49	13.74	13¾	0.230	¼	⅛	5.000	5	0.335	5/16	12	⅞	9/16

W SHAPES
Properties

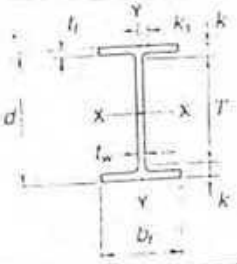
Nominal Wt. per Ft	Compact Section Criteria $\frac{b_f}{2t_f}$	F_y	$\frac{d}{t_w}$	F_y	r_T	$\frac{d}{A_f}$	Elastic Properties Axis X-X I	S	r	Axis Y-Y I	S	r	Plastic Modulus Z_x	Z_y
Lb		Ksi		Ksi	In.		In.^{4}	In.^{3}	In.	In.^{4}	In.^{3}	In.	In.^{3}	In.^{3}
132	7.1	—	22.7	—	4.05	0.97	1530	209	6.28	548	74.6	3.76	234	113
120	7.8	—	24.5	—	4.04	1.05	1380	190	6.24	495	67.5	3.74	210	102
109	8.5	58.6	27.3	—	4.02	1.14	1240	173	6.22	447	61.2	3.73	192	92.7
99	9.3	48.5	29.2	—	4.00	1.25	1110	157	6.17	402	55.2	3.71	173	83.6
90	10.2	40.4	31.9	—	3.99	1.36	999	143	6.14	362	49.9	3.70	157	75.6
82	5.9	—	28.1	—	2.74	1.65	882	123	6.05	148	29.3	2.48	133	44.8
74	6.4	—	31.5	—	2.72	1.79	796	112	6.04	134	26.6	2.48	120	40.6
68	7.0	—	33.8	57.7	2.71	1.94	723	103	6.01	121	24.2	2.46	110	36.9
61	7.7	—	37.0	48.1	2.70	2.15	640	92.2	5.98	107	21.5	2.45	98.0	32.8
53	6.1	—	37.6	46.7	2.15	2.62	541	77.8	5.89	57.7	14.3	1.92	87.1	22.0
48	6.7	—	40.6	40.2	2.13	2.89	485	70.3	5.65	51.4	12.6	1.91	78.4	19.6
43	7.5	—	44.8	32.9	2.12	3.22	428	62.7	5.62	45.2	11.3	1.89	69.6	17.3
38	6.6	—	45.5	31.9	1.77	4.04	385	54.6	5.87	26.7	7.88	1.55	61.5	12.1
34	7.4	—	49.1	27.4	1.76	4.56	340	48.6	5.83	23.3	6.91	1.53	54.0	10.6
30	8.7	55.3	51.3	25.1	1.74	5.34	291	42.0	5.73	19.6	5.82	1.49	47.3	8.99
26	6.0	—	54.5	22.2	1.28	6.59	245	35.3	5.65	8.91	3.54	1.08	40.2	5.54
22	7.5	—	59.7	18.5	1.25	8.20	199	29.0	5.54	7.00	2.80	1.04	33.2	4.39



W SHAPES
Dimensions

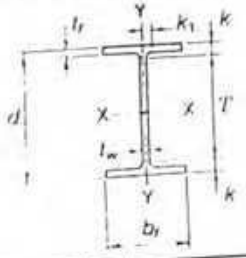
Design-nation	Area A	Depth d		Web			Flange				Distance		
				Thickness t_w		$\frac{t_w}{2}$	Width b_f		Thickness t_f		T	k	k_1
	In.^{2}	In.		In.		In.	In.		In.		In.	In.	In.
W 12×336*	98.8	16.82	16⅞	1.775	1¾	⅞	13.385	13⅜	2.955	2¹⁵⁄₁₆	9½	3¹⁵⁄₁₆	1½
×305*	89.6	16.32	16⅜	1.625	1⅝	¹³⁄₁₆	13.235	13¼	2.705	2¹³⁄₁₆	9½	3¹³⁄₁₆	1⁷⁄₁₆
×279*	81.9	15.85	15⅞	1.530	1½	¾	13.140	13⅛	2.470	2½	9½	3¹³⁄₁₆	1⅜
×252*	74.1	15.41	15⅜	1.395	1⅜	¹¹⁄₁₆	13.005	13	2.250	2¼	9½	2¹⁵⁄₁₆	1⁵⁄₁₆
×230*	67.7	15.05	15	1.285	1⅜	¹¹⁄₁₆	12.895	12⅞	2.070	2⅛	9½	2¾	1¼
×210*	61.8	14.71	14¾	1.180	1³⁄₁₆	⅝	12.790	12¾	1.900	1⅞	9½	2⅝	1¼
×190	55.8	14.38	14⅜	1.060	1⅛	⁹⁄₁₆	12.670	12⅝	1.735	1¾	9½	2½	1⅜
×170	50.0	14.03	14	0.960	¹⁵⁄₁₆	½	12.570	12½	1.560	1⁹⁄₁₆	9½	2¼	1⅛
×152	44.7	13.71	13¾	0.870	⅞	⁷⁄₁₆	12.480	12½	1.400	1⅜	9½	2⅛	1¹⁄₁₆
×136	39.9	13.41	13⅜	0.790	¹³⁄₁₆	⁷⁄₁₆	12.400	12⅜	1.250	1¼	9½	1¹⁵⁄₁₆	1
×120	35.3	13.12	13⅛	0.710	¹¹⁄₁₆	⅜	12.320	12⅜	1.105	1⅛	9½	1¹³⁄₁₆	¹⁵⁄₁₆
×106	31.2	12.89	12⅞	0.610	⅝	⁵⁄₁₆	12.220	12¼	0.990	1	9½	1¾	¹³⁄₁₆
× 96	28.2	12.71	12¾	0.550	⁹⁄₁₆	⁵⁄₁₆	12.160	12⅛	0.900	⅞	9½	1½	¾
× 87	25.6	12.53	12½	0.515	½	¼	12.125	12⅛	0.810	¹³⁄₁₆	9½	1⁷⁄₁₆	¾
× 79	23.2	12.38	12⅜	0.470	½	¼	12.080	12⅛	0.735	¾	9½	1⅜	¾
× 72	21.1	12.25	12¼	0.430	⁷⁄₁₆	¼	12.040	12	0.670	¹¹⁄₁₆	9½	1³⁄₁₆	¾
× 65	19.1	12.12	12⅛	0.390	⅜	³⁄₁₆	12.000	12	0.605	⅝	9½	1¹⁄₁₆	¹¹⁄₁₆
W 12× 58	17.0	12.19	12¼	0.360	⅜	³⁄₁₆	10.010	10	0.640	⅝	9½	1⅛	¹¹⁄₁₆
× 53	15.6	12.06	12	0.345	⅜	³⁄₁₆	9.995	10	0.575	⁹⁄₁₆	9½	1¼	⁵⁄₈
W 12× 50	14.7	12.19	12¼	0.370	⅜	³⁄₁₆	8.080	8⅛	0.640	⅝	9½	1⅛	¹¹⁄₁₆
× 45	13.2	12.06	12	0.335	⁵⁄₁₆	³⁄₁₆	8.045	8	0.575	⁹⁄₁₆	9½	1¼	⅝
× 40	11.8	11.94	12	0.295	⁵⁄₁₆	³⁄₁₆	8.005	8	0.515	½	9½	1¼	⅝
W 12× 35	10.3	12.50	12½	0.300	⁵⁄₁₆	³⁄₁₆	6.560	6½	0.520	½	10½	1	⁹⁄₁₆
× 30	8.79	12.34	12⅜	0.260	¼	⅛	6.520	6½	0.440	⁷⁄₁₆	10½	¹⁵⁄₁₆	½
× 26	7.65	12.22	12¼	0.230	¼	⅛	6.490	6½	0.380	⅜	10½	⅞	½
W 12× 22	6.48	12.31	12¼	0.260	¼	⅛	4.030	4	0.425	⁷⁄₁₆	10½	⅞	½
× 19	5.57	12.16	12⅛	0.235	¼	⅛	4.005	4	0.350	⅜	10½	¹³⁄₁₆	½
× 16	4.71	11.99	12	0.220	¼	⅛	3.990	4	0.265	¼	10½	¾	½
× 14	4.16	11.91	11⅞	0.200	³⁄₁₆	⅛	3.970	4	0.225	¼	10½	¹¹⁄₁₆	½

*For application refer to Notes in Table 2



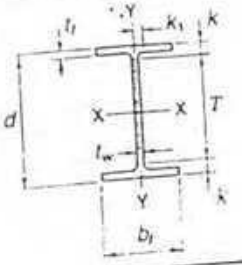
W SHAPES
Properties

Nominal Wt per Ft	Compact Section Criteria				r_T	$\frac{d}{A_f}$	Elastic Properties						Plastic Modulus	
							Axis X-X			Axis Y-Y			Z_x	Z_y
	$\frac{b_f}{2t_f}$	F_y'	$\frac{d}{t_w}$	F_y''			I	S	r	I	S	r		
Lb.		Ksi		Ksi	In.		In.^{4}	In.^{3}	In.	In.^{4}	In.^{3}	In.	In.^{3}	In.^{3}
336	2.3	—	9.5	—	3.71	0.43	4060	483	6.41	1190	177	3.47	603	274
305	2.4	—	10.0	—	3.67	0.46	3550	435	6.29	1050	159	3.42	537	244
279	2.7	—	10.4	—	3.64	0.49	3110	393	6.16	937	143	3.38	481	220
252	2.9	—	11.0	—	3.59	0.53	2720	353	6.06	828	127	3.34	428	196
230	3.1	—	11.7	—	3.56	0.56	2420	321	5.97	742	115	3.31	386	177
210	3.4	—	12.5	—	3.53	0.61	2140	292	5.89	664	104	3.28	348	159
190	3.7	—	13.6	—	3.50	0.65	1890	263	5.82	589	93.0	3.25	311	143
170	4.0	—	14.6	—	3.47	0.72	1650	235	5.74	517	82.3	3.22	275	126
152	4.5	—	15.8	—	3.44	0.79	1430	209	5.66	454	72.8	3.19	243	111
136	5.0	—	17.0	—	3.41	0.87	1240	186	5.58	398	64.2	3.16	214	98.0
120	5.6	—	18.5	—	3.38	0.96	1070	163	5.51	345	56.0	3.13	186	85.4
106	6.2	—	21.1	—	3.36	1.07	933	145	5.47	301	49.3	3.11	164	75.1
96	6.8	—	23.1	—	3.34	1.16	833	131	5.44	270	44.4	3.09	147	67.5
87	7.5	—	24.3	—	3.32	1.28	740	118	5.38	241	39.7	3.07	132	60.4
79	8.2	62.6	26.3	—	3.31	1.39	662	107	5.34	216	35.8	3.05	119	54.3
72	9.0	52.3	28.5	—	3.29	1.52	597	97.4	5.31	195	32.4	3.04	105	49.2
65	9.9	43.0	31.1	—	3.28	1.67	533	87.9	5.28	174	29.1	3.02	96.8	44.1
58	7.8	—	33.9	57.6	2.72	1.90	475	78.0	5.28	107	21.4	2.51	86.4	32.5
53	8.7	55.9	35.0	54.1	2.71	2.10	425	70.6	5.23	95.8	19.2	2.48	77.9	29.1
50	6.3	—	32.9	60.9	2.17	2.36	394	64.7	5.18	56.3	13.9	1.96	72.4	21.4
45	7.0	—	36.0	51.0	2.15	2.61	350	58.1	5.15	50.0	12.4	1.94	64.7	19.0
40	7.8	—	40.5	40.3	2.14	2.90	310	51.9	5.13	44.1	11.0	1.93	57.5	16.8
35	6.3	—	41.7	38.0	1.74	3.66	285	45.6	5.25	24.5	7.47	1.54	51.2	11.5
30	7.4	—	47.5	29.3	1.73	4.30	238	38.6	5.21	20.3	6.24	1.52	43.1	9.56
26	8.5	57.9	53.1	23.4	1.72	4.95	204	33.4	5.17	17.3	5.34	1.51	37.2	8.17
22	4.7	—	47.3	29.5	1.02	7.19	156	25.4	4.91	4.66	2.31	0.847	29.3	3.66
19	5.7	—	51.7	24.7	1.00	8.67	130	21.3	4.82	3.76	1.88	0.822	24.7	2.98
16	7.5	—	54.5	22.2	0.96	11.3	103	17.1	4.67	2.82	1.41	0.773	20.1	2.26
14	8.8	54.3	59.6	18.6	0.95	13.3	88.6	14.9	4.62	2.36	1.19	0.753	17.4	1.90



