**JALPAIGURI GOVERNMENT ENGINEERING COLLEGE**
**[A GOVERNMENT AUTONOMOUS COLLEGE]**
**JGEC/B.TECH/CE/CE (HS) 801/2022-23**
**2023**
**PAPER NAME : Professional Practice Law & Ethics**

Full Marks: 70 Times: 3 Hours

*The figures in the margin indicate full marks.*
*Candidates are instructed to write the answers in their own words as far as practicable.*

**GROUP-A**
**[OBJECTIVE TYPE QUESTIONS]**

Answer ***all***questions 5x2=10

1. What is justice ? 2
2. What is Rule of Law ? 2
3. What is good life ? 2
4. What is profession ? 2
5. What is Virtue Ethics ? 2

**GROUP-B**
**[LONG ANSWER TYPE QUESTIONS]**

Answer any ***five*** questions 12x5 =60

6. Write a short note on Secularism. 12
7. Write a short note on Indian Constitution & its societal values ? 12
8. Explain the concept of mental health and social values ? 6+6
9. Write a short note on dynamics communication ? 12
10. Write a short note on kinesics ? 12
11. What is Ethics ? What are the general principles of the 'codes of ethics'? 4+8
12. Write a short note on Democracy ? 12

# JALPAIGURI GOVERNMENT ENGINEERING COLLEGE
[A GOVERNMENT AUTONOMOUS COLLEGE]
JGEC/B.TECH./CE/CE(PE)801D/2022-23
2023
## PAVEMENT MATERIALS

Full Marks: 70 Times: 3 Hours

*The figures in the margin indicate full marks.*
*All the notations have their usual meanings unless specifically mentioned.*
*Candidates are requested to write their answers in their own words as far as practicable.*
***Please write the answer of all part questions of a broad type question successively as far as practicable.***
**[Please provide two (02) mm graph paper along with the answer script]**

### GROUP-A
### [OBJECTIVE TYPE QUESTIONS]
Answer ***all*** questions 5×2=10

1. Name the types of tests are to be carried out to evaluate the strength properties of the soil. 2
2. What is the objective of proportioning of aggregate for bituminous mix design? 2
3. In a vane shear test, the applied torque is 42 N-m and the height of vane and diameter of the blades are 100 mm and 80 mm respectively. Find out the shear strength of the soil. 2
4. Why does calculation of % air voids need to be done during Marshall stability test? 2
5. Find out the 'modulus of elasticity' and 'flexural strength' for a M25 concrete. 2

### GROUP-B
### [LONG ANSWER TYPE QUESTIONS]
Answer any ***four*** questions 4×15=60

6. The properties of a subgrade soil are found as 5+5

| Description | Values |
|---|---|
| % finer than 00.075 mm | 55% |
| Liquid limit | 50% |
| Plastic limit | 40% |

i) Classify the soil by: (a) HRB soil classification system and (b) Unified soil classification system. Use the following two tables.

