

Sylhet Engineering College, Sylhet
(Shahjalal University of Science & Technology)
Department of Civil Engineering

Final Examination, 2023
Course No.: CE 845
Time: 02 (Two) hours

4th Year 2nd Semester
Course Title: Geotechnical Engineering III
Full Marks: 40

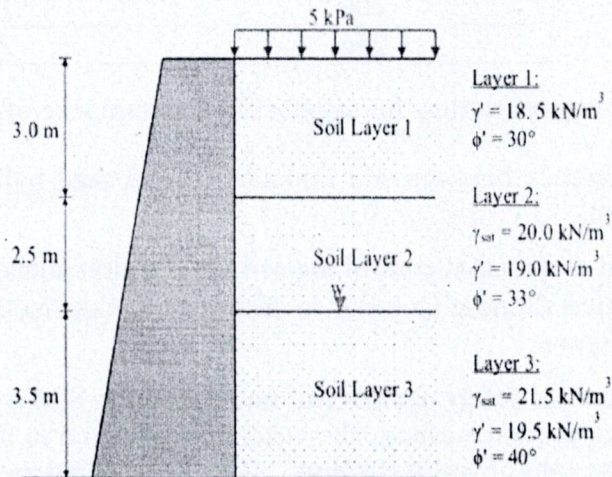
N.B. : (i) Answer any two questions from each PART
(iii) Marks allotted are indicated in the margin

(ii) Use separate answer scripts for each PART
(iv) Special Instruction (if any)-----N/A-----

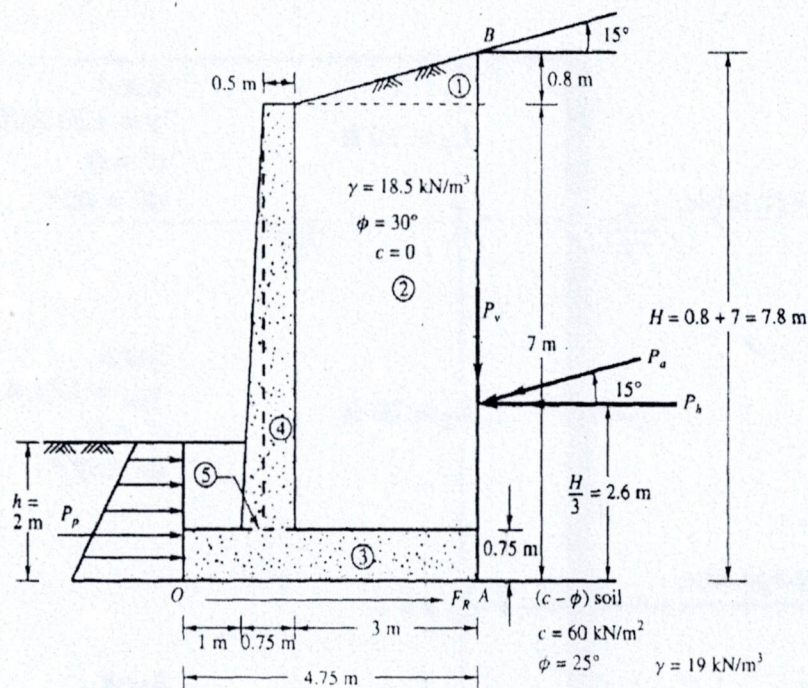
PART- A

(Answer any two questions)

1. (a) Define the terms: (i) counterfort retaining wall (ii) caisson foundation 2
- (b) Determine the resultant force and its location of retaining wall is shown in figure below. 6



- (c) How do we calculate the pressure coefficient (K_0) at rest conditions? Describe mathematically 2
2. (a) Determine the Factor of safety against overturning and sliding of retaining wall given below. 5



- (b) What is dewatering ? write the purposes of dewatering 3
- (c) Describe the multistage well point system for dewatering with an appropriate figure. 2
3. (a) Describe different types machine foundation with appropriate figures. 3
- (b) Which criteria should be satisfied for a good machine foundation? Describe properly. 3
- (c) A 20-tonne weighted machine foundation whose diameter is 2.5 m carrying 15 kN sinusoidal vertical force (rotating mass excitation) at a frequency of 12 Hz. Calculate frequency, Amplitude (A), displacement amplitude, and velocity amplitude. Where $\nu = 0.4$ and $\gamma = 18 \text{ kN/m}^3$ and $G = 110 \text{ MN/m}^2$ 4

PART- B

(Answer any two questions)

4. (a) Mention the different test method system to determine the dynamic properties of soil also describe cross hole test method to determine dynamic properties mathematically with appropriate figure. 3

(b) The table below shows the applied load and settlement from a plate load test. The area of the plate is 0.3 m^2 , considering $\nu = 0.35$. Determine the subgrade modulus, modulus of elasticity, and shear modulus. 5

Load per unit area (kPa)	Elastic settlement (mm)
50	0.60
100	1.15
150	1.55
200	1.80
250	2.60

(c) Describe design considerations for satisfactory performance of machine foundation. 2