W SHAPES
Dimensions

Design-ation	Area A	Depth d		Web: Thickness t_w		Web: $\frac{t_w}{2}$	Flange: Width b_f		Flange: Thickness t_f		Distance: T	Distance: k	Distance: k_1
	In.^{2}	In.		In.		In.	In.		In.		In.	In.	In.
10 × 112	32.9	11.36	11⅜	0.755	¾	⅜	10.415	10⅜	1.250	1¼	7⅛	1⅞	1⁵⁄₁₆
× 100	29.4	11.10	11⅛	0.680	¹¹⁄₁₆	⅜	10.340	10⅜	1.120	1⅛	7⅛	1¾	⅞
× 88	25.9	10.84	10⅞	0.605	⅝	⅜	10.265	10¼	0.990	1	7⅛	1⅝	1⁵⁄₁₆
× 77	22.6	10.60	10⅝	0.530	½	¼	10.190	10¼	0.870	⅞	7⅛	1½	1⁵⁄₁₆
× 68	20.0	10.40	10⅜	0.470	½	¼	10.130	10⅛	0.770	¾	7⅛	1⅜	¾
× 60	17.6	10.22	10¼	0.420	⁷⁄₁₆	¼	10.080	10⅛	0.680	¹¹⁄₁₆	7⅛	1⅛	⅝
× 54	15.8	10.09	10⅛	0.370	⅜	⅛	10.030	10	0.615	⅝	7⅛	1¹⁄₁₆	1⁵⁄₁₆
× 49	14.4	9.98	10	0.340	⅜	⅛	10.000	10	0.560	⁹⁄₁₆	7⅛	1	1⁵⁄₁₆
10 × 45	13.3	10.10	10⅛	0.350	⅜	⅛	8.020	8	0.620	⅝	7⅛	1⅛	1⁵⁄₁₆
× 39	11.5	9.92	9¾	0.315	⁵⁄₁₆	⅛	7.985	8	0.530	½	7⅛	1⅛	1¹⁄₁₆
× 33	9.71	9.73	9¾	0.290	⁵⁄₁₆	⅛	7.960	8	0.435	⁷⁄₁₆	7⅛	1¹⁄₁₆	1¹⁄₁₆
10 × 30	8.84	10.47	10½	0.300	⁵⁄₁₆	⅛	5.810	5¾	0.510	½	8⅛	1⁵⁄₁₆	½
× 26	7.61	10.33	10⅜	0.260	¼	⅛	5.770	5¾	0.440	⁷⁄₁₆	8⅛	⅜	½
× 22	6.49	10.17	10⅛	0.240	¼	⅛	5.750	5¾	0.360	⅜	8⅛	¾	½
10 × 19	5.62	10.24	10¼	0.250	¼	⅛	4.020	4	0.395	⅜	8⅛	1⁵⁄₁₆	½
× 17	4.99	10.11	10⅛	0.240	¼	⅛	4.010	4	0.330	⁵⁄₁₆	8⅛	¾	½
× 15	4.41	9.99	10	0.230	¼	⅛	4.000	4	0.270	¼	8⅛	1¹⁄₁₆	⅜₁₆
× 12	3.54	9.87	9⅞	0.190	³⁄₁₆	⅛	3.960	4	0.210	³⁄₁₆	8⅛	⅝	⅞₁₆



W SHAPES
Properties

Nominal Wt. per Ft	Compact Section Criteria: $\frac{b_f}{2t_f}$	Compact Section Criteria: F_y	Compact Section Criteria: $\frac{d}{t_w}$	Compact Section Criteria: F_y	r_T	$\frac{d}{A_f}$	Elastic Properties: Axis X-X I	Axis X-X S	Axis X-X r	Axis Y-Y I	Axis Y-Y S	Axis Y-Y r	Plastic Modulus Z_x	Plastic Modulus Z_y
Lb.		Ksi		Ksi	In.		In.^{4}	In.^{3}	In.	In.^{4}	In.^{3}	In.	In.^{3}	In.^{3}
112	4.2	—	15.0	—	2.88	0.87	716	126	4.66	236	45.3	2.68	147	69.2
100	4.6	—	16.3	—	2.85	0.96	623	112	4.60	207	40.0	2.65	130	61.0
88	5.2	—	17.9	—	2.83	1.07	534	98.5	4.54	179	34.8	2.63	113	53.1
77	5.9	—	20.0	—	2.80	1.20	455	85.9	4.49	154	30.1	2.60	97.6	45.9
68	6.6	—	22.1	—	2.79	1.33	394	75.7	4.44	134	26.4	2.59	85.3	40.1
60	7.4	—	24.3	—	2.77	1.49	341	66.7	4.39	116	23.0	2.57	74.6	35.0
54	8.2	63.5	27.3	—	2.75	1.64	303	60.0	4.37	103	20.6	2.56	66.6	31.3
49	8.9	53.0	29.4	—	2.74	1.79	272	54.6	4.35	93.4	18.7	2.54	60.4	28.3
45	6.5	—	28.9	—	2.18	2.03	248	49.1	4.32	53.4	13.3	2.01	54.9	20.3
39	7.5	—	31.5	—	2.16	2.34	209	42.1	4.27	45.0	11.3	1.98	46.8	17.2
33	9.1	50.5	33.6	58.7	2.14	2.81	170	35.0	4.19	36.6	9.20	1.94	38.8	14.0
30	5.7	—	34.9	54.2	1.55	3.53	170	32.4	4.38	16.7	5.75	1.37	36.6	8.84
26	6.6	—	39.7	41.8	1.54	4.07	144	27.9	4.35	14.1	4.89	1.36	31.3	7.50
22	8.0	—	42.4	36.8	1.51	4.91	118	23.2	4.27	11.4	3.97	1.33	26.0	6.10
19	5.1	—	41.0	39.4	1.03	6.45	96.3	18.8	4.14	4.29	2.14	0.874	21.6	3.35
17	6.1	—	42.1	37.2	1.01	7.64	81.9	16.2	4.05	3.56	1.78	0.844	18.7	2.80
15	7.4	—	43.4	35.0	0.99	9.25	68.9	13.8	3.95	2.89	1.45	0.810	16.0	2.30
12	9.4	47.5	51.9	24.5	0.96	11.9	53.8	10.9	3.90	2.18	1.10	0.785	12.6	1.74

The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2009
Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering IV Course Code: CE 433 Credit: 2.00
Time: 2.00 Hours Full Marks: 135

Answer ANY THREE of the following four Questions.

1(a). A power plant discharges 300 kg of SO_2 per hour through a stack, which has an effective height of 60 meters. The wind velocity at a height of 10 m is 4.5 m/sec, and the atmosphere is "neutral". Determine ground level SO_2 concentration at 1 km downwind, along the center-line of the plume. (Given: p = 0.25; Table for calculation of dispersion coefficient provided) **25**

(b). How does a three-way catalytic converter help reduce emission of pollutants from a car? How air-fuel ratio affects efficiency of a catalytic converter? **10**

(c). Based on available data, which air pollutants are of particular concern in Dhaka? During which period air quality becomes worse? During which period air quality improves and what are the reasons for this improvement? **10**

2(a). On a particular day, cars are traveling at a speed of 50 km/hr and average distance between cars is 20 m. each car is emitting carbon monoxide (CO) at a rate of 5.2 g/km. Wind speed is 3.2 m/sec perpendicular to the road and the atmosphere is "neutral". Estimate the ground level concentration of CO at 1 km downwind. **20**

(b). What devices are available for control of particulate contaminants from industrial sources? **5**

(c). Explain the process of formation of H_2O-H_2SO_4 droplets in the atmosphere. Explain how sulfate particles affect visibility. **10**

(d). What mechanisms are most important for deposition of particles in the respiratory system? Provide appropriate sketches to explain these mechanisms. Which of these mechanisms are primarily responsible for the deposition of relatively smaller (< 0.5 mm) particles? **10**

3(a). Classify air pollutants according to origin, chemical composition and state of matter. Give at least two examples of each class. Also define primary and secondary pollutants. **10**

(b). What do you understand by "Thermal NO_x" and "Fuel NO_x"? What do you understand by photochemical smog? What are its principal constituents? **12**

(c). Particulates of anthropogenic (i.e. man-made) origin are considered more harmful compared to particulates of natural origin. Explain why. **10**

(d). With respect to internal combustion engines, what do you understand by: (i) stoichiometric ratio, (ii) lean mixture, (iii) rich mixture. Explain the effect of "air-fuel ratio" on emission of CO, HC and NO_x from a four-stroke engine. **13**

4(a). What do you understand by "unstable" atmosphere? Draw the shapes of "fumigating" and "lofting" plumes and the corresponding temperature structure. Also comment on the pollution potential of each plume. **10**

(b). What are the major pollutants of concern for diesel engines? Are catalytic converters suitable for controlling emissions from a diesel engine? Explain. **8**

(c). What are the major sources of carbon monoxide (CO) in urban areas? Explain how CO affects oxygen carrying capacity of blood. **10**

(d). On a global scale, what are the major sources of SO_x in the atmosphere? Why SO_x is particularly harmful in dusty atmosphere? Explain. **10**

(e). According to ECR-1997, the air quality standard for NO_2 in Bangladesh is 100 $\mu g/m^3$. Express the standard in ppm (at 1 atm and 20 °C). **7**

Table Values of the constants a, c, d, and f for use in (7.44) and (7.45)

		$x \leq 1$ km			$x \geq 1$ km		
Stability	a	c	d	f	c	d	f
A	213	440.8	1.941	9.27	459.7	2.094	−9.6
B	156	106.6	1.149	3.3	108.2	1.098	2.0
C	104	61.0	0.911	0	61.0	0.911	0
D	68	33.2	0.725	−1.7	44.5	0.516	−13.0
E	50.5	22.8	0.678	−1.3	55.4	0.305	−34.0
F	34	14.35	0.740	−0.35	62.6	0.180	−48.6

Note: The computed values of σ will be in meters when x is given in kilometers.
Source: Martin (1976).

$\sigma_y = a \cdot x^{0.894}$; $\sigma_z = cx^d + f$

The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2009
Program: B.Sc Engineering (Civil)

Course # CE 451 Course Title: **Transportation Engineering –II: Highway Design & Railways**
Full Marks: 100 Time : 3 hrs

There are SEVEN questions. Answer any FIVE

1. (a) List out common gauges with their dimension? Why is it desirable to use uniform gauges in a country? (3+7)
   (b) Establish a relationship between degree of curvature and versine of a curve. (5)
   (c) Write short note on "Conning of wheel (5)

2. (a) What are corrugated or roaring rails? What are the causes of rail corrugation? Where does it occurre? Describe their effects and remedies. (2+2+1+2)
   (b) What are the advantages and disadvantages of wooden sleeper? (7)
   (c) Why generally the followings are favored? (6)
   i) Flat footed rail ii) Geo-textile

3. (a) Discuss the classification of fixed signals. (7)
   (b) What are the requirements of sleeper? What are the functions of rail? (4+4)
   (c) Briefly differentiate between point and crossing. (5)

4. (a) Elaborately explain different type of distresses in rigid and flexible pavement. Also discuss the causes of these distresses and relevant remedial measures. (15)
   (b) Draw a typical doweled expansion joint. (5)

5. (a) Describe different stress inducing factors of rigid pavement. Also explain the problems arise from these factors and suggest how these problems can be handle . (8)
   (b) Show the classification of different types of asphalt. Write a short note on "Emulsified asphalt". (5+3)
   (c) Explain "Pavement Serviceability Concept". (4)

6. (a) Compare the rigid and flexible pavement systems from various criteria. (7)
   (b) Write a short note on semi rigid pavement. (3)
   (c) For the following data, design and draw the distributed reinforcement and tie bars for a rigid pavement: (10)

   Thickness of the rigid pavement= 9 inch
   Lane width= 11 ft, two lane
   Spacing of the transverse joint=42 ft
   Allowable stress of steel =20000 psi
   Compressive strength of concrete= 3650 psi, f = 1.5

7. (a) What do you mean by "pumping of joints"? How does pumping occur in rigid pavement? How can we prevent pumping action? (1+2+2)

(b) An asphalt concrete surface course mixture is being designed by Marshall Method for heavy traffic. Test results for different asphalt contents are given in the following table: (15)

Asphalt content (%)	Unit wt. of specimens, (pcf)	Marshall stability (lbs)	Marshall flow value	V_a (%)	VMA (%)
4.5	150.32	1732	9.0	4.40	15.30
5.0	151.63	1785	10.0	3.10	14.90
5.5	152.88	1808	12.0	1.45	14.45
6.0	152.56	1652	15.0	0.90	15.19
6.5	151.63	1426	19.0	0.82	16.30

The maximum size of the aggregate is 1.0 inch for which the minimum VMA% should be 13% as per Marshall design criteria. Compaction, no. of blows in each end of specimen is 50.Determine the optimum asphalt content. Is the mix satisfactory? Check from the design criteria table. If not, what adjustments may be suggested? To plot data use graph paper.