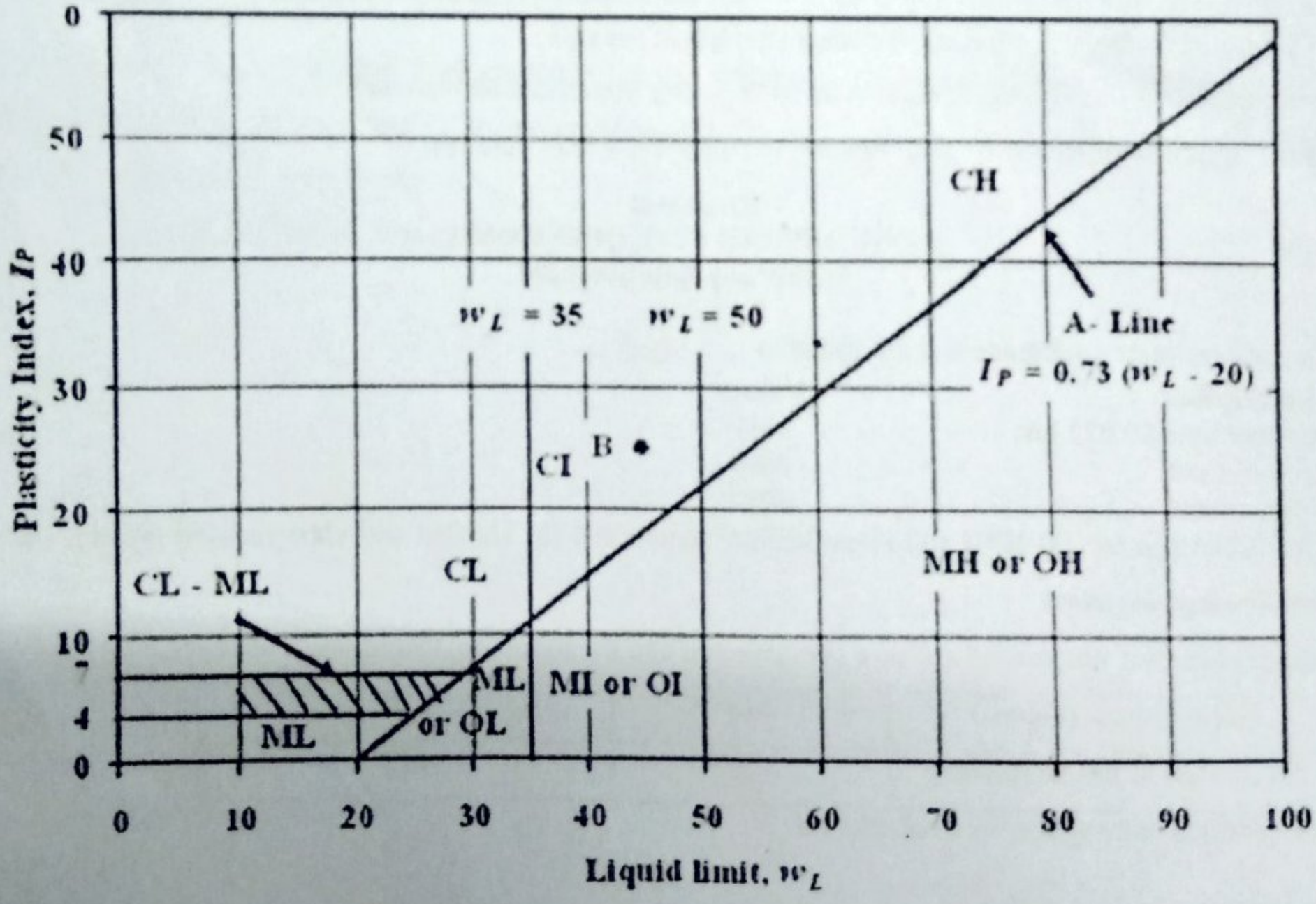
ii) A direct shear test was carried out on a cohesive soil and the following results were obtained. 5

| Normal stress ($kN/m^2$) | 150 | 250 |
|---|---|---|
| Shear stress at failure ($kN/m^2$) | 110 | 120 |

Find cohesion and angle of internal friction.

HRB CLASSIFICATION OF SOILS AND SOIL-AGGREGATE MIXTURES

| *General Description* | *Granular materials (35% or less passing 75 micron IS sieve)* | | | | | | | *Silt clay materials (more than 35% passing 75 micron IS sieve)* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Group Classification* | A-1 | | A-3 | A-2 | | | | A-4 | A-5 | A-6 | A-7 |
| | A-1-a | A-1-b | | A-2-4 | A-2-5 | A-2-6 | A-2-7 | | | | A-7-5<br>A-7-6 |
| Sieve analysis, percent passing<br>2.0 mm IS sieve | 50 max | | | | | | | | | | |
| 425 micron sieve | 30 max | 50 max | 51 min | | | | | | | | |
| 75 micron sieve | 15 max | 25 max | 10 max | 35 max | 35 max | 35 max | 35 max | 36 min | 36 min | 36 min | 36 min |
| Characteristics of fraction passing 425 micron sieve<br>Liquid Limit | | | | 40 max | 41 min | 40 max | 41 min | 40 max | 41 min | 40 max | 41 min |
| Plasticity Index | 6 max | | NP | 10 max | 10 max | 11 min | 11 max | 10 max | 10 max | 11 min | 11 min |
| Group Index | Zero | | | | | 4 max | | 8 max | 12 max | 16 max | 20 max |
| Usual type of significant constituent materials | Stone fragments gravel and sand | | Fine sand | Silty or clayey gravel and sand | | | | Silty soils | | Clayey soils | |
| General rating as subgrade | Excellent to good | | | | | Fair to poor | | | | | |