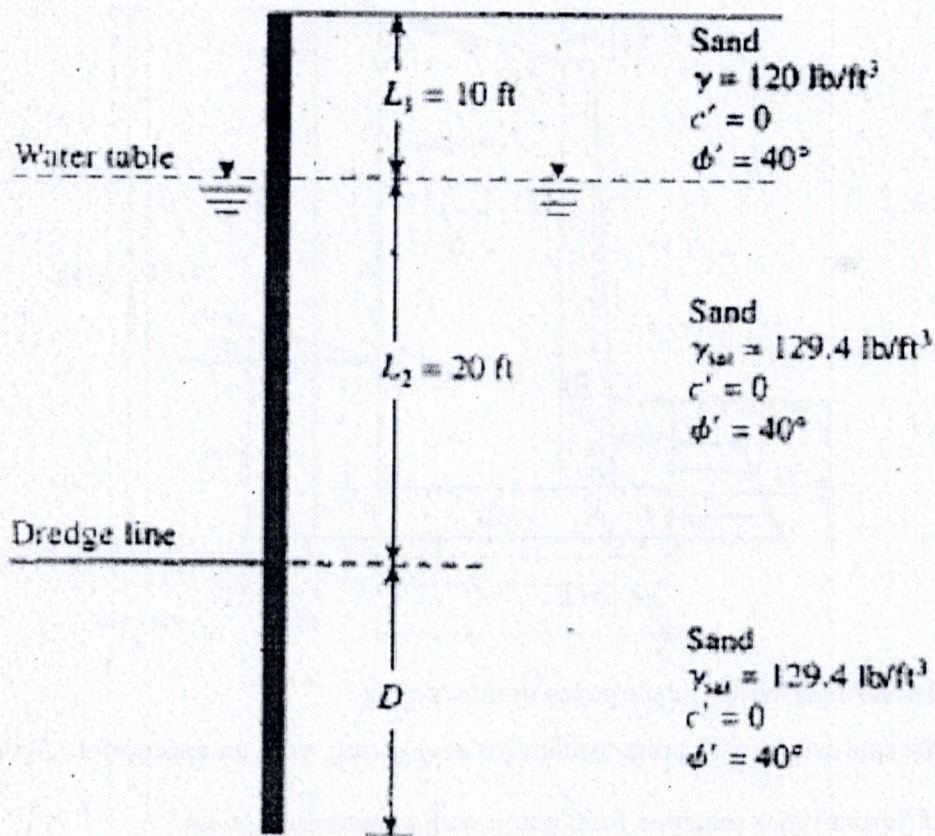
5. (a) What is the difference between soil liquefaction and sand boiling? Explain mathematically based on your judgment. 2

(b) Explain different factors that control the soil liquefaction phenomenon. 2

(c) Describe "modified Chinese Criteria" to describe soil liquefaction for clay soil with appropriate dimension and figure. 2

(d) Calculate the factor of safety against soil liquefaction in Sylhet city. The corrected SPT value is 12 at 8 m depth from ground surface. The water table is at 4.5 m from GL. Saturated unit weight is 19 kN/m^3 and unit weight of soil is 9 kN/m^3 . Using simplified method and earthquake magnitude is 7.5. 4

6. (a) Design cantilever sheet pile embedded cohesion soil using conventional method. 10



Attachment

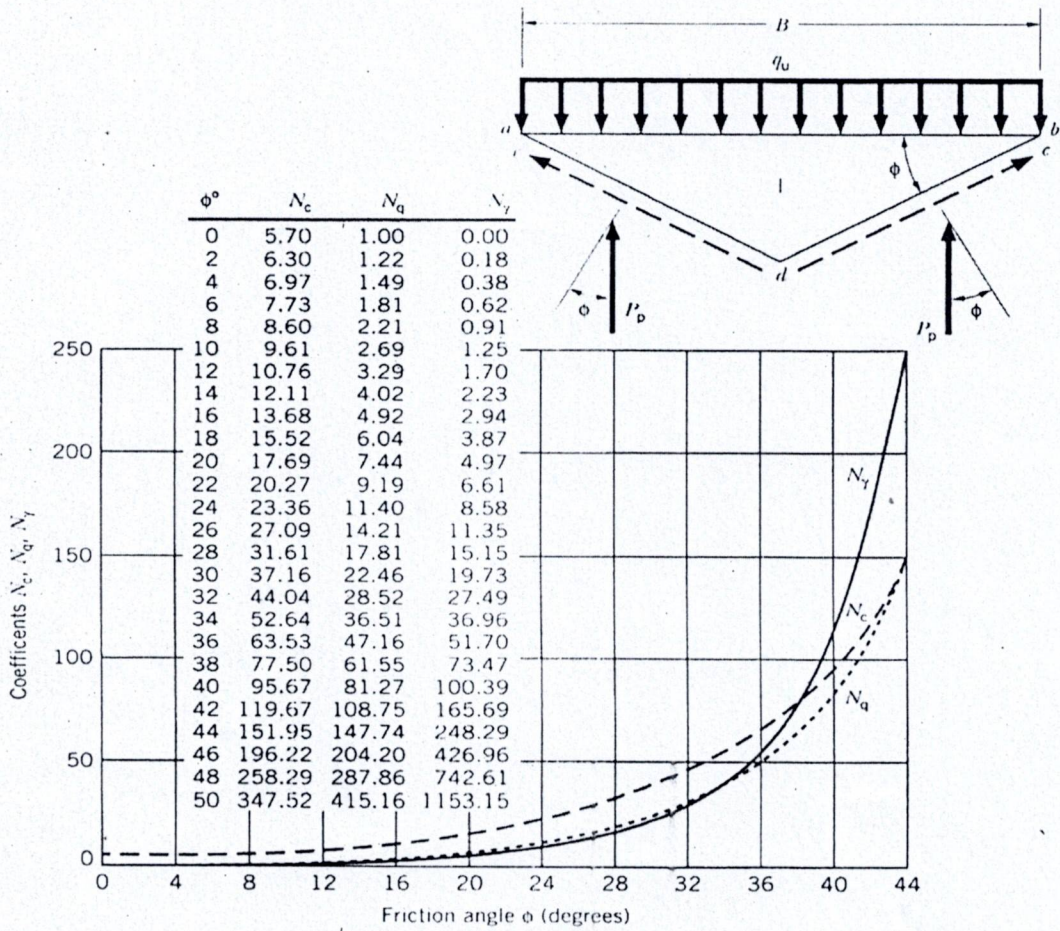
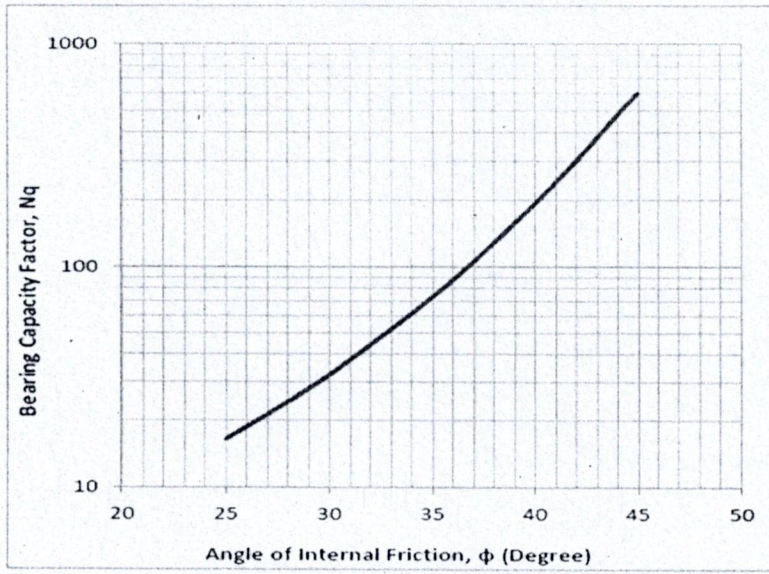