Table : Design Criteria for Marshall Method

Marshall method mix criteria	Surface and base					
	Light traffic		Medium traffic		Heavy traffic	
	Min.	Max.	Min.	Max.	Min.	Max.
Compaction, no. of blows each end of specimen	35		50		75	
Stability (lb)	750	-	1200	-	1800	-
Flow, 0.25 mm (0.01 in)	8	18	8	16	8	14
% Air voids	3	5	3	5	3	5
% VFA	70	80	65	78	65	75

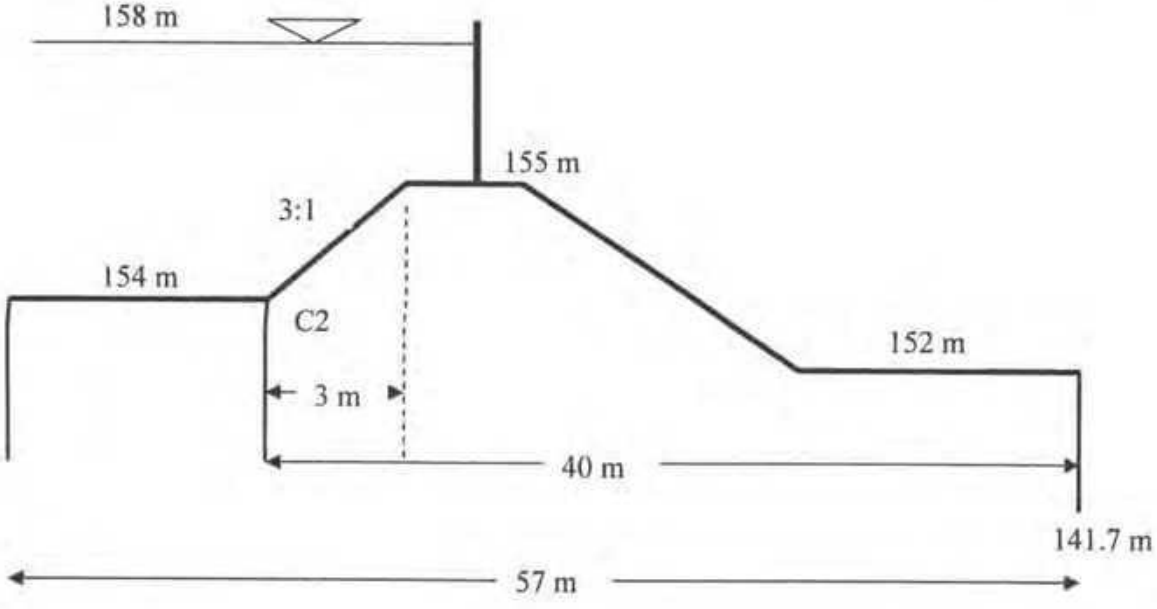
The University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2009
Program: B.Sc Engineering (Civil)

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

Section A
Answer question no. 1 and any THREE from the rest
(Assume any reasonable data if not given)

1. (a) Distinguish between the following (any Four) (16)
   i) Surface and sub-surface irrigation
   ii) Weir and Barrage
   iii) Aqueduct and siphon aqueduct
   iv) Ogee and drop spillways
   v) Super passage and siphon super passage
   vi) Level crossing and 'inlet and outlet'

   (b) Using Khosla's curves, determine the following for the apron shown below:
   (i) If percentage of pressure at C2 is 56% what will be the percentage of pressure at this point after corrections due to pile interference and slope.
   (ii) Find exit gradient where, correction factor for slope, 3:1 = 4.5, assume floor thickness = 1 m. (16)



2. (a) What is meant by 'Duty of water'? Explain the influence of several factors, which affect duty. (10)

(b) The command area of a channel is 4000 hectares. The intensity of irrigation crop is 70%. The crop requires 60 cm of water in 15 days, when the effective rainfall is recorded as 15 cm during that period. Find (a) The duty at the head of field. (b) The duty at the head of channel. (c) The head discharge at the head of channel. Assume total losses as 15%. (5)

(c) Find out the capacity of a reservoir from the following data. The cultivable command area is 80,000 hectares. (10)

Crop	Base in days	Duty in hec/cumec	Irrigation Intensity(%)
Rice	120	1800	25
Wheat	120	2000	30
Sugarcane	320	2500	20

Assume the canal and reservoir losses as 5% and 10% respectively.

3. (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 lakh. 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

(c)What is 'piping' in a hydraulic structure? What are the ill effects of piping and how to avoid these effects? (5)

4. (a) What is meant by cross-drainage works? Explain its necessity. (2+5=7)
(b) Distinguish between drop spillway and ogee spillway. (6)
(c) Design the shape of an ogee spillway for the following data (12)
Maximum head over the crest = 5m
Height of the spillway = 15m
Upstream face of the spillway is vertical for which constants value of k and n are 2.0 and 1.85 respectively.

5. (a) Distinguish between Montague fall and Inglish fall with sketch. (5)

(b) Describe a centrifugal pump with sketch along with its advantages and disadvantages. How do you calculate Brake and Water horse power of a pump? (10)

(c) A centrifugal pump is required to lift water at the rate of 150l/s. Calculate the horse power of the pump from the following data: (10)

Suction head = 6m
Coefficient of friction = 0.01
Efficiency of pump = 75%
Diameter of pipe = 15cm

Section B

Answer Question no.6 and any ONE from the rest

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6. (a) Explain the following (any four) (8)

i) Bankful stage
ii) Return period
iii) Polder
iv) Flood wall
v) Flood plain
vi) Retired Embankment

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

7. (a) Distinguish between the following (any Three) (9)

i) Flood and Drainage congestion
ii) Flood control and Flood management
iii) Flood proofing and Flood protection
iv) IWRM and IFM

(b) Write and explain a general relationship between critical characteristics of flood hazard (depth, area, duration) and flood loss. (7)

(c) Explain impacts of flood. (7)

8. (a) What are the types and causes of flood in Bangladesh? (5+5=10)

(b) Explain the phenomenon of occurrence of catastrophic flood in Bangladesh. (6)

(c) What are to be integrated in IFM ? (7)

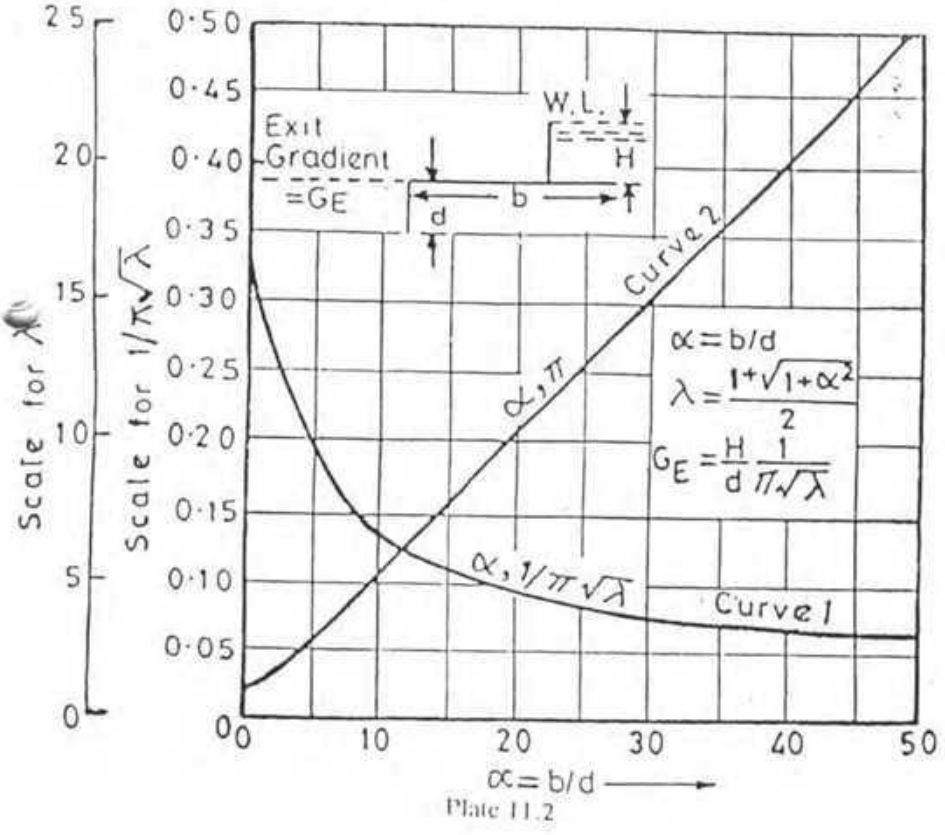
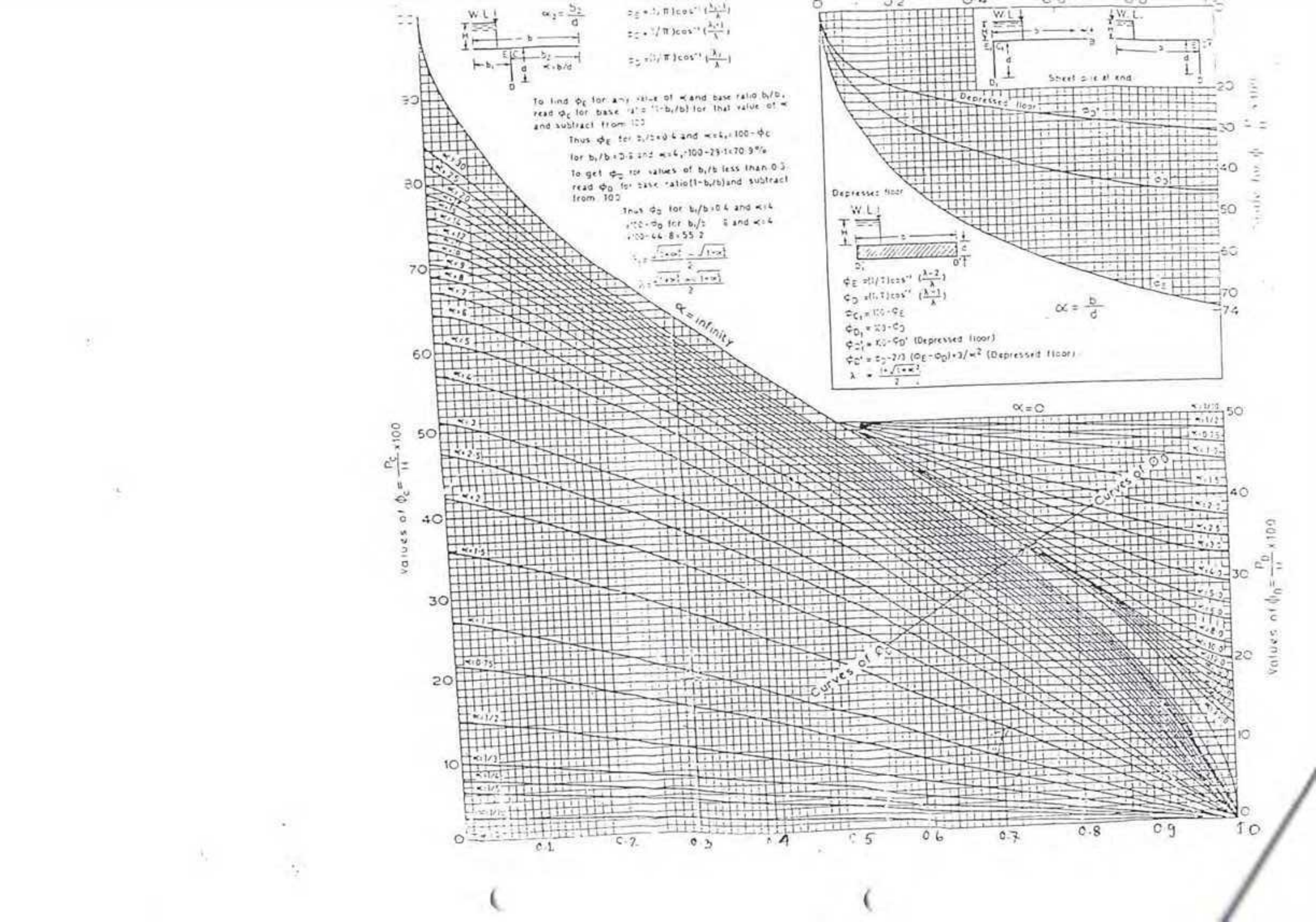

Scale for λ
Scale for 1/π√λ
Exit Gradient =GE
W.L.
H
d
b
Curve 2
α, π
α = b/d
λ = (1+√(1+α²))/2
GE = H/d · 1/π√λ
α, 1/π√λ
Curve 1
α = b/d

Plate 11.2


W.L
$\alpha_2 = \frac{b_2}{d}$
b
b_1
b_2
d
$\alpha < b/d$
$\phi_E = (\lambda_1/\pi)\cos^{-1}\left(\frac{\lambda_1-1}{\lambda}\right)$
$\phi_C = (1/\pi)\cos^{-1}\left(\frac{\lambda+1}{\lambda}\right)$
$\phi_D = (\lambda_1/\pi)\cos^{-1}\left(\frac{\lambda_1}{\lambda}\right)$
To find ϕ_E for any value of α and base ratio b_1/b, read ϕ_E for base ratio $(1-b_1/b)$ for that value of α and subtract from 100
Thus ϕ_E for $b_1/b = 0.6$ and $\alpha = 4$, $= 100 - \phi_C$
for $b_1/b = 0.6$ and $\alpha = 4$, $= 100 - 29.1 = 70.9\%$
To get ϕ_D for values of b_1/b less than 0.5 read ϕ_D for base ratio $(1-b_1/b)$ and subtract from 100
Thus ϕ_D for $b_1/b = 0.4$ and $\alpha = 4$
$= 100 - \phi_D$ for $b_1/b = 0.8$ and $\alpha = 4$
$= 100 - 44.8 = 55.2$
$\lambda_1 = \frac{\sqrt{1+\alpha^2} - \sqrt{1+\alpha^2}}{2}$
$\lambda = \frac{\sqrt{1+\alpha^2} + \sqrt{1+\alpha^2}}{2}$
Depressed floor
W.L
$\alpha = \frac{b}{d}$
$\phi_E = (1/\pi)\cos^{-1}\left(\frac{\lambda-2}{\lambda}\right)$
$\phi_D = (1/\pi)\cos^{-1}\left(\frac{\lambda-1}{\lambda}\right)$
$\phi_{C_1} = 100 - \phi_E$
$\phi_{D_1} = 100 - \phi_D$
$\phi_C' = 100 - \phi_D'$ (Depressed floor)
$\phi_D' = \phi_D - 2/3\ (\phi_E - \phi_D) \times 3/\alpha^2$ (Depressed floor)
$\lambda = \frac{1+\sqrt{1+\alpha^2}}{2}$
Sheet pile at end
$\alpha = \infty$
$\alpha = 0$
Curves of ϕ_D
Curves of ϕ_C
Values of $\phi_C = \frac{P_C}{H} \times 100$
Values of $\phi_D = \frac{P_D}{H} \times 100$

The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring- 2009
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_09" data folder.