7. i) The load-penetration values of CBR test conducted on a soil specimen are given below. Determine the average CBR value of the soil if 10 divisions of the load dial represent 20 kg load in the calibration chart of the proving ring. 8

| Penetration of Plunger, mm | Load Dial reading, division |
|---|---|
| 0.00 | 0 |
| 0.5 | 10 |
| 1.0 | 18 |
| 1.5 | 26 |
| 2.0 | 34 |
| 2.5 | 40 |
| 3.0 | 50 |
| 4.0 | 62 |
| 5.0 | 70 |
| 7.5 | 87 |
| 10.0 | 95 |
| 12.5 | 109 |

ii) A plate load was conducted on a soaked subgrade during monsoon season using a plate diameter of 30 cm. The load value corresponding to mean settlement dial readings are given below. Determine the modulus of subgrade reaction. 7

| Settlement, mm | 0.0 | 0.26 | 0.52 | 0.76 | 1.02 | 1.26 | 1.53 | 1.76 |
|---|---|---|---|---|---|---|---|---|
| Load. kg | 0.0 | 540 | 1010 | 1290 | 1510 | 1600 | 1720 | 1840 |

8. i) Use analytical method to find the proportioning of the aggregates A, B and C as per the sieve analysis given below. 9

| Sieve size, mm | % finer (Aggregate A) | % finer (Aggregate B) | % finer (Aggregate C) | Target grading range |
|---|---|---|---|---|
| 19.2 | 100 | 100 | 100 | 100 |
| 13.2 | 63 | 100 | 100 | 70 – 85 |
| 4.75 | 19 | 100 | 100 | 40 – 55 |
| 2.36 | 8 | 93 | 100 | 30 – 42 |
| 0.300 | 5 | 55 | 100 | 20 – 30 |
| 0.150 | 3 | 36 | 97 | 12 – 22 |
| 0.075 | 0 | 3 | 88 | 5 – 11 |

ii) What are the different types of bituminous materials used in road construction? Under what circumstances each of these materials is preferred? 6

9. i) The specific gravities and weight proportion of aggregates and bitumen are as follows for the preparation of Marshall mix design. The volume and weight of the Marshall specimen was found to be 475 cc and 1100 gm. Assuming absorption of bitumen by aggregates is zero, find $V_v$, $V_b$, *VMA* and *VFB*. 9

| Item | A_1 | A_2 | A_3 | A_4 | Bitumen |
|---|---|---|---|---|---|
| Weight (gm) | 825 | 1200 | 325 | 150 | 100 |
| Specific gravity | 2.63 | 2.51 | 2.46 | 2.43 | 1.05 |

ii) Define the following terms: (a) Paving grade bitumen (b) Modified bitumen binders (c) Cut-back bitumen (d) Bitumen emulsion 6

10. i) Calculate the mix proportion in kg for cement, water, coarse aggregates and sand for preparation of 1 cubic meter of concrete for the following data. No chemical admixture is used. 7

a) Mass of water required = 197 kg per 1 cubic meter of concrete

b) Water Cement ratio = 0.5

c) Coarse aggregates = 60% of total aggregates

d) Specific gravity of cement, water, coarse aggregates and sand are 3.15, 1, 2.80 and 2.70 respectively.