Figure: Terzaghi Bearing Capacity factor

Friction, angle ϕ	Shape factors	Depth factors	Inclination factors
Any ϕ	$S_c = 1 + 0.2K_p(B/L)$	$d_c = 1 + 0.2\sqrt{K_p}(D/B)$	$i_c = i_q = (1 - \alpha/90^\circ)^2$
For $\phi = 0^\circ$	$S_\gamma = S_q = 1.0$	$d_\gamma = d_q = 1.0$	$i_\gamma = 1.0$
For $\phi \geq 10^\circ$	$S_\gamma = S_q = 1 + 0.1K_p(B/L)$	$d_\gamma = d_q = 1 + 0.1\sqrt{K_p}(D/B)$	$i_q = (1 - \alpha/\phi)$

$K_p = \tan^2(45^\circ + \phi/2)$
 $\alpha =$ angle of resultant measured from vertical axis.

$$q_u = c'_2 N_c F_{cd} F_{ci} + q N_q F_{qd} F_{qi} + \frac{1}{2} \gamma_2 B' N_\gamma F_{\gamma d} F_{\gamma i}$$

where

$$q = \gamma_2 D$$

$$B' = B - 2e$$

$$F_{cd} = F_{qd} - \frac{1 - F_{qd}}{N_c \tan \phi'_2}$$

$$F_{qd} = 1 + 2 \tan \phi'_2 (1 - \sin \phi'_2)^2 \frac{D}{B'}$$

$$F_{\gamma d} = 1$$

$$F_{ci} = F_{qi} = \left(1 - \frac{\psi^\circ}{90^\circ}\right)^2$$

$$F_{\gamma i} = \left(1 - \frac{\psi^\circ}{\phi'_2}\right)^2$$

$$\psi^\circ = \tan^{-1} \left(\frac{P_a \cos \alpha}{\Sigma V} \right)$$

Table 7.4. Spring constants for rigid footings on an elastic half space.

Motion	Spring constant	Reference
Circular footing, radius r		
SDOF		
SPRING STIFFNESS 'K'		
Vertical	$k_z = \frac{4Gr}{(1-\nu)}$	Timoshenko & Goodier 1951
Horizontal	$k_x = \frac{32(1-\nu)Gr}{(7-8\nu)}$	Bycroft 1956
Rocking	$k_\psi = \frac{8Gr^3}{3(1-\nu)}$	Borowicka 1943
Torsion	$k_\theta = \frac{16Gr^3}{3}$	Reissner & Sagoci 1944
Rectangular footing, 2c x 2d		
Vertical	$k_z = \frac{2G\beta_z(cd)^{1/2}}{(1-\nu)}$	Barkan 1962
Horizontal	$k_x = 4(1+\nu)G\beta_x(cd)^{1/2}$	Barkan 1962
Rocking	$k_\psi = \frac{8G\beta_\psi cd^2}{(1-\nu)}$	Gorbunov-Possadov & Serebrajanyi 1961

For Rectangular footings, use equivalent radius 'r'

Translation: $r = \sqrt{4cd/\pi}$ → Equating Area
 Rocking: $r = (16cd^3/3\pi)^{1/4}$ → Equating Moment of Inertia
 Torsion: $r = (8cd(c^2+d^2)/3\pi)^{1/4}$ → Equating Moment of Inertia

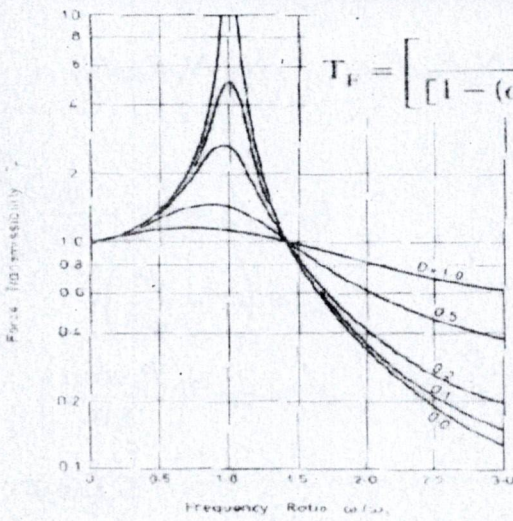
Table 7.5. Damping ratios for various modes of vibration—Rigid circular surface footing.

Mode of vibration	Modified mass or inertia ratio	Damping ratio	Reference
Vertical	$B_z = \frac{(1-\nu)m}{4\rho r^3}$	$D_z = \frac{0.425}{B_z^{1/2}}$	Lysmer & Richart 1966
Sliding	$B_x = \frac{(7-8\nu)m}{32(1-\nu)\rho r^3}$	$D_x = \frac{0.288}{B_x^{1/2}}$	Hall 1967
Rocking	$B_\psi = \frac{3(1-\nu)I_\psi}{8\rho r^5}$	$D_\psi = \frac{0.15}{(1+B_\psi)B_\psi^{1/2}}$	Hall 1967
Torsional	$B_\theta = \frac{I_\theta}{\rho r^5}$	$D_\theta = \frac{0.50}{(1+2B_\theta)}$	Whitman & Richart 1967

Table 7.7. Form of equations for resonant frequency and vibration amplitudes.