$6 + 3 + 4 + 4 + 3 = 20$

1. a. You have a shape file 'uttara.shp' representing a sector in Uttara (Each polygon represents a holding, thus there are 5257 holdings). You have also a map pole.shp representing the position of electric poles (there are 1775 poles). DESA divided their electric poles into five zones, namely zone 1, zone 2, zone 3, and zone 4 and zone 5 for daily load shedding management. In the map, zones are represented in "ID" column of pole.shp map. If DESA imposes load-shedding everyday as per the following schedule:

Time	Zone
5.00 pm – 6.00 pm	1
6.00 pm – 7.00 pm	2
7.00 pm – 8.00 pm	3
8.00 pm – 9.00 pm	4
9.00 pm – 10.00 am	5

Find out, (a) How many holdings will be affected during load shedding at zone 1?

(b) How many holdings will be affected during load shedding at zone 2?

(c) How many holdings will be affected during load shedding at zone 3?

(d) How many holdings will be affected during load shedding at zone 4?

(e) How many holdings will be affected during load shedding at zone 5?

Assume, rest of the holdings has no electric line (vacant plot).

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 175 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 total number of wards and ward numbers that cross the rail lines 1 to 4.

d. The Mouza map of uttara is given in 'sec.shp' and the location of various mobile tower antenna in the sectors are shown in antenna.shp. Find out how many antenna tower are in sectors 4, 7 and 8, respectively.

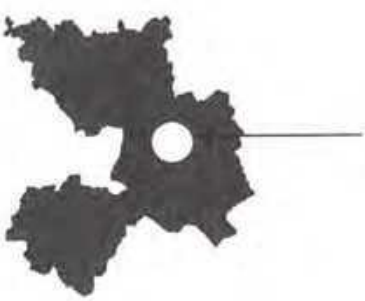
e. Dhaka metropolitan map is given in dhaka_1.shp. What is the area in square km of ward nos 8, 21 and 35? What is the total perimeter of Dhaka city?

2+2+2+7+2=15

2. Dhaka metropolitan map is given in dhaka_1.shp. There are 90 wards in Dhaka city. X is a super shop (shop.shp) which operates 168 branches in 90 wards. Location and daily sales volume (sales volume) is given in Newfield1.shp. Find,
   (a) Which ward generates highest revenue and how much?
   (b) Which ward generates lowest revenue and how much?
   (c) What is the total sum of sales volume?
   (d) Create a map based on sales volume by symbolizing sales data.
   (use color schemes as "Red monochromatic")
   (e) Prepare a layout showing the sales volume.

3+5+3+2+3=15

3. a. There are 20 thanas (add thana.shp) in Dhaka city. Create a new theme map as per the following figure and save as lake.shp.



b. Add **districts.shp** in your view. There are four airports in Bangladesh. They are situated in Dhaka, Chittagang, Sylhet and Rajshahi District. Create a point theme map showing the four airports and add attributes as follows:

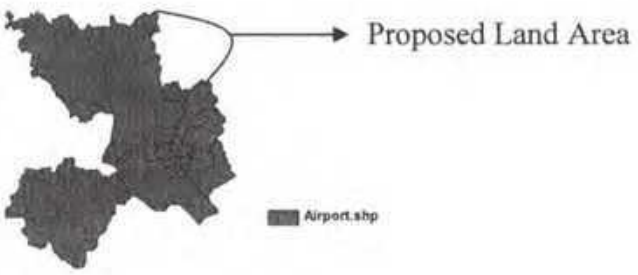
Shape	Airport	Status	X	Y
Point	Dhaka	International	90.33	23.72
Point	Chittagang	International	91.97	22.27
Point	Sylhet	International	91.87	24.90
Point	Jessore	Domestic	88.60	24.48

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

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

Shape	Highway	Length(km)
Line	Dhaka-Chittagang	250

d. Dhaka is expanding every year (add **thana.shp** in your view) The area shown was five years earlier. RAJUK wants to acquire new lands to develop a model town. Create a new map with the help of existing map. The figures are shown below,



Save the newly created theme map as **'new_dhaka.shp'.**

e. Add thana__1.shp in your view. Find out the name of the upozilla whose area is greater than 70 sqkm but less than 260 sqkm.

The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2009

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

Answer any **Five** questions:

Q.1 a) Define the term "dynamic equilibrium". Show how the equilibrium constants K_p and K_c are related. (6)

b) 8.1 moles of H_2 and 2.3 moles of I_2 gave 13.5 moles of HI when heated at 444 °C in a 2.0 L flask. Find the equilibrium constant K_c for the reaction: (4)

$$H_2 + I_2 \rightleftharpoons 2HI.$$

Q.2 a) Deduce the integrated rate expression for a "zero order" reaction. Show that half-life ($t_{½}$) of a first order reaction is constant. (6)

b) For a certain first order reaction, $t_{½}$ is 100 sec. How long will it take for the reaction to be completed 75% ? (4)

Q.3 a) What is meant by "softening of water"? Discuss the principles of 'Calgon' and 'Permutit' methods involved in the softening process. (6)

b) Discuss the chemical action of water when treated with metals and non-metals. (4)

Q.4 a) What do you understand by the term "isotope"? How will you write symbolically the isotopes of chlorine (Cl) and oxygen (O) atoms ? Draw the atomic models of Cl and O isotopes. (6)

b) Draw the molecular orbital of O_2 and N_2 molecules and comment on their bond order and magnetic properties. (4)

Q.5 a) Explain the terms "heat of reaction at constant pressure (ΔH)" and "heat of reaction at constant volume (ΔE)". How does the heat of reaction vary with temperature ? Derive thermodynamically Kirchoff's equation in this connection. (6)

b) The heat of combustion of carbon mono oxide at constant volume and at 17 °C is –283.3 KJ. Calculate its heat of combustion at constant pressure. (4)

Q.6 a) What is meant by "dry corrosion" ? Explain dry corrosion of metals by oxygen and hydrogen both at ordinary and high temperature. (6)

b) Discuss 'Bredigs arc method' for the preparation of a silver hydrosol. (4)

Q.7 a) How does acid rain occur ? Show the possible chemical processes involved in the acid rain. (6)

b) "Making a hole in the sky" – what does the statement mean ? Discuss the chemical role of this phenomenon. (4)

The University of Asia Pacific
Department of Civil Engineering
Semester Final Examination, Spring -2009

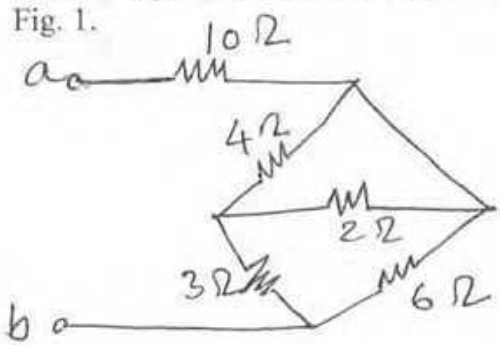
Program: B.Sc. Engineering(2nd year/1st Semester)

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

Time : 3.00 Hours Full Marks:150

There are **Eight** Questions, answer any **Six**. All questions are of equal value.

1. Find the equivalent resistance between the terminals a-b and c-d for the circuits shown in Fig. 1.



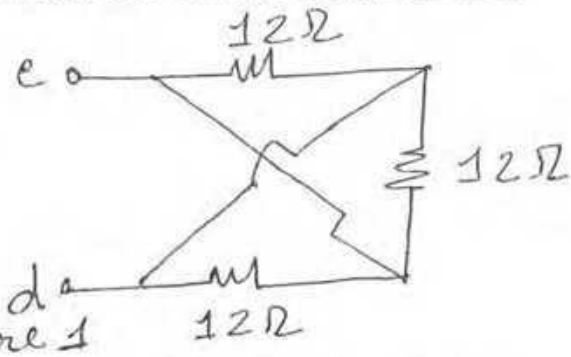


Figure 1

2. For the circuit shown in Fig. 2, determine the value of currents I_1, I_2 and I_3 by using the Mesh analysis technique.

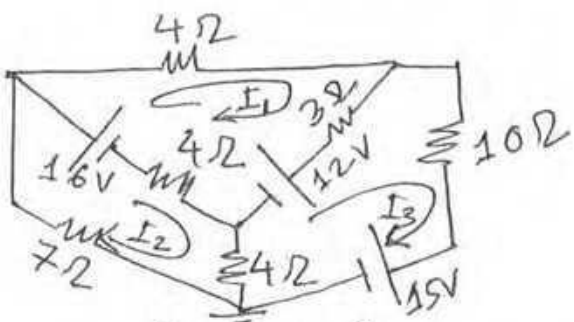


Figure 2

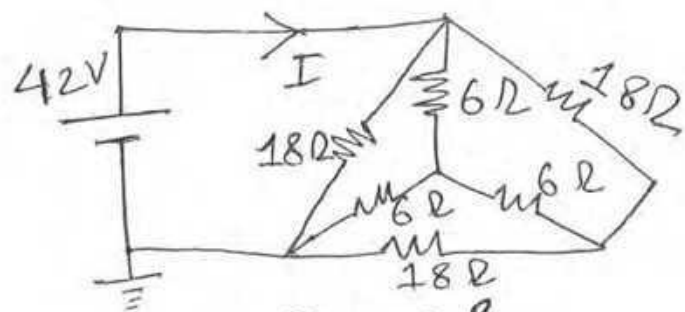
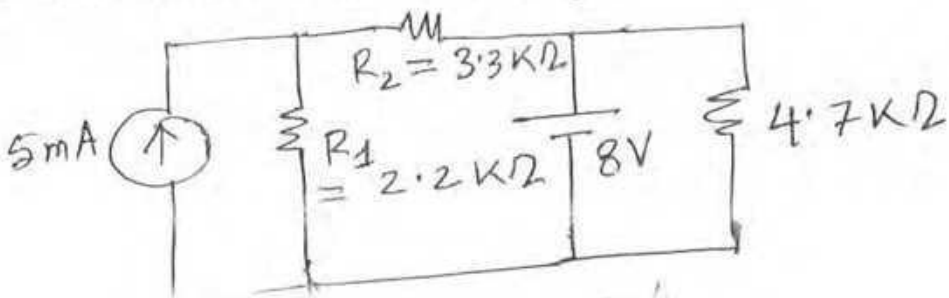


Figure 3

3. Find the value of current I in the circuit shown in Fig. 3.



4. By using the superposition theorem, determine the value of power consumed by the resistors R_1 and R_2 of the circuit shown in Fig. 4.

5. For the circuit shown in Fig. 5 obtain the value of current I using the [illegible]

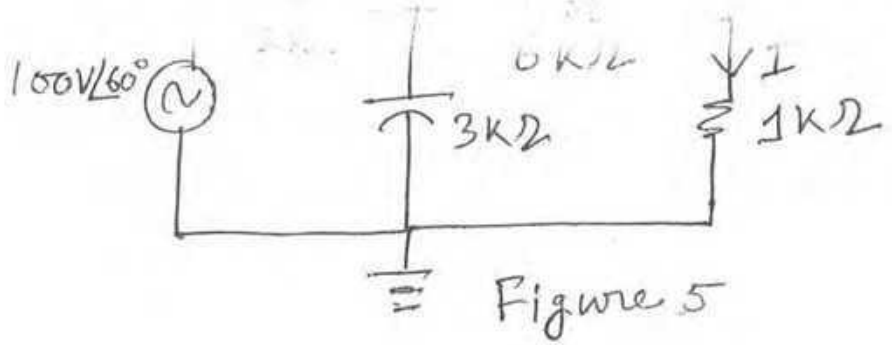


Figure 5

6. Find the number of turns necessary to establish a flux of 12×10^{-4} Wb in the magnetic circuit shown in Fig. 6. Also, determine the permeability of the material.