ii) Write down the significance of the following term related to bituminous mix design 8

a) Low VMA value

b) High VMA value

c) Low flow value

d) High flow value

11. Describe in brief with a neat sketch of apparatus for the following experiments of aggregate mentioning (a) Objective (b) Test procedure and (c) Recommended value (if any). 7.5 + 7.5

i) Aggregate Impact Value

ii) Aggregate Crushing Strength

----End---

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**JGEC/B.TECH/CE/CE(OE)801B/2022-23**
**2023**
**BRIDGE ENGINEERING**

Full Marks: 70 Times: 3 Hours

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**GROUP-A**
**[OBJECTIVE TYPE QUESTIONS]**

Answer ***all*** questions 5x2=10

1. Define theCapacity of railway track 2
2. What are general features of deck Slab Bridge? 2
3. Write down "impact factor" for bridges. 2
4. Define Cable stayed Bridge 2
5. What are the advantages of river training? 2

**GROUP-B**
**[LONG ANSWER TYPE QUESTIONS]**

Answer any ***four*** questions 4x15=60

6. A reinforced concrete simply supported slab forms the deck of a road bridge, having the following data: (i) Clear span = 6 m. (ii) Carriage way -2 Lane. (iii) Width of kerb= 500 mm on either side (iv) Width of bearing= 400 mm (v) Materials = M25 grade concrete and Fe 415 steel. (vi) Type of loading IRC class AA tracked vehicle. Design the deck slab and show the reinforcement details. (Assume suitable data as and when required) 15

7. i) Define (Any Four): 4x2
   a) Theoretical nose of crossing
   b) Sleeper density
   c) Creep of rail
   d) Turn out
   e) Switch Angle
   f) Causeway
   g) Abutment pier
   ii) Explain the various components of a well foundation with their functions. 7

8. i) Explain the different type of forces and their combinations in the design of box culverts. 5
   ii) How a scour depth for bridge foundation is estimated? Explain in brief 10

9. i) What is meant by economical span? 2
   ii) Derive the conditions for an economical span, stating clearly the assumptions made in the derivation. 8
   iii) What are the criteria for selection of a Bridge site? 5

10. Explain about. 7+8
    i) Effective Width Method
    ii) Pigeaud's Coefficient Method of Bridge slab design

11. i) A bridge has a linear waterway of 150 m constructed across a stream whose natural linear way is 220 m. If the average flood discharge is 1200 $m^3/s$ and average flood depth is 3 m , Calculate the afflux under the bridge 6
    ii) What is Clearances in road bridges- explain with diagram 3
    iii) Describe the various types of Bridge Trusses 6

12 A plate girder is simply supported over an effective span of 25m; it carries an UDL of 85 kN/m exclusive of self-weight. Design the plate girder (riveted/welded) completely, assuming that it is effectively supported in lateral direction. 15

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**2023**

# ENVIRONMENTAL IMPACT ASSESSMENT AND LIFE CYCLE ANALYSIS

Full Marks: 70 Times: 3 Hours

*The figures in the margin indicate full marks.*
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## GROUP-A
## [OBJECTIVE TYPE QUESTIONS]

5x2=10

Answer *all* questions

1. What is mitigation Plan? 2
2. What are the typical input and output in an LCA? 2
3. Define conservative and non-conservative pollutants? 2
4. What is Environmental Audit? 2
5. What is Life Cycle Costing (LCC)? 2

## GROUP-B
## [LONG ANSWER TYPE QUESTIONS]

4x15 = 60

Answer any *four* questions

6. i) Deduce the necessary expression for predicting the concentration of any conservative constituent in a riverine system given in 'O'connors Model'. 8
   ii) Determine the effluent concentration from a treatment system designed as a plug-flow reactor, assuming the removal of constituents being described by a retarded first order reaction. Given the following: 7
   a) Reaction rate constant (K) = 0.3/day
   b) Initial concentration of the pollutant ($C_i$) = 250 mg/l
   c) Retardation co-efficient ($r_t$) = 0.75/day

   Compare the effluent concentration with or without retardation after 3 days, considering the exponent (n) of the retardation term equals to 1.0 and 1.5 respectively.