Constant force excitation ($F_0 = \text{constant}$)	SDOF Force = $F_0 \sin \omega t$	Rotating mass excitation ($F_0 = m_e \omega^2$)
Resonant frequency (ω_r)	$\omega_r = \omega_n (1 - 2D^2)^{1/2}$	$\omega_r = \omega_n (1 - 2D^2)^{-1/2}$ ($\omega_n = \text{relevant natural frequency}$)
Resonant amplitude Maximum vibration amplitude (A_{max})	$A_{max} = \frac{F_0}{2Dk(1-D^2)^{1/2}}$	$A_{max} = \frac{m_e c}{m 2D(1-D^2)^{1/2}}$
Amplitude at any frequency $\omega(A)$	$A = \frac{F_0}{k((1-\omega^2/\omega_n^2)^2 + (2D\omega/\omega_n)^2)^{1/2}}$	$A = \frac{m_e c(\omega/\omega_n)^2}{m((1-\omega^2/\omega_n^2)^2 + (2D\omega/\omega_n)^2)^{1/2}}$

Force Transmissibility



$$T_F = \left[\frac{1 + (2D\omega/\omega_n)^2}{[1 - (\omega/\omega_n)^2]^2 + (2D\omega/\omega_n)^2} \right]^{1/2}$$

Transmissibility is less than 1.0 only when ω/ω_n ratio exceeds $\sqrt{2}$.

Many isolating materials possess low values of damping ratio (D)

Figure 1.7 Force transmissibility for a single degree of freedom system

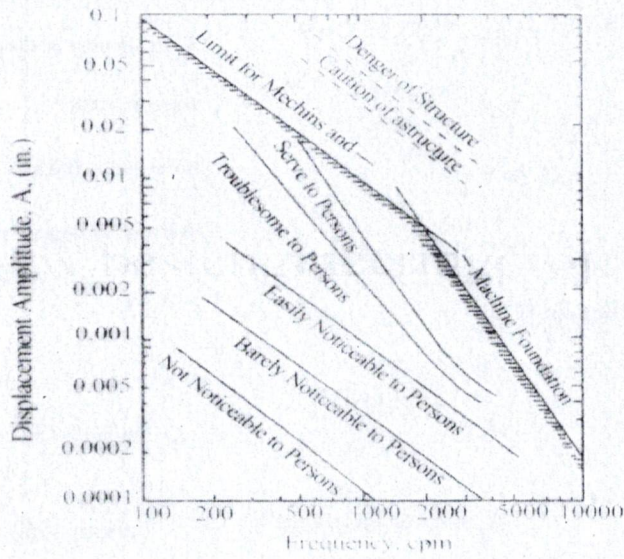


Figure 1 General Limits of Displacement Amplitude for a Particular Frequency Vibration (Richard, 1962)

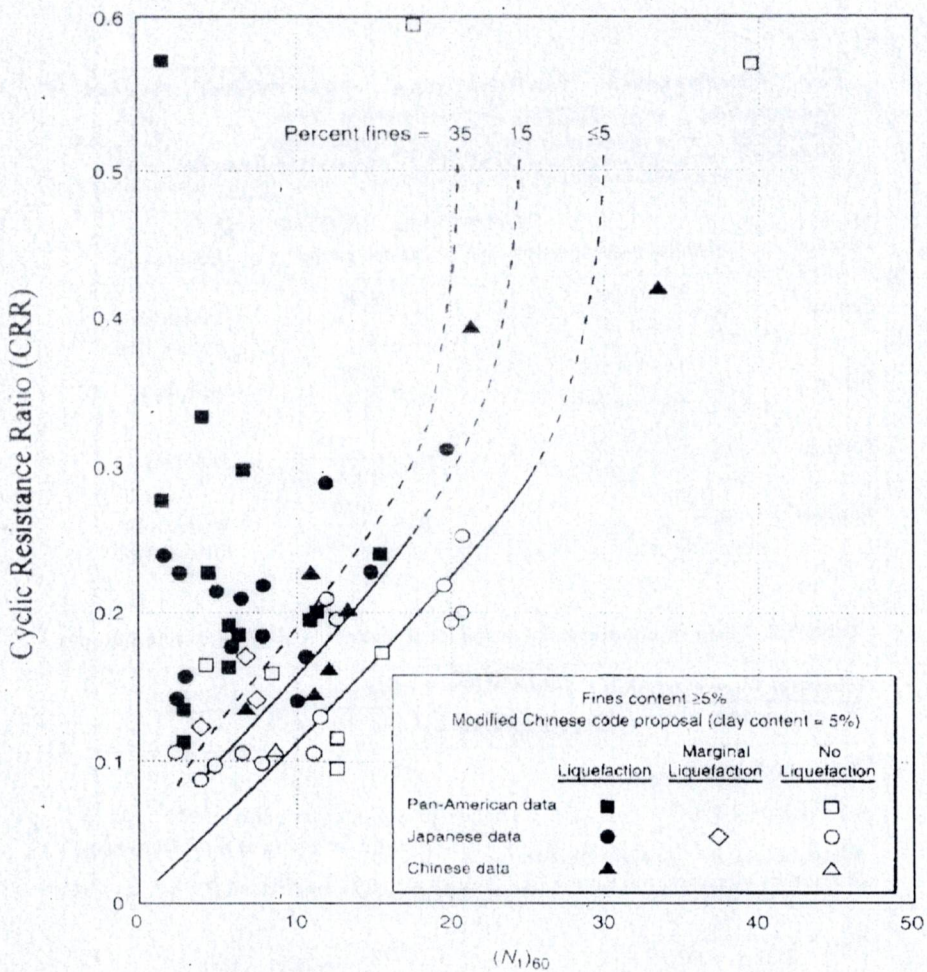


FIGURE 6.6 Plot used to determine the cyclic resistance ratio for clean and silty sands for $M = 7.5$ earthquakes. (After Seed et al. 1985, reprinted with permission of the American Society of Civil Engineers.)