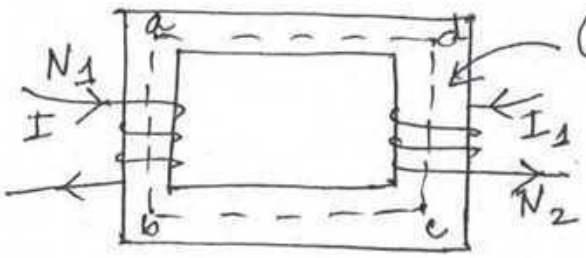


Figure 6

Cast steel

$I = 2A$

$I_1 = 1A$

$N_2 = 30$ turns

Area $= 0.0012m^2$

laveda (length) $= 0.2m$

7. Find the value of resistance R_1 for which the resistance R_4 in the circuit shown in Fig. 7 will receive maximum power. What is the value of the maximum power transferred to R_4.

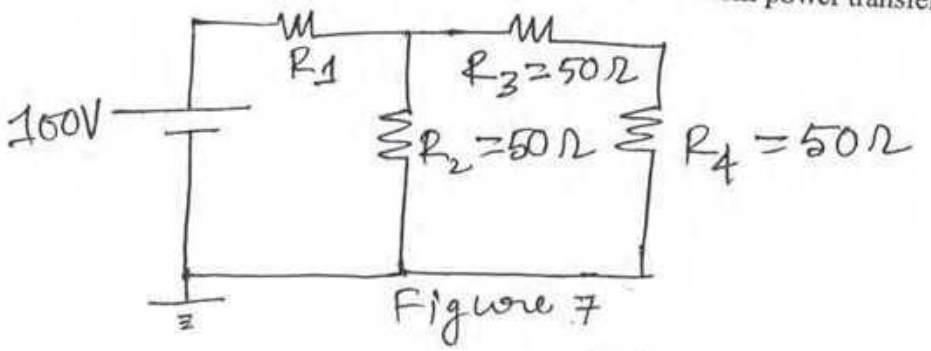


Figure 7

8. Find the equivalent impedances for the circuits shown in Fig. 8

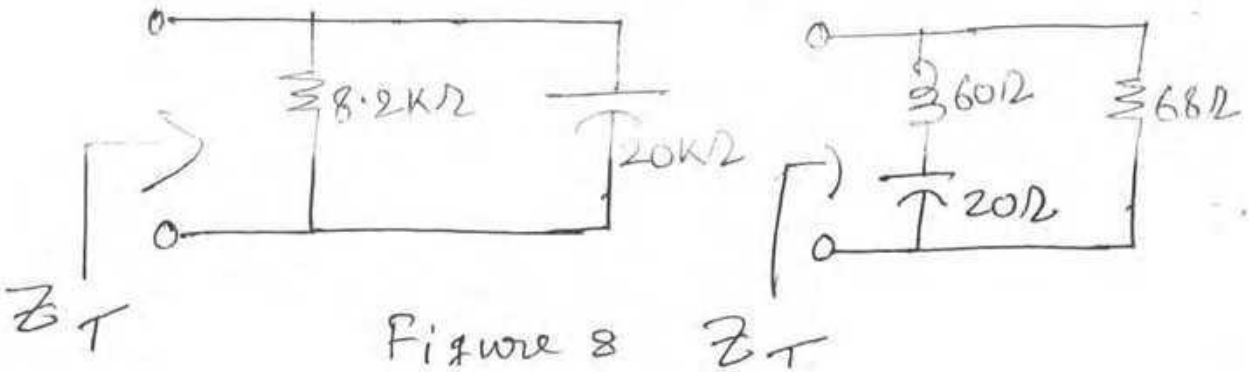


Figure 8

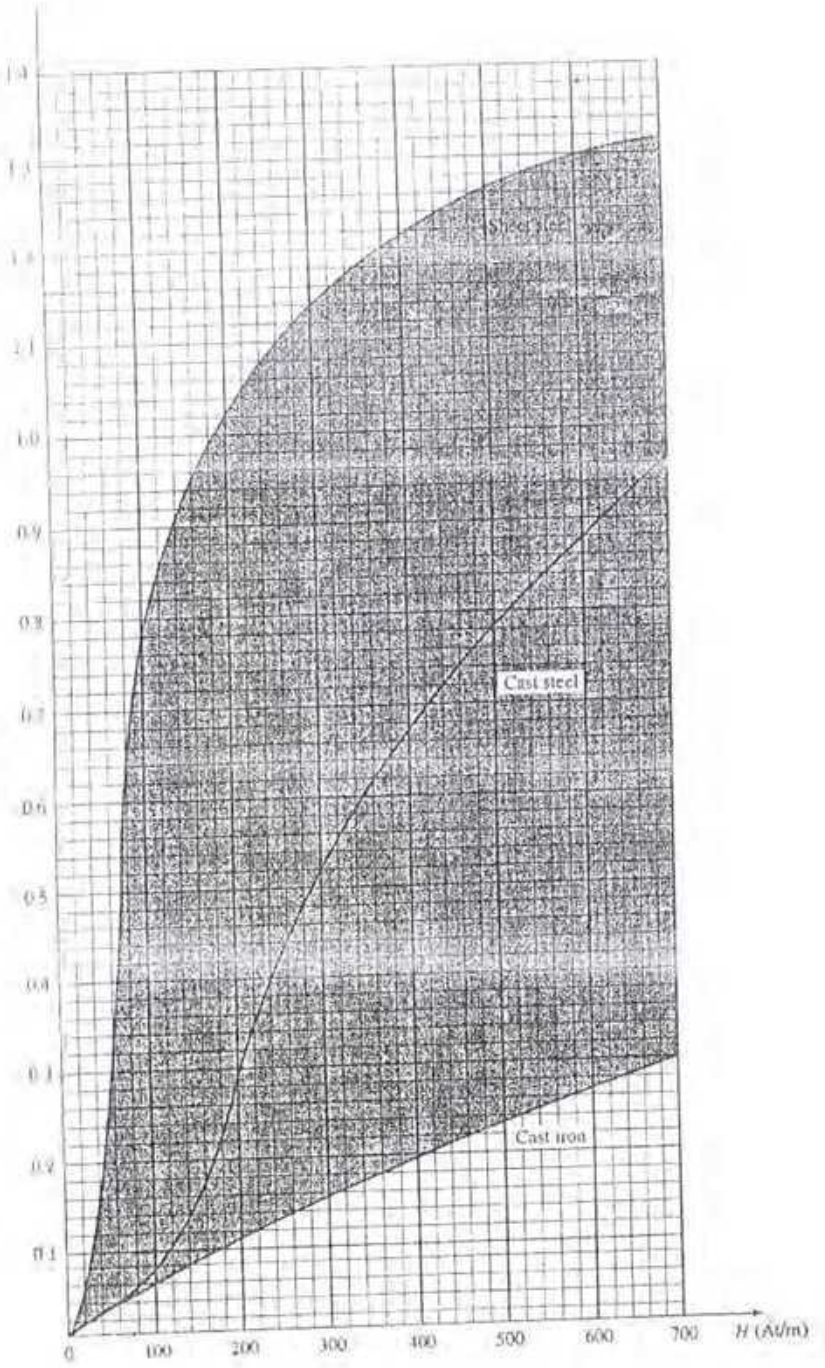
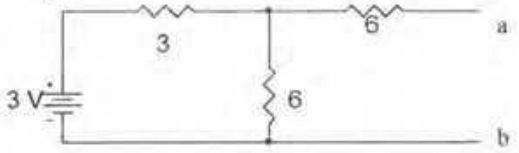


FIG. 12.8

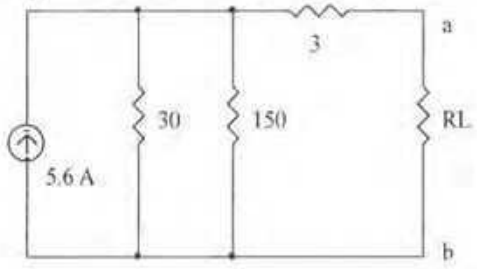
Expanded view of Fig. 12.7 for the low magnetizing force region.

c. Find the norton's equivalent circuit. 10

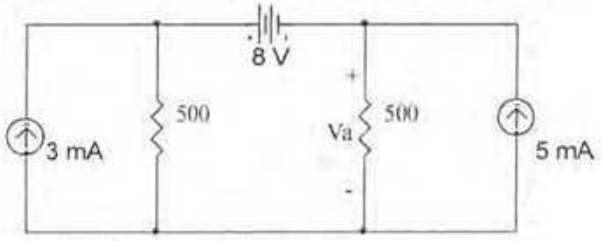


4. a. Briefly describe Maximum Power Transfer theorem. Derive the condition for which Maximum Power will transfer to the load. Hence Show that, $P_{max}=V_S^2/4R_L$. 15

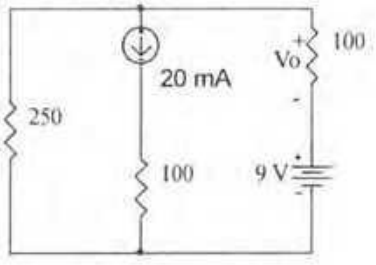
b. Find the maximum power transferred to R_L for the circuit given below. 10



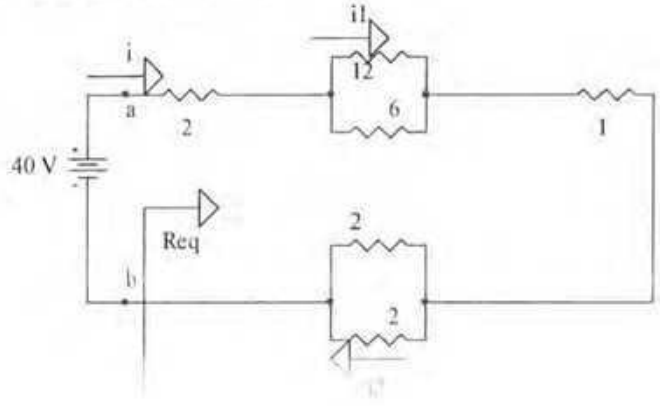
5. a. Determine the node voltage V_a for the circuit given below. 13



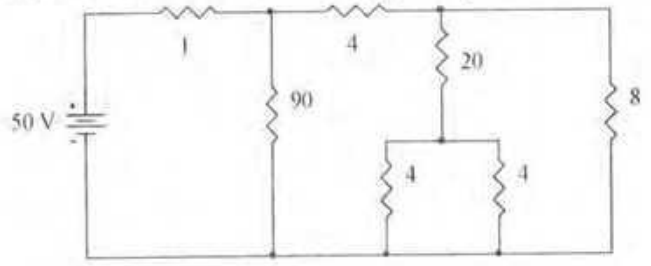
b. Find V_o for the circuit shown below. 12



6. a. Find i, i_1 & i_2 and also find R_{eq}. 13



b. Find equivalent resistance and current supplies by the active source. 12

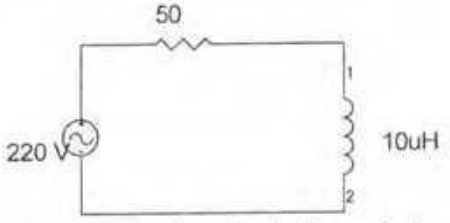


7. a. What is an AC quantity? Draw an AC signal and label it. 05

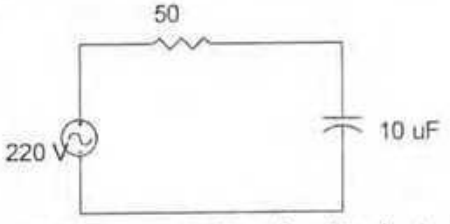
b. Define each of the following with appropriate 20

i. Oscillating current
ii. Cycle and period
iii. Periodic current
iv. Frequency

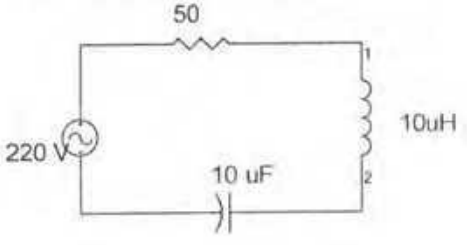
8. a. Find inductive reactance X_L for the circuit shown below and also determine the impedance of the circuit. Also draw the Vector diagram for a R-L series circuit. 08



b. Find inductive reactance X_C for the circuit shown below and also determine the impedance of the circuit. Also draw the Vector diagram for a R-C series circuit. 08



c. Draw the Vector diagram for a R-L-C series circuit. And write the equation of the resultant. And also the p.f. angle. 09



The University of Asia Pacific

Department of Civil Engineering

Semester Final Examination, Spring-2009

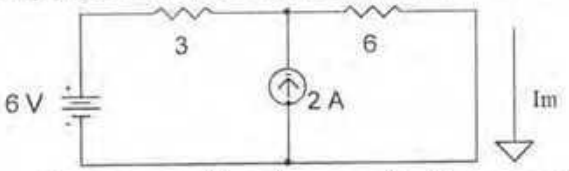
Program: B. Sc Engineering (2nd year/ 2nd semester)

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

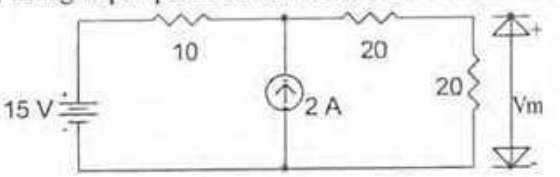
Time: 3.00 Hour. Full Marks: 150

There are **Eight (8)** questions. Answer any **Six (6).** Figures in the right margin indicate marks. Draw necessary figures where needs.