7. a) What is Environmental Management Plan (EMP)? State the essential features of a complete Environmental Management Plan? 2+3
   b) Why the goal of sustainable development may not be fulfilled by waste treatment only? 2
   c) What should be the steps taken into account to complete a Life Cycle Impact Assessment (LCIA)? What do the results of an LCIA mean? 3+1
   d) State the structural and non-structural mitigation measures recommended by MoEF for industrial sector. 4

8. i) Draw a sketch to show different steps to perform EIA for 'B' type projects only. 4
   ii) What are the tentative areas of application of one, two and three dimensional models in the context of water environment? 3
   iii) What is Life Cycle Interpretation? What are the key steps of Life Cycle Interpretation according to ISO 14043? 2+4
   iv) Why is rainy season excluded for monitoring to measure background concentration? 2

9. i) 'EIA is type of waste minimisation'- Explain. 3
   ii) What are the two different types of EIA? What is the basic difference between them? 2
   iii) What are the application and limitation of LCA? 6
   iv) Describe the process of Grant or Rejection of prior Environmental Clearance (EC). 4

10. i) What is Life Cycle Inventory (LCI)? Why conduct an LCI? 2+3
    ii) Write the categories of projects based on given threshold limit or fact: 10x1
    a) An asbestos mine with 50 ha of mining lease area.
    b) A coal washery located outside mining area and handling 3 million ton of coal/ 3 year.
    c) A secondary lead producing unit of 20,000 tonnes/ annum and registered under Hazardous

Substance Management Rule.

d) A cement plant of 0.8 million tonnes/ annum production capacity.
e) A petroleum refining industry within Haldia Notified Area.
f) A molasses based distilleries of capacity 25 KLD.
g) An off-shore gas exploration project with project cost 100 million only
h) A Common Effluent Treatment Plant (CETP).
i) A ship breaking yards including ship breaking units.
j) A sponge iron manufacturing unit of capacity 150 tonnes/ day.

11. i) What is screening? What type of project need to be screened? What is the basis for screening the projects? 3

ii) Write short notes on the following: 4x3

a) Transferability of EC.
b) History of LCA.
c) Changes brought in 2006 in EIA procedure
d) Post EC Monitoring

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**JGEC/B.TECH/CE/CE (PE) 601B/2022-23**
**2023**

# FOUNDATION ENGINEERING

Full Marks: 70 Times: 3 Hours

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***Do not carry IS code in the examination hall.***

## GROUP-A
## [OBJECTIVE TYPE QUESTIONS]

Answer ***all*** questions 5x2=10

1. How minimum depth of soil exploration is decided for a footing? 2
2. What is critical depth of pile embedded in sand? 2
3. A flexible footing is subjected to pressure of q kPa. Draw the qualitative soil reaction. 2
4. Why the inside clearance is provided in a soil sampler? 2
5. Why bentonite slurry is used during wash boring? 2

## GROUP-B
## [LONG ANSWER TYPE QUESTIONS]

Answer any ***five*** questions 12x5 =60

6. a) A 30cm square plate is loaded to failure. Failure load is determined as 90 kPa. Determine safe load for 3m×3m footing for two conditions: i) soil is clay andii) soil is sand. 3
   b) In a sand deposit, at 5m depth SPT value is 25. During SPT test energy ratio is measured as 45%. Determine $(N_1)_{60}$. $\gamma$= 16.5 kN/m$^3$. 3
   c) Design N –value (corrected) for 2m width footing placed at 1.5m depth is 20. Determine allowable bearing pressure for 30mm settlement. 3
   d) The following soil samplers are available in the market: 3

| Inside diameter (mm) | Outside diameter (mm) |
|---|---|
| 35 | 36.8 |
| 36 | 37.8 |
| 37 | 38.8 |

Select a sampler to collect undisturbed soil from a deposit of soft sensitive clay.