Sylhet Engineering College, Sylhet
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Department of Civil Engineering

Final Examination, 2023

Course No.: CE 827

Time: 02 (Two) hours

4th Year 2nd Semester

Course Title: Prestressed Concrete

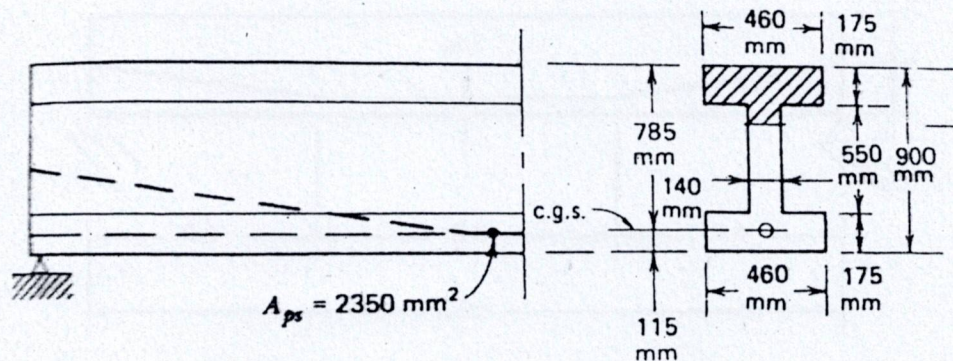
Full Marks: 40

N.B: (i) Answer any two questions from each part (ii) Use separate answer script for each part (iii) Marks allotted are indicated in the margin (iv) Assume data if necessary

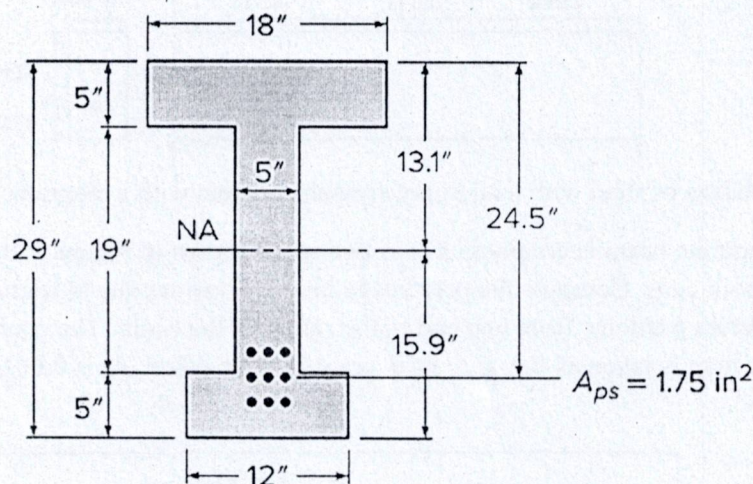
PART- A

(Answer any two questions)

1. (a) Explain the loss of prestress due to friction. 1.5
- (b) Why only high strength concrete and high tensile steel are used in prestressed concrete? 2.5
- (c) A prestressed-concrete rectangular beam 400 mm by 600 mm has a simple span of 6.5 m and is loaded by a uniform load of 40 kN/m including its own weight. The prestressing tendon is located 180 mm above the bottom edge and produces an effective prestress of 1580 kN. Using the second concept compute fiber stresses in the concrete at the midspan section. 6.0
2. (a) Discuss the advantages and disadvantages of prestressed concrete over reinforced concrete. 3.0
- (b) An I-shaped beam is pressed with $A_{ps} = 2350 \text{ mm}^2$ as prestressing steel with an effective stress of 1100 MPa. The c.g.s. of the strands which supply the prestress is 115 mm above the bottom of the beam along with the shape of the concrete cross section shown in fig. Find the ultimate resisting moment of the section for design following the ACI code. Material properties: $f_{pu} = 1860 \text{ MPa}$, $f_c = 48 \text{ MPa}$. 7.0



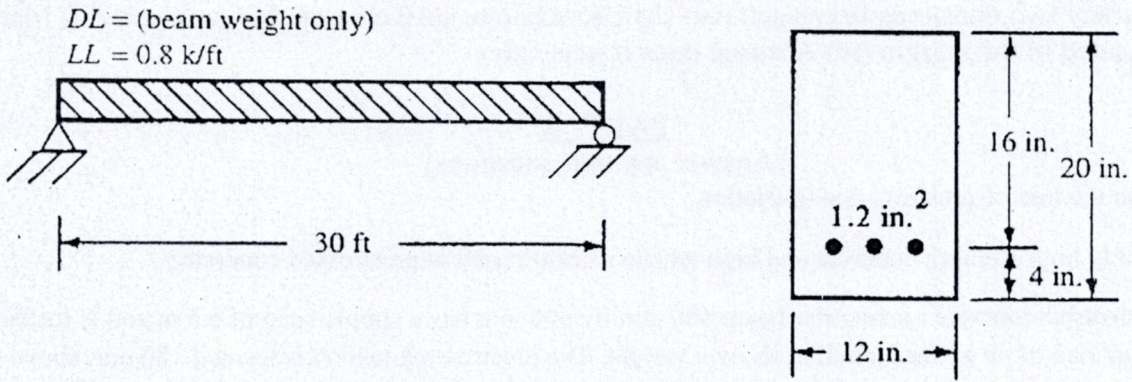
3. (a) What is anchorage slip? How does it affect prestress? 3.0
- (b) The unsymmetrical I beam shown in Fig. below carries an effective prestress force of 288 kips and supports a superimposed dead load of 345 lb/ft and service live load of 900 lb/ft, in addition to its own weight of 255 lb/ft, on a 50 ft simple span. At the maximum moment section, the effective depth to the main steel is 24.5 in. (eccentricity 11.4 in.). The strands are deflected upward starting 15 ft from the support, and eccentricity is reduced linearly to zero at the support. If concrete with $f_c' = 5000 \text{ psi}$ and stirrups with $f_{yt} = 60,000 \text{ psi}$ are used, and if the prestressed strands have strength $f_{pu} = 270 \text{ ksi}$, what is the required stirrup spacing at a point 10 ft from the support? Use ACI guidelines. 7.0