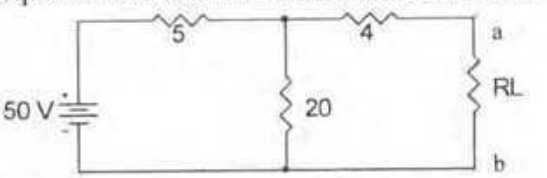
1. a. Explain Super Position Theorem with necessary diagram. 05
   b. Find I_m using super position theorem. Resistances are in ohms. 10



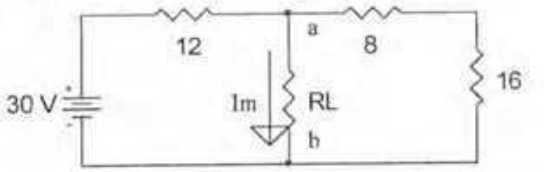
   c. Determine V_m using super position theorem. Resistances are in ohms. 10



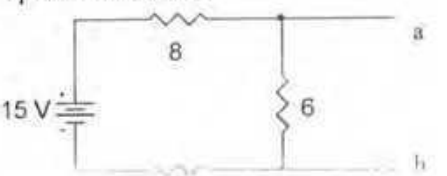
2. a. Briefly describe Thevnin's Theorem. 05
   b. Find thevnin's equivalent circuit and also find the current through R_L. 10



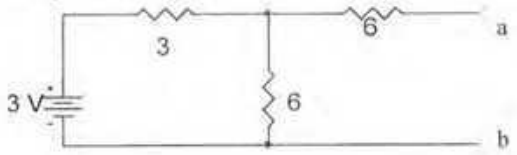
   c. Determine the value of current I_m through load R_L. 10



3. a. State Norton's theorem. 05
   b. Draw the norton's equivalent circuit. 10



c. Find the Norton's equivalent circuit. 10



4. a. Briefly describe Maximum Power Transfer theorem. Derive the condition for which Maximum Power will transfer to the load. Hence Show that, $P_{max}=V_S^2/4R_L$. 15

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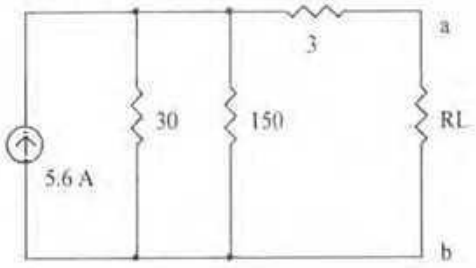
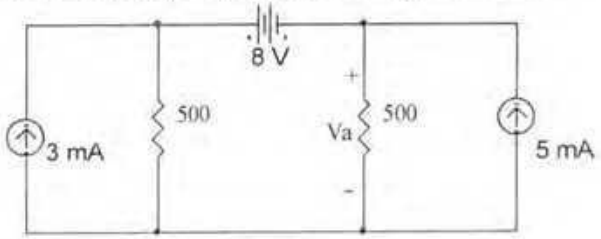
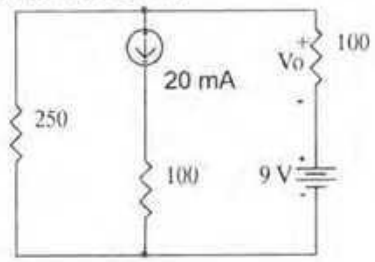


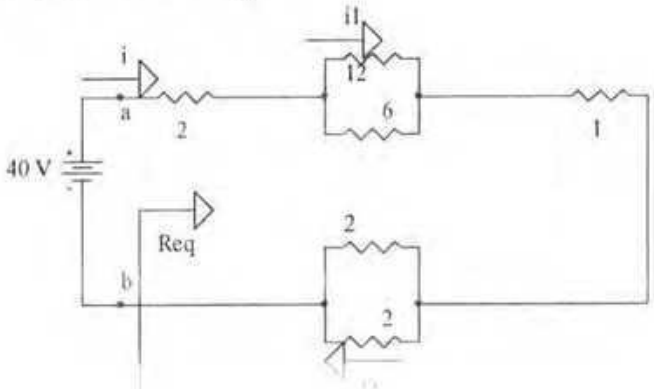
5. a. Determine the node voltage V_a for the circuit given below. 13



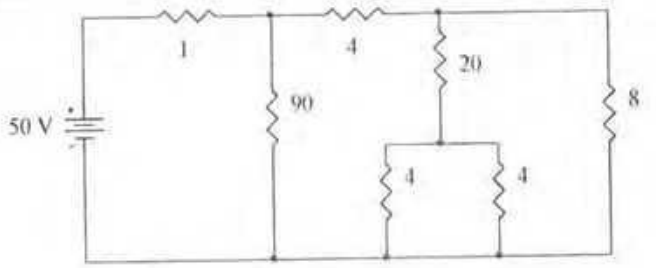
b. Find V_o for the circuit shown below. 12



6. a. Find i, i_1 & i_2 and also find R_{eq}. 13



b. Find equivalent resistance and current supplies by the active source. 12

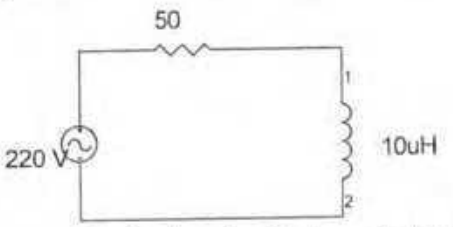


7. a. What is an AC quantity? Draw an AC signal and label it. 05

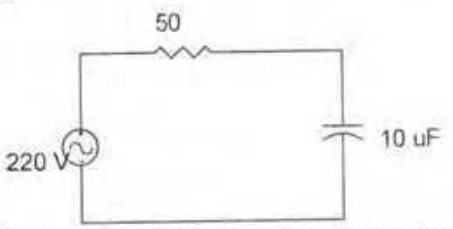
b. Define each of the following with appropriate 20

i. Oscillating current
ii. Cycle and period
iii. Periodic current
iv. Frequency

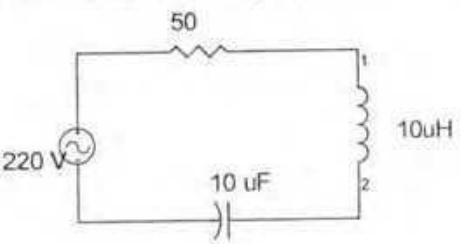
8. a. Find inductive reactance X_L for the circuit shown below and also determine the impedance of the circuit. Also draw the Vector diagram for a R-L series circuit. 08



b. Find inductive reactance X_C for the circuit shown below and also determine the impedance of the circuit. Also draw the Vector diagram for a R-C series circuit. 08



c. Draw the Vector diagram for a R-L-C series circuit. And write the equation of the resultant. And also the p.f. angle. 09



The University of Asia Pacific

Department of Civil Engineering

Semester Final Examination, Spring-2009

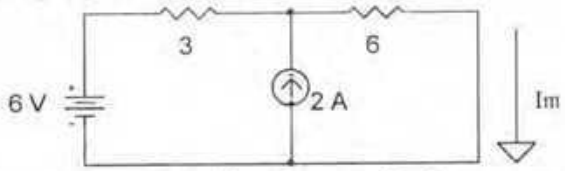
Program: B. Sc Engineering (2nd year/ 2nd semester)

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

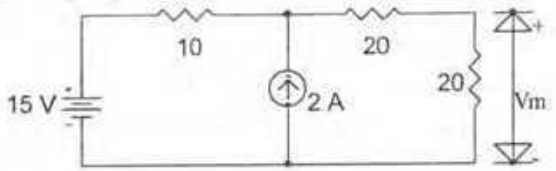
Time: 3.00 Hour. Full Marks: 150

There are **Eight (8)** questions. Answer any **Six (6).** Figures in the right margin indicate marks. Draw necessary figures where needs.

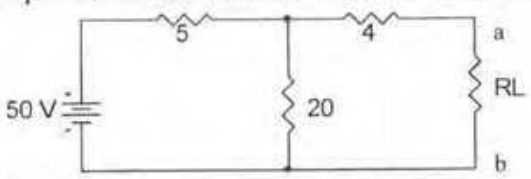
1. a. Explain Super Position Theorem with necessary diagram. 05
   b. Find I_m using super position theorem. Resistances are in ohms. 10



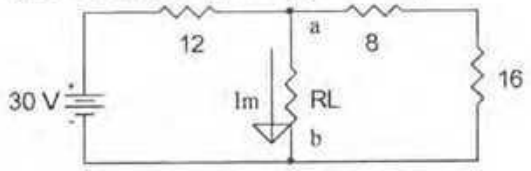
   c. Determine V_m using super position theorem. Resistances are in ohms. 10



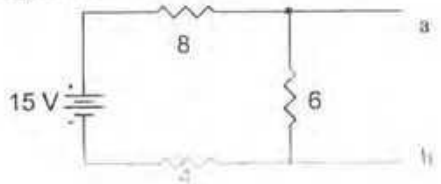
2. a. Briefly describe Thevnin's Theorem. 05
   b. Find thevnin's equivalent circuit and also find the current through R_L. 10



   c. Determine the value of current I_m through load R_L. 10



3. a. State Norton's theorem. 05
   b. Draw the norton's equivalent circuit. 10



give it the shape I want. He will put a plaster case over it to keep it in its new shape. I shall have to spend the next week or two anxiously wondering whether the operation has been successful or not. Will my nose really look better? Or shall I look uglier than before? Won't there be scars after the operation? What shall I do if my nose does not have the shape I wanted? And so on. And then the great day will come. The surgeon will take off the bandages and the plaster; I shall see my expensive new nose! Will it be worth all the trouble and expense...? Sometimes these operations go wrong, and then the patient comes away looking worse than before.

Q. a. Match the words of column A with the words of column B according to meaning. **5**

A	B
Beautiful	of great help and assistance
Careful	nice to look at
Doubtful	doing everything very well
Hopeful	full of sadness
Peaceful	taking great pains or troubles
Sorrowful	not certain
Successful	using things up needlessly
Useful	expecting good things in the future
Wakeful	very quiet
Wasteful	not able to sleep

Q. b. Fill in the blanks with *at, in, on*, or *to*: **5**

I went-------consult a plastic surgeon because I wanted------ have a pretty nose. He sent me ------a nursing home. I spent three weeks -----the nursing home. -----the day after my arrival the surgeon operated -----my nose-------the operating theatre. Afterwards he put it ------a plaster cast. I was taken back -----my bed and waited -----great excitement until it was time.

Q. c. Answer the following questions. Do not write more than three sentences. **10**

1. Who are plastic surgeons? How are they different from other surgeons?
2. How expensive is plastic surgery?
3. When can you have a plastic surgery? What should you do first if you want to change your nose?
4. Describe the steps taken by a plastic surgeon before and after a surgery.
5. What is the negative side of plastic surgery?

Q.6. Write the homophones of any five of the following words and make sentences with the words and their homophones. **10**

Nun, won, ate, peace, check, wood, wait

Q.7. Write two sentences with any five (ten sentences) of the following words giving their two different meanings. **10**

Fine, tap, pole, well ,interest,,form ,watch, star

Q.8. Punctuate the following sentences and write capital letters where necessary. **5**

a. several countries participated in the conference such as india nepal pakistan etc
b. the film harry potter is one of the highest grossing films in hollywood
c. sheser kabita is a wonderful invention of rabindranath tagore
d. sawan said sejan why are you late for school everyday
e. if youre interested in studying geography youll find your visit to nepal very useful

Q. 9 Add one prefix with any five of following words and make a sentence with each of the new words. **5**

Un-, pre-, re-, dis-, en-, il-, mis-, post-,
Guide, arrange, honest, war, logic, necessary, courage

Q, 10. Fill in the blanks with appropriate parts of speech. **10**

1. H e still can't speak English----------(fluent). I think he needs a lot of---------(improve)
2. The students ----------(capital) the letters but forgot to put proper ---------- (punctuate) marks.
3. E-mails have----------(certain) helped us to----------(communication) easily.
4.----------(travel) is a good way to ----------(education) people about life.
5. Three important ----------(qualify) are necessary to be--------(success)

Q. 11. Match the words according to vowel sound. **5**

brawl, ground, pull, term, dark, fly, grasp, clown, grow, slab, grain, smart, root, race, grind, all, shirt, would, clue, goal

Q.12. The following extract has some misspelled words. Find them out and write them correctly . **5**

Nearly everything in his cotage has come from the sea-- chairs, tables, even teans of food. What's the most unusal thing he has ever found? 'A barrel of bear just before Christmas. That was nice.' he remembers. He finds lots of bottles with mesages in them, mainly from children. But does he really make a living? 'Half a living,' he replies. I bertar with a lot of things I find, and I have my police pansion. But I don't actualy need money. My life is rich in varity. People spend all their lives chassing things they don't really need.

The University of Asia Pacific

Final Examination, Spring 2009
Course No: HSS-101, Course Title-English Language-1
Time- 3 hrs. **Total Marks- 100 (50)**

Section –A (Answer any three from the following questions. All questions carry 10 marks.)

Q.1. Compare and contrast a museum and a cinema hall. (200 words)

Q.2. Describe any famous visiting place of your city or village. (200 words)

Q.3. Write a letter to your friend telling him/her about your university life. (200 words)

Q.4. Translate the following paragraph into English.

ক্লিওপেট্রা ছিলেন পৃথিবীর অন্যতম শক্তিশালী মহিলা সম্রাজ্ঞী। মাত্র সতের বছর বয়সে তিনি প্রাচীন মিশরের ক্ষমতা হাতে তুলে নেন, যা আজও মানুষকে অবাক করে। প্রাচীন লেখনী এবং চিত্র থেকে পাওয়া তথ্য অনুযায়ী, তিনি আলেক সান্দ্রিয়ার কাছে একটি দ্বীপে তার রাজকীয় প্রাসাদ গড়ে তোলেন। আলেক সান্দ্রিয়া, প্রাচীন মিশরের রাজধানী, অবশ্য এখন সমুদ্রগর্ভে প্রায় ১৬ হাজার বছর আগে ক্রমাগত বন্যা এবং ভূমিকম্পের কারণে এটি সমুদ্রে তলিয়ে যায়। এখন অবশ্য ডুবুরিরা শহরটির সন্ধান পেয়েছেন এবং সমুদ্রের তলা থেকে মহামূল্যবান মূর্তি, মাটির তৈরী কলস ইত্যাদি খুঁজে পেয়েছেন। প্রাচীন মিশরীয়রা বহুল সংখ্যক দেব-দেবীতে বিশ্বাস করত। এদের অনেকের বিশাল মূর্তি সমুদ্র থেকে উদ্ধার করা সম্ভব হয়েছে।

Section-B

Q. 5. Read the following passage and answer the questions that follow.

Plastic Surgery

Are you unhappy about the shape of your nose? Or do you feel that your ears are too big or your eyes too small? You don't need to despair about any of these things any longer. They can all be put right by a surgeon. Surgeons are doctors who make sick people well by operating on them. But some surgeons today are really beauty specialists. Their job is to make ugly or plain people beautiful. This work is called plastic surgery.

Plastic surgeons are very popular in some countries. They make a lot of money by selling beauty to men and women.- especially women. Plastic surgery is very expensive. A new nose may cost as much as a new car. Suppose I can afford to pay so much money and want to change my ugly nose for a more handsome one. I must consult a plastic surgeon. What will he do?

First of all, he will ask me to enter a nursing home. I shall have to spend about three weeks there. The surgeon will give me an anesthetic. Then he will operate on my nose to

The University of Asia Pacific

Department of Architecture/ Business Admin/ CE/ CSE/ EEE/ Pharmacy

Final Examination Spring - 2009

Course Title: English Language II | Course Code: HSS 103 | Credit: 3 .00 (three)

Time: 3.00 Hours | Full Mark: 100 (50)

Section A: Answer All the Questions from this Section

Q. 1. Read the following passage on Glass-blowing and answer the questions that follow:

There are two types of glass: the most common type is soda-lime glass, which is used for making windows and drinking glasses. The other type of glass, called borosilicate or pyrex, is a special type of glass used in scientific apparatus.

Borosilicate glass has the property of being heat resistant and therefore does not crack when heated. To distinguish between the two types of glass, hold them up to the light; the soda glass will appear very green whilst the borosilicate glass will be greyer in colour. Those are many other ways of distinguishing between soda and borosilicate glass. Because of its resistance to cracking, usually only borosilicate glass is used during introductory glass-blowing classes.

The working temperature of borosilicate glass is about 1080° C, and in order to reach this temperature a burner using oxygen and gas is necessary. A special glass-blowing torch would cost between 3 and 4 million rupees, but for small glass-blowing work, a welding torch costing rupees 75,000 is sufficient. For a welding torch to operate the following apparatus is necessary:

1. Cylinder of oxygen 2.Cylinder of LPG gas 3. Connecting hose 4.Oxygen pressure regulator 5.LPG gas pressure regulator 6.Welding torch

A. Write 'T' next to the correct statements and 'F' next to the incorrect ones: *05*

a. Borosilicate glass and pyrex are two different varieties of glass.
b. Borosilicate glass is greener than soda glass.
c. Borosilicate glass will easily crack when heated.
d. A welding torch costs much less than a special glass-blowing torch.
e. A cylinder of oxygen is necessary in order for a welding torch to operate.

B. Answer the following questions briefly: *05*

a. Which glass is used for making drinking glasses?
b. Why does borosilicate glass not crack when heated?
c. Which glass is used in scientific apparatus?
d. What is the working temperature of borosilicate glass?
e. What is the cost of special glass-blowing torch?

Q.2. Rewrite the following sentences using appropriate modal verbs: (any ten) *10*

a. There is possibility of his doing the task.
b. Am I allowed to do it, sir?
c. You have the necessity to learn how to drive a car.
d. They're probably not in because the phone constantly rings.
e. He is permitted to go there.
f. It is suggested that he plays cricket regularly.
g. I offer myself to help you in doing this.
h. I am obliged to visit my friend tomorrow.
i. I pray that you do well in the examination.
j. She has no obligation to go there.
k. We were not able to visit the place.
l. I had the habit of doing physical exercise in the nearby gym.

Q. 3. Join the following sentences with appropriate joining words: (any ten). Don't repeat any joining word. **10**

a. I saw this boy yesterday. He was walking in the field.
b. Your voice is very low. We cannot hear you.
c. We must hurry up. We will miss the programme.
d. We had heavy luggage. We had to hire a porter.
e. Zahid wants to be a cricket player. He does not play good.
f. I can't understand what he has written. They are complicated.
g. The clothes are expensive and uncomfortable. People take it.
h. We use this car. This needs to be repaired.
i. I'll give this book to Redwan. He doesn't need it.
j. I like him. He is a gentleman.
k. I will finish my course. I will join the office.
l. All the students will need handouts to do the exercise. But we don't have many.

Q. 4. Write one synonym and one antonym of any ten (10) of the following words and make sentences with these synonyms and antonyms: *(10 marks for correct synonyms & antonyms + 10 for making sentences)* **20**

a. Absurd	d. Conceal	Abundant	Callous
b. Notorious	e. Durable	Brutal	Assist
c. Immense	f. Pessimistic	Enhance	Zenith

Section B: Answer Any Five (5) Questions from this Section

Q. 5. Write a letter to the Head of your Department requesting his help to organize a study tour. **10**

Q. 6. UAP will participate in the next Inter-University Debate Championship. As the Convener of UAP Debating Club, write memorandum to the members of your club to this effect. **10**

Q. 7. UAP has recently organized a reception ceremony for the merit scholarship winners in its own campus. As a reporter of a national daily, write a news-report on this event for publication in your newspaper. **10**

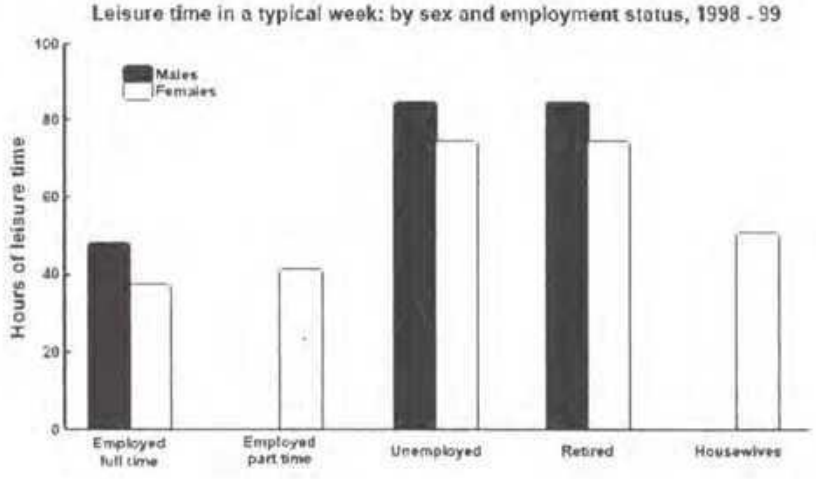
Q. 8. Write single sentence definitions of any five (5) of the following words: **10**

a. Marker (class)	c. Optimistic (synonym)	e. Coca-cola (class)
b. Library (function)	d. Octopus (description)	f. Dictionary (negation)

Q. 9. Write a paragraph on any one of the followings (word limit: 200 words): **10**

a. A Rainy Day, b. My Future Plan, c. Impact of Day-light Saving Time in My Daily Life

Q. 10. The chart below shows the amount of leisure time enjoyed by men and women of different employment status. Write a comparative analysis on the information given in the chart. **10**



The University of Asia Pacific
Department of Interdepartmental Courses
Final Examination, Spring-2009
Department of BBA, CE, CSE, EEE & B. Pharm
Credit: 2.00

Course Title: Bangladesh Studies: History of Bengal **Course Code - HSS 111(B)**
HSS: 211(B) [for CE]

Full Marks: 50 Time: **2.00 Hours.**

Answer any five of the following questions: **10x5=50**

1. Who were the Baro- Bhuiyans in Bengal? How Islam Khan Chisti did suppress the Baro- Bhuiyans?
2. Point out the main causes of the Battle of Palashi of 1757.
3. What is Dual system of 1765? Discuss its result.
4. Briefly discuss Raja Ram Mohan Roy's contribution in the social reform of Bengal.
5. What were the causes behind the Partition of Bengal of 1905?
6. What was the issue of Language Movement in Pakistan after 1947? Briefly describe the Language movement of 1952.
7. What was the Six-Points programme of 1966? What was its effect on the emergence of Bangladesh?

THE UNIVERSITY OF ASIA PACIFIC
Department of Interdepartmental Courses
Semester Final Examination, Spring-2009
Program: 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 **Full Marks: 50**

All questions are of equal value

Answer ANY FIVE of the following

1. Discuss family as a social institution.

2. What are the major classifications of family? Which type of family is not seen in Bangladesh?

3. Define social stratification. What are caste and class? Distinguish between caste and class system.

4. Explain rural stratification patterns according to land and power. Give example from Bangladesh.

5. "The nature of Third-World urbanization is over-urbanization" (Gerald Breese). In this context, analyze the patterns of Third-World urbanization.

6. Define political institution. What are the general functions of a government? Discuss on any one type of government.

7. Write short notes (any two)

a. Slavery
b. Urban stratification patterns in Bangladesh
c. Traditional professional groups / Ethnic groups.

The University of Asia Pacific

Department of Interdepartmental Courses
Semester Final Examination Spring 2009
Program: B.Sc. Engineering (CE)

Course Title: Math-I **Course Code: MTH-101** **Credit: 3.00**

Time: 3 hr **Full Marks: 50**

Group: A

Answer any one of the following: **10**

1. (a) Find the equation of tangent to the curve $\frac{x^{2/3}}{a^{2/3}}+\frac{y^{2/3}}{b^{2/3}}=1$ or $\left(\frac{x}{a}\right)^{2/3}+\left(\frac{y}{b}\right)^{2/3}=1$ at the point (x_1, y_1).

   (b) Find the equation of the circle of curvature at the point (3,1) on the curve $y=x^2-6x+10$.

   (c) Find the radius of curvature of the parabola $y^2=4x$ at the origin (0,0).

2. (a) Find the volume of solid bounded above by the sphere $x^2+y^2+z^2=25$, bounded below by the xy-plane and having the cylinder $x^2+y^2=9$ as side wall.

   (b) The density at the point (x,y) of a lamina bounded by the circle $x^2+y^2-2ax=0$ is $\rho=x$. Find its mass using multiple integral.

Group: B

Answer any Five of the following: **5×8=40**

1. (a) If f(x) has a maximum or a minimum at x = c and if $f'(c)$ exists, show that $f'(c)=0$.

   (b) Show that the minimum value of $4e^{2x}+9e^{-2x}$ is 12.

2. Use L'hospital's rule to evaluate any two of the following:

(i) $\underset{x\to 0}{Lt}\dfrac{x-\sin x}{x^3}$; (ii) $\underset{x\to 0}{Lt}\, x^{2x}$; (iii) $\underset{x\to 2}{Lt}\left[\dfrac{4}{x^2-4}-\dfrac{1}{x-2}\right]$

3. (a) State Euler's theorem on homogeneous function of two variables.

(b) Show that tanu is a homogeneous function of x and y where $u = \tan^{-1}\dfrac{x^3+y^3}{x-y}$.

Determine the degree of homogeneity and show that $x\dfrac{\delta u}{\delta x}+y\dfrac{\delta u}{\delta y}=\sin 2u$.