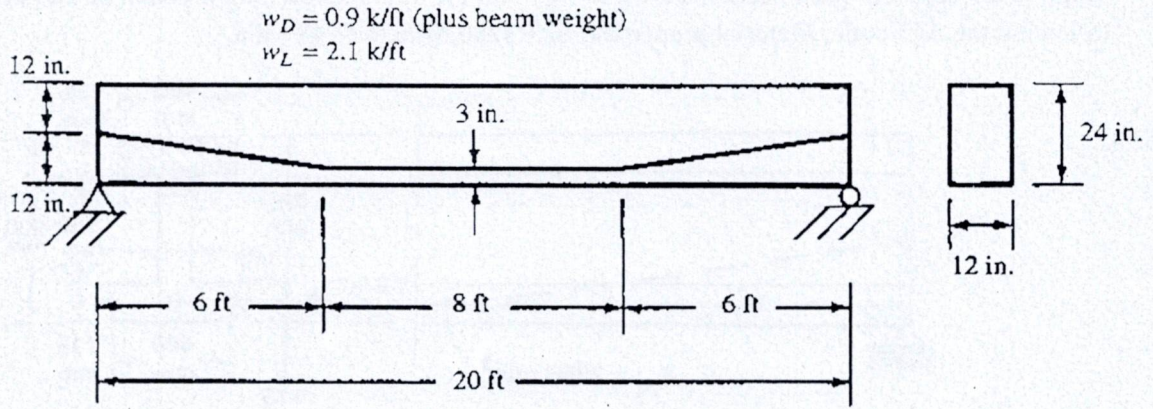
PART-B

(Answer any two questions)

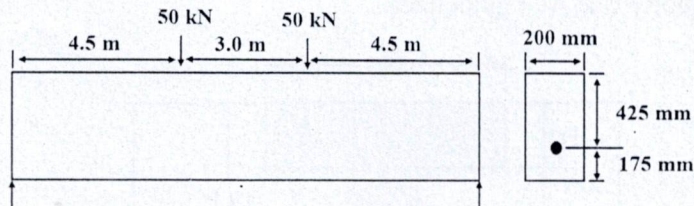
4. (a) The pretensioned rectangular beam shown in figure below has straight cables with initial stresses of 175 ksi and final stresses after losses of 140 ksi. Determine the deflection at the beam centerline immediately after the cables are cut. $E_c = 4 \times 10^6$ psi. Assume the concrete is uncracked. 5.0



- (b) Calculate the shearing strength of the section shown in figure below at 4 ft from the supports, using both the approximate method and the more detailed method allowed by the ACI Code. Assume that the area of the prestressing steel is 1.0 in.^2 , the effective prestress force is 250 k, and $f'_c = 4000$ psi, normal weight. 5.0



5. (a) Define kern zone. Derive the kern depth for a rectangular beam. 3.0
- (b) A posttensioned simple beam on a span of 12 m has a cross section shown in Figure. The initial prestress in the steel is 950 MPa, reducing to 820 MPa after deducing all losses. The parabolic cable has an area of 1600 mm^2 , $n = 6$. Compute the total dead load and live load that can be carried by the beam- i) for zero stress in the bottom fibers, ii) for cracking in the bottom fibers at a modulus of 4.2 MPa, and assuming concrete to take tension up to that value. 7.0



6. (a) Describe the variation of steel with load in prestressed concrete with a diagram. 3.0
- (b) A prestressed-concrete beam is continuous over two spans shown in Figure 5. Its curved tendon is to be tensioned from both ends. Compute the percentage loss of prestress due to friction considering gradual reduction in different portions, from one end to the center of the beam. The coefficient of friction between the cable and the duct is taken as 0.4, and the average wobble effect, K , is 0.0026 per meter. 7.0

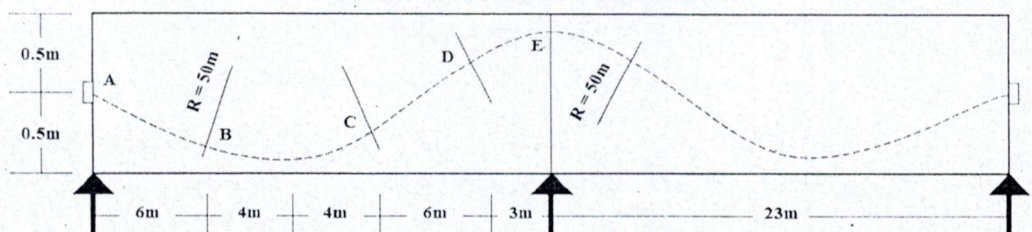


Figure 5

Sylhet Engineering College, Sylhet
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Department of Civil Engineering

Final Examination, 2023
Course No.: CE 887
Time: 02 (Two) hours

4th Year 2nd Semester
Course Title: Professional Practices and Communication
Full Marks: 40

N.B: (i) Answer any two questions from each part (ii) Use separate answer script for each part (iii) Marks allotted are indicated in the margin.

Part- A

(Answer any two questions)

1. (a) Who are the stakeholders in a project? 2.0
- (b) What are the main components of a project proposal? 2.0
- (c) For a single house project, there are 11 work packages: A and B (civil work, substructure), C, D, E, and F (civil work, superstructure), G (electrical, interior), H (electrical, exterior), I (mechanical, HVAC), J (mechanical, elevator), and K (mechanical, plumbing). Activities E and F follow activity B. Activity C precedes activity G. Activity I follows the completion of activity E. The predecessors to activity K are activities H and I. Activity D follows activity A and precedes activity H. Activity J is preceded by activities F and G. Develop a logical relationship among the activities and draw an activity network. 6.0
2. (a) What is the significance of contract in construction? 2.0
- (b) What are the four methods of specification? How to select the most appropriate method of specification? 3.0
- (c) Identify the similarities and dissimilarities between "cost plus percentage of cost" contract and "cost plus fixed fee" contract. 5.0
3. (a) Briefly discuss the complete process of bid evaluation. 4.0
- (b) The cash flows for two projects are given below. Assuming an 8% discounted rate, determine the most suitable project on the basis of NPV. 6.0

Year	Cash flow for project "A"	Cash flow for project "B"
0	1600	1500
1	1000	400
2	700	700
3	500	900
4	300	1000

Part- B

(Answer any two questions)

4. (a) What is grapevine communication? 2.0
- (b) Why is communication important in management? 3.0
- (c) According to the ASCE Code of Ethics, answer the following questions: 5.0
 - (i) What types of conduct or professional practices should an engineer avoid in order to maintain ethical integrity?
 - (ii) Under what circumstances should an engineer engage, or recommend engaging, qualified specialists or experts?
 - (iii) What ethical principle should an engineer uphold regarding fair compensation for individuals involved in engineering work?