4. Evaluate (i) $\int_0^{\pi/2}\dfrac{x\,dx}{\sin x+\cos x}$ and (ii) $\int_0^{\pi}\dfrac{x\sin x}{1+\cos^2 x}dx$

5. (a) Write down definition of Gamma and Beta function and establish the relation between them that is $\beta(m,n)=\dfrac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$.

(b) Show that $\int_0^{\pi/2}\dfrac{d\phi}{\sqrt{1-\frac{1}{2}\sin^2\phi}}=\dfrac{\left[\Gamma(\frac{1}{4})\right]^2}{4\sqrt{\pi}}$

6. (a) Sketch the region bounded by the graphs of $y = x^2$, $y = 0$ and $x = 2$. Then find the volume of revolution of the region about the x-axis and about y-axis.

(b) Find the volume and surface area of revolution of the cardioide $r = a(1 + \cos\theta)$ about the initial line.

Q6. a) Find in symmetrical form of the equation of a line $x + y + z + 1 = 0 = 4x + y - 2z + 2$ and find its dc's.

b) Find the distance of the point (-1,-5,-10) from the point of intersection of the line $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{12}$.

Q7. a) Define sphere. Find the centre and radius of the sphere given by, $3x^2 + 3y^2 + 3z^2 - 8x + 12y - 10z + 10 = 0$.

b) Find the co-ordinates of the centre and radius of the circle $x + 2y + 2z = 15$, $x^2 + y^2 + z^2 - 2y - 2z = 11$.

Q8. a) Evaluate $\int_0^{\pi/2} \left(3\sin u\, \hat{i} + 2\cos u\, \hat{j} \right) du$

b) If $F = (2x+y)\mathbf{i} + (3y-x)\mathbf{j}$, evaluate $\int_c \vec{F} . d\vec{r}$ where c is the curve in the xy-plane consisting of the straight lines from (0,0) to (2,0) and then to (3,2).

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THE UNIVERSITY OF ASIA PACIFIC
Department of Interdepartmental Courses
Final Examination Spring-2009
Program: B.Sc. Engineering (CE)

Course Title: Math-II **Course Code: MTH-103** **Credit:3.00**
Time: 3.00 Hrs. **Full Marks: 50**

Group-A

Answer any one of the followings: **1×10= 10**

Q1. a) Represent graphically, i) a force of 10N in a direction 30° north of east.
ii) a force of 15N in a direction 30° east of north.

b) Prove that diagonals of a parallelogram bisect each other.

c) Find a unit vector parallel to the resultant of the vectors $\mathbf{r}_1 = 2\mathbf{i} + 4\mathbf{j} - 5\mathbf{k}$ and $\mathbf{r}_2 = \mathbf{i} + 2\mathbf{j} + 3\mathbf{k}$.

Q2. (a) Show that the sum of any three conjugate semi diameters of an ellipsoid is constant.

(b) Find the condition that the plane $x + 2y + 3z = 1$ should touch the conicoid $ax^2 + by^2 + cz^2 = 1$.

Group-B

Answer any five of the followings: **5×8 = 40**

Q3. (a) Show that the locus of the tangents from the point (α, β, γ) to the paraboloid $ax^2 + by^2 = 2z$ given by $(ax^2 + by^2 - 2z)(a\alpha^2 + b\beta^2 - 2\gamma) = (a\alpha x + b\beta y - z - \gamma)^2$.

(b) Find the equation of a paraboloid with vertex at the origin, axis OY and passing through (1, - 2, 1) and (- 3, - 3, - 2).

Q4.a) Define direction cosine and direction ratio. Find the relation between direction Cosine and direction ratio.

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 intersectionof this line with yz-plane.

Q5. a) Find the equation of the plane passing through the lines of itersection of the planes $2x-y = 0$ and $3z-y = 0$ and perpendicular to the plane $4x + 5y - 3z + 1 = 0$.

b) Find the equation of the plane through the line $\frac{x-2}{3} = \frac{y-3}{5} = \frac{z}{7}$ and passing through the point (1,-2, 3).

THE UNIVERSITY OF ASIA PACIFIC
Department of Interdepartmental Courses
Final Examination Spring-2009
Program: B.Sc. Engineering (CE)

Course Title: Math-II **Course Code: MTH-103** **Credit:3.00**
Time: 3.00 Hrs. **Full Marks: 50**

Group-A

Answer any one of the followings: **1×10= 10**

Q1. a) Represent graphically, i) a force of 10N in a direction 30° north of east.
ii) a force of 15N in a direction 30° east of north.

b) Prove that diagonals of a parallelogram bisect each other.

c) Find a unit vector parallel to the resultant of the vectors $\mathbf{r}_1 = 2\mathbf{i} + 4\mathbf{j} - 5\mathbf{k}$ and $\mathbf{r}_2 = \mathbf{i} + 2\mathbf{j} + 3\mathbf{k}$.

Q2. (a) Show that the sum of any three conjugate semi diameters of an ellipsoid is constant.

(b) Find the condition that the plane $x + 2y + 3z = 1$ should touch the conicoid $ax^2 + by^2 + cz^2 = 1$.

Group-B

Answer any five of the followings: **5×8 = 40**

Q3. (a) Show that the locus of the tangents from the point (α, β, γ) to the paraboloid $ax^2 + by^2 = 2z$ given by $(ax^2 + by^2 - 2z)(a\alpha^2 + b\beta^2 - 2\gamma) = (a\alpha x + b\beta y - z - \gamma)^2$.

(b) Find the equation of a paraboloid with vertex at the origin, axis OY and passing through (1, - 2, 1) and (- 3, - 3, - 2).

Q4.a) Define direction cosine and direction ratio. Find the relation between direction Cosine and direction ratio.

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 intersectionof this line with yz-plane.

Q5. a) Find the equation of the plane passing through the lines of itersection of the planes $2x-y = 0$ and $3z-y = 0$ and perpendicular to the plane $4x + 5y- 3z +1 = 0$.

b) Find the equation of the plane through the line $\frac{x-2}{3} = \frac{y-3}{5} = \frac{z}{7}$ and passing through the point (1,-2, 3).

THE UNIVERSITY OF ASIA PACIFIC
Department of Interdepartmental Courses
Final Examination 'Spring-2009
Program: B.Sc. Engineering (CE)

Course Title: Math-III **Course Code: MTH-201** **Credit: 3.00**
Time: 3.00 Hours **Full Marks: 50**

There are Six questions, Answer any 05(Five) of the following questions: 40

Q.1. (a) Define linear mapping.Show that the mapping T is Linear where $T: R^3 \to R^2$ defined by $T(x,y,z) = (x+y, x-y+z)$.

(b) Let $T: V_3(R) \to V_3(R)$ be a linear mapping defined by $T(x,y,z) = (x+2y, y-z, x+2z)$. Find a bais 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. Verify that the matrix representation of the linear operator $T: R^2 \to R^2$ defined by $T(x,y) = (5x+y, 3x-2y)$ with respect to the basis $\{f_1 = (1,2), f_2 = (2,3)\}$ is given by $[T]_f = \begin{pmatrix} -23 & -39 \\ 15 & 26 \end{pmatrix}$;
also 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 thereom) where $A = \begin{pmatrix} 2 & 0 & 0 \\ -1 & 1 & 0 \\ 1 & -4 & 0 \end{pmatrix}$.

Q.5. 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 matrices P and Q from $\{e_i\}$ to $\{f_i\}$ and from $\{f_i\}$ to $\{e_i\}$ respectively. Verify that PQ = I.
(ii) also verify that $[v]_e = P[v]_f$ for any vector $v \in R^2$.

Q6. a) Find in symmetrical form of the equation of a line $x + y + z + 1 = 0 = 4x + y - 2z + 2$ and find its dc's.

b) Find the distance of the point (-1,-5,-10) from the point of intersection of the line $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{12}$.

Q7. a) Define sphere. Find the centre and radius of the sphere given by, $3x^2 + 3y^2 + 3z^2 - 8x + 12y - 10z + 10 = 0$.

b) Find the co-ordinates of the centre and radius of the circle $x + 2y + 2z = 15$, $x^2 + y^2 + z^2 - 2y - 2z = 11$.

Q8. a) Evaluate $\int_0^{\pi/2} \left(3\sin u\, \hat{i} + 2\cos u\, \hat{j} \right) du$

b) If $F = (2x+y)\mathbf{i} + (3y-x)\mathbf{j}$, evaluate $\int_c \vec{F}.d\vec{r}$ where c is the curve in the xy-plane consisting of the straight lines from (0,0) to (2,0) and then to (3,2).

THE UNIVERSITY OF ASIA PACIFIC
Department of Interdepartmental Courses
Final Examination Spring-2009
Program: B.Sc. Engineering (CE)

Course Title: Math-IV **Course Code: MTH-203** **Credit:3.00**
Time: 3.00 Hrs. **Full Marks: 50**

Group-A

Answer any one of the followings: **1×10= 10**

Q1.a) Form the differential equation of which, $c(y+c)^2 = x^3$ is the complete Integral.

b) Find the differential equation of all circles passing through the origin and having their centers on the x-axis.

c) Solve $\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$

Q2. a) Define exact differential equation.

b) Find the necessary and sufficient condition for a differential equation of first degree being exact.

Group-B

Answer any five of the followings: **5×8 = 40**

Q3. a) Solve $(x-y)^2 \frac{dy}{dx} = a^2$.

b) Solve $\frac{dy}{dx} = \frac{x+2y-3}{2x+y-3}$.

Q4. Explain standard form of Linear Differential equation and by using this form solve $x\frac{dy}{dx} + 2y = x\log x$

Q5. Explain standard form of Bernoulii equation and by using this form solve $\frac{dy}{dx} + \frac{2}{x}y = \frac{y^3}{x^3}$

Q6.a) Define linear differential equation with constnt co-efficients.Solve the differential equation $D^4y + m^4y = e^{mx}$.

b) Solve $x^2\frac{d^2y}{dx^2} - 2y = x^2 + \frac{1}{x}$.

Q7. a) Define infinite fourier transform and laplace transform

b) Establish the relation between Laplace and Fourier transform.

c) Find the Fourier transform of, $f(x) = x, \quad |x| < a$

$0, \quad |x| > a$

Q8. a) Find finite Fourier sine and cosine transform of $f(x) = x^2$, $0<x<4$.

b) Show that finite sine transform of $\frac{x}{\pi}$ is $(-1)^{s+1}\frac{1}{s}$

The University of Asia Pacific
Department of Interdepartmental Courses
Final Examination Spring-2009
Program: B.Sc Engineering (CSE/CE/ARCH)

Course Title: Physics I Course Code: PHY 101 Credit: 3.00

Time: 3 Hours Full Marks: 50

There are **Eight** Questions. Answer any **five** from **group A** and **one** from **group B**

Group A

1.(a) Prove that $T = \frac{r\left(h + \frac{r}{3}\right)\rho.g}{2\cos\theta}$, where the terms have their usual meanings. 6

(b) Calculate the excess pressure inside a soup bubble of radius 760 cm.

Surface tension of soup solution is 5.8×10^{-3} N/m. 2

2.(a) State and explain the Stoke's law and prove that $\eta = \frac{2r^2(\rho-\sigma)g}{9v}$,

where the terms have their meanings. 6

(b) Find the limiting velocity of a rain drop. Diameter of the rain drop is $2\text{x}10^{-3}$ 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] 2

3.(a) What do you mean by Lissajous' figures? Prove that $y = A \sin(\omega t + \phi)$

from the composition of two simple harmonic motions in a straight line. 6

(b) In an experiment to obtain Lissajous' figures, one tuning fork is of frequency 350 Hz and a circular figure occurs after every five seconds. What deductions may be made about the frequency of the other tuning fork. 2

4. (a) What do you mean by free damped vibrations of sound? Find out the frequency of a damped vibration $n=\frac{1}{2\pi}\sqrt{k^2-b^2}$. 5

(b) Show that for a particle executing simple harmonic motion, its velocity at any instant is $\frac{dy}{dt} = \omega\sqrt{a^2-y^2}$. 3

5. (a) State equipartition theorem. Show that the average kinetic energy associated with each degree of freedom is $\frac{1}{2}KT$ 6

(b) Calculate the root mean square velocity of a molecule of mercury vapour at 300 K 2

6. (a) State and explain Carnot cycle of Carnot engine. 5

(b) Show that the efficiency of the carnot cycle is $\eta = 1 - \frac{T_C}{T_H}$ 3

Group B

7.(a) What is called cantilever? Prove that depression $y = \frac{Wl^3}{3YI_g}$, where the terms have their usual meanings. 7

(b) A uniform rod of length 2.3 m is clamped horizontally at one end. A weight of 10 kg is attached at the free end. Calculate the depression of the mid point of the rod. The diameter of the rod is 0.06 m. ($Y = 3x10^{12}$ n/m^2) 3

8. (a) State the Van der Waals equation of state of gas and prove that $\left(P + \frac{a}{V^2}\right)(V - b) = RT$. 7

(b) State and explain the second law of thermodynamics. 3