5. (a) What is bill of quantities? 2.0
(b) What is industrial dispute? Note down the causes of industrial disputes. 3.0
(c) Explain the principles of document interpretation. 5.0
6. (a) What is the basic difference between "industrial relations" and "labor relations"? 2.0
(b) What is meant by professional ethics? What is its importance in civil engineering? 3.0
(c) Briefly discuss the problems due to which moral dilemmas arise. What steps can a professional follow to overcome such moral dilemmas? 5.0

The End

Sylhet Engineering College, Sylhet
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Department of Civil Engineering

Final Examination, 2023
Course No: CE 873
Time: 02 (Two) hours

4th Year 2nd Semester
Course Title: River Engineering
Full Marks: 40

N.B.: (i) Answer any two questions from each PART

(ii) Use separate answer scripts for each PART

(iii) Marks allotted are indicated in the margin

(iv) Special Instruction (if any) -----N/A-----

PART- A

(Answer any two questions)

1. (a) Define groynes? Classify and describe groynes with figures. Differentiate between spurs and groynes. 5
(b) Define delta and estuary. Differentiate between them. 3
(c) What is the sinuosity of river. Show with figure. 2

2. (a) What is flood plain. Describe the longitudinal profile of rivers 4
(b) What is meandering river? What are the characteristics of meandering? 3
(c) Explain roles of rivers in development of civilization. 3

3. (a) Draw typical sections of levees for different heights. 6
(b) Jamuna river has Thalweg length from Bahadurabad ghat to Aricha ghat is 255km. If channel straight Bahadurabad to Aricha reach length is 199.5 km. Calculate channel sinuosity of the river. 4

PART- B

(Answer any two questions)

4. The following hydraulic data pertains to a bridge site of a river. Maximum discharge 6000 cumecs, HFL 104 m, riverbed level 100 m, Average diameter of riverbed material 0.10 mm, Design and sketch Bell's Bunds including the launching apron to train the river. Assume plentiful availability of boulders near the site. 10

5. (a) Classify bed forms with necessary figures. Write down their characteristics. 5
(b) Describe different modes of sediment transport. Define: Bedload, suspended load, sediment load, wash load. 5

6. (a) Write names of different formulas for determination of bed load 5
(b) Define aggradation and degradation. Differentiate between them. How to mitigate them? 5

Sylhet Engineering College, Sylhet
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Department of Civil Engineering

Final Examination, 2023

Course No.: CE 835

Time: 02 (Two) hours

4th Year 2nd Semester

Course Title: Solid Waste Management

Full Marks: 40

N.B. : (i) Answer any two questions from each PART

(ii) Use separate answer scripts for each PART

(iii) Marks allotted are indicated in the margin

(iv) Special Instruction (if any)-----N/A-----

PART- A

(Answer any two questions)

1. a. Explain the concept of solid waste in your own words. Propose and provide real-life examples of practical strategies to reduce solid waste. 4
- b. Describe the properties of solid waste and explain their importance in waste management. How do these properties help in selecting appropriate disposal and treatment methods? 6
2. a. Draw a flow diagram illustrating the material flow in your local community or a specific industry. 4
- b. What is an engineered landfill? Design a simple layout for an engineered landfill tailored to a specific location or community. 6
3. a. Analyzing stationary-container collection system solid wastes from a commercial area are to be collected using a stationary container collection system having 4 m³ containers. Determine the appropriate truck capacity for the following conditions: (i) Container size = 4 m³, (ii) Container utilization factor = 0.75, (iii) Average number of containers at each location = 2, (iv) Collection-vehicle compaction ratio = 2.5; (v) Container unloading time = 0.1 h/container, (vi) Average driving time between container locations = 0.1 h, (vii) One-way haul distance = 30 km, (viii) Speed limit = 88 km/h, (ix) Time from garage to first container location = 0.33 h, (x) Time from last container location to garage = 0.25 h, (xi) Number of trips to disposal site per day = 2 and (xii) Length of work day = 8 h. 8
- b. What are the problems that may arise due to the mismanagement of solid wastes? 2

PART- B

(Answer any two questions)

4. a. Explain the following: 4
 - (i) Pyrolysis
 - (ii) Open dumping
 - (iii) Refuse derived fuel
 - (iv) Biogasification
- b. Draw the typical sectional view of a fixed dome biogas digester. Determine the size of a biogas digester and hydraulic chamber. Given 12 cows with body weight 150 kg each and temperature = 30 °C. Assume standard data if necessary. 6
5. a. Explain the adverse health and environmental impacts due to improper handling of solid waste. 04
- b. A transfer station handling 350 tons/day, 5 days per week, costs Tk 7.5 million to build and Tk 0.2 million per year to operate. An individual tractor-trailer costs Tk 5.5 million and carries 25 tons/trip. Annual operation and maintenance costs (including fuel) of the truck are Tk 0.15 million; the driver makes Tk 0.25 million per year (including benefits). The capital costs of the building and transfer trucks are to be amortized over a 15-yr period using a 12% discount factor. Suppose, it takes 1 hour to make a one-way trip from the transfer station to the disposal site and 7 round trips per day are made. Find the transfer station and hauling cost (BDT) per ton. 06
6. a. What are the purposes of incineration? Describe the basic process of the preparation of refuse-derived fuel (RDF) with a suitable flow sheet. 6
- b. Describe the role of landfill sealants in controlling gas and leachate movement in a sanitary landfill. Why are these sealants important for environmental protection? 4

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Department of Civil Engineering

Final Examination, 2023
Course No.: CE 855
Time: 02 (Two) hours

4th Year 2nd Semester
Course Title: Transportation Engineering-III
Full Marks: 40

N.B. : (i) Answer any two question from each PART
(iii) Marks allotted are indicated in the margin

(ii) Use separate answer scripts for each PART
(iv) Special Instruction (if any)-----N/A-----

PART- A

(Answer any two questions)

1. (a) Calculate trip distribution matrix using gravity model. Necessary information is given below 08

Travel time (min)

Zone	1	2	3
1	0	5	7
2	4	0	6
3	6	6	0

Attraction and Production of trips among the zones

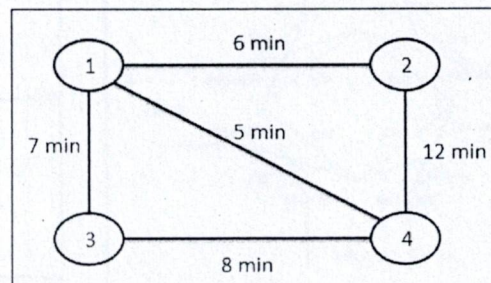
Zone	1	2	3	total
Trip production	140	330	280	750
Trip attraction	300	270	180	750

- (b) Which are the factors influencing the attraction and production of trips in a location? 02

2. An urban area is divided into 4 zones for transportation demand analysis. Zone pair trip distribution is given in the table and the zone pair travel time is given in Figure-2 below. Calculate total no. of trip assigned in each link of road. Using all or nothing assignment model. 07

Table: Origin- Destination matrix

OD	1	2	3	4
1	0	100	200	300
2	200	0	200	400
3	100	300	0	100
4	200	400	200	0



- (a) What are the elements of transportation planning in highway design? 03

3. (a) Differentiate between Logit model and Probit model. 03

- (b) Utility function of road user travelling from sub urban to CBD (Central Business District) of Dhaka city using mode CNG and BUS are given below. 07

$$U_{\text{CNG}} = -0.06 - 0.07(\text{CNG travel time in min.}) - 0.105(\text{parking cost in dollar}) + 0.0001(\text{HH income in dollar})$$

$$U_{\text{bus}} = -0.07(\text{bus travel time in min.}) - 0.012(\text{bus waiting time in min.}) - 0.66(\text{bus fare in dollar})$$

The travel characteristics pattern between two zones are given below:

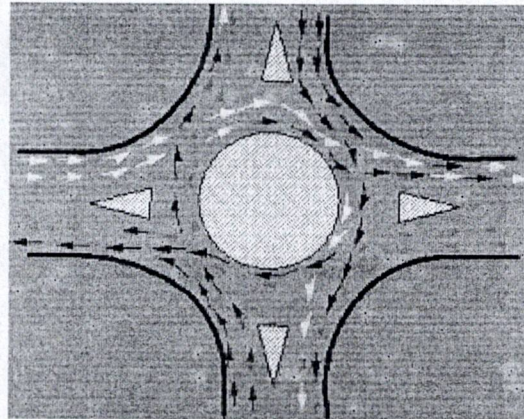
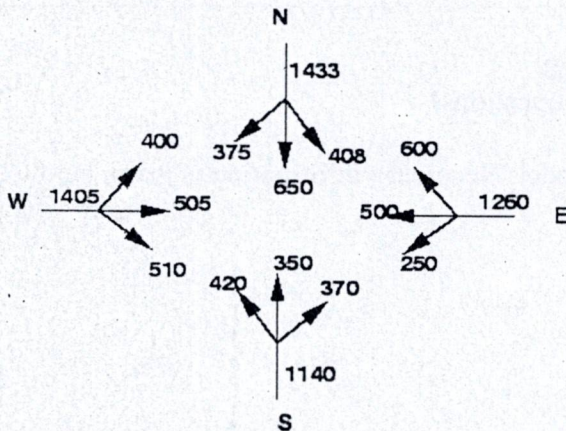
Variable	Unit	Auto	Bus
CNG travel time	Minute	40	-
Parking cost	Dollar	8	-
Bus fare	Dollar	-	2
Bus travel time	Minute	-	48
Bus headway	Minute	-	18
Annual house hold income=\$8000.			

- (i) Compute probability as individual will choose CNG for trip
(ii) In order to increase ridership in public transport which option will consider transport authority?
- (1) Reducing base fare by 40 cents.
 - (2) Doubling parking price
 - (3) Doubling the number of bus

PART- B

(Answer any two questions)

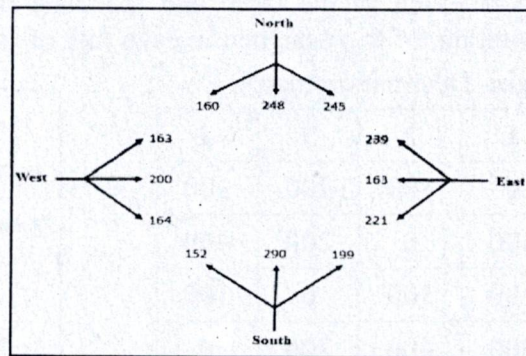
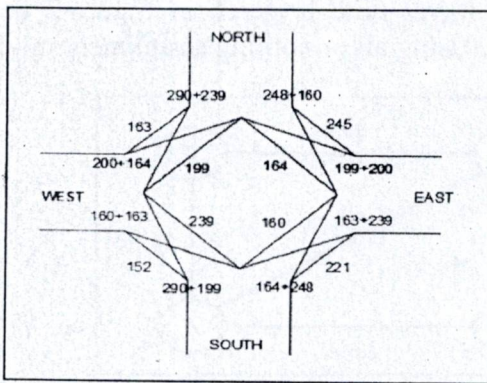
4. (a) Which types of data are required for transportation planning? Mention the main objectives of transportation planning. 03
- (b) Find out the non-weaving traffic and weaving traffic ratio. 07



$$Q_p = \{280w(1+e/w)\} * (1-p/3) / (1+w/l)$$

Design a rotary intersection based on following data

Direction (Approach)	Left Turning	Straight	Right Turning
North	245PCU/h	248PCU/h	160PCU/h
South	152	290	199
East	221	163	239
West	163	200	164



5. (a) The increasing rate of private car usage in Sylhet city as a result of poor government policy is key cause of smooth urban traffic movement. Car parking is one of the concern factors for transport and traffic management in Sylhet commercial area. The co-ordination between parking policy and traffic management revealed how parking is becoming a barrier to the through-traffic operation. To develop an integrated transported system, parking characteristics and parking facilities are essential. 10
- (a) Define traffic management. Write objectives of traffic management system.
- (b) Write the contents of transportation planning and parking policy.
- (c) Mention six elements of transportation planning to make ensure sustainability in traffic management.
- d) What is TDM? Mention the factors of parking policy?
6. (a) Briefly discuss road safety strategy for sustainable transport system. 03
- (b) Define terms related with parking characteristics --(i) parking accumulation (ii) parking load (iii) parking overturn and (iv) parking load. 04
- (c) Write short note on (i) parallel parking (ii) 45° parking (iii) off street parking. 03