7. a) How structural capacity of pile is determined? When structural capacity of pile comes into play? 2
   b) Write effect of installation of driven piles in sand deposits. 2
   c) Abored cast in situ pile of diameter 0.5m and of length 15m is embedded in a deposit of sand. Water table is located at 2m depth. $\gamma$ = 16.5kN/m3, $\gamma$sat = 18.5 kN/m3, $\phi'$=32.5°. Determine pile capacity considering critical depth. Chart, table given in Annexure may be used. 5
   d) What is negative skin friction? How do you reduce it? 2
   e) A square group of nine friction piles of d = 0.5m, L = 15m, spacing = 2.5d is embedded in a 20m thick clay deposit. The clay deposit is underlain by rock. To calculate consolidation settlement of the pile group, how much thickness of clay layer is to be considered? 1

8. a) Where free standing piles are used? 1
   b) Determine group capacity of nine bored cast-in situ concrete piles (square group) embedded in clay. Pile diameter, d = 0.50m, length = 20m. Spacing = 3d. Cut off level 2m, pile cap is extended 250mm from outer edge of the pile. Cu = 65kPa. = 17.4kN/m$^3$. 6
   c) Determine uplift capacity of a under-reamed pile shown in Annexure. $d$ = 0.75m, db = 2m, L = 10m, UCS = 100kPa. 4
   d) True/false: Negative skin friction decreases pile capacity. 1

9. a) A 2m×2m footing placed at 1m below a clay deposit. Load on the footing, P = 500kN. UCS of clay = 4

95kPa. Modulus of elasticity of clay = 27000kPa. Determine immediate settlement at center of the footing. Consider depth correction and rigidity correction. Chart, table given in Annexure may be used.

b) What is the function of interlocking provision in sheet pile?

c) Height of an anchored sheet pile wall penetrating sand is 7.5m. Water table is a 2.5m below GL. Anchor is placed at 1.5m below GL. $\gamma$ = 16.2 kN/m$^3$ and $\gamma$sat = 19.3 kN/m$^3$ and $\phi$ = 31.5°. Determine depth of penetration, anchor force and maximum moment considering fixed earth support analysis.

10. a) Write a short note on sand drain used for ground improvement in clay. 3

b) Two test plates are loaded at a site, one being 60cm×60cm and the other 75cm×75cm. The smaller plate support a load of 114.5kN at 12.5mm settlement and larger plate supports 150.0kN at that settlement. Determine the bearing capacity of a footing 3m square for a maximum settlement of 12.5mm. 3

c) To determine resistivity of a site, Wenner Spread is used where electrode spacing =2m. For flow of 1.5Acurrent through outer electrodes, potential drop is measured between inner electrodes as 30 V. Determine average resistivity of soil. 2

d) What is resistivity sounding and resistivity mapping? 2

e) Write basic principles of seismic refraction method of soil exploration. 2

11. a) What is the limitation of wash boring? 1

b) In a sand deposit, at 5m depth below G.L., $N_c b_r$ (determined without using bentoniteslurry)is determined as 15. Determine SPT N-value. 2

c) From a plate load test using 30cm plate, coefficient of subgrade reaction of sand is determined as 12000 kPa/m. Determine subgrade reaction for footing of large width. 3

d) Two vane shear tests are done in a homogeneous clay to determine undrained cohesion using two different vane, one being (diameter 50mm and height 100mm) and other (diameter 60mm and height 130mm). Maximum torque measured for two cases are 0.034 kN.m and 0.063 kN.m respectively. Assume uniform cohesions develop on horizontal plane and vertical plane as $C_{u\text{-}h}$and $C_{u\text{-}v}$ respectively. Determine the ratio $C_{u\text{-}h}/C_{u\text{-}v}$. 4

e) Write a short note on vibroflotation. 2

12. a) Write behavior of long and short pile subjected to lateral load. 2

b) A concrete pile, of diameter = 0.65m and length 20m is embedded in submerged sand having average N-value = 20. E(pile) = $2\times10^7$kPa. Check whether it is short or long pile and determine horizontal load that can be carried by the pile at the ground level with 8mm deflection in restrained condition (as per IS code method). Determine fixed end moment also. Relevant chart, table given in Annexure. 6

c) A short fixed head pile of diameter = 0.5m and length 4m embedded in clay having UCS = 120kPa. Draw soil reaction as per Broms theory. Determine horizontal load that the pile can carry and maximum moment at pile cap. 4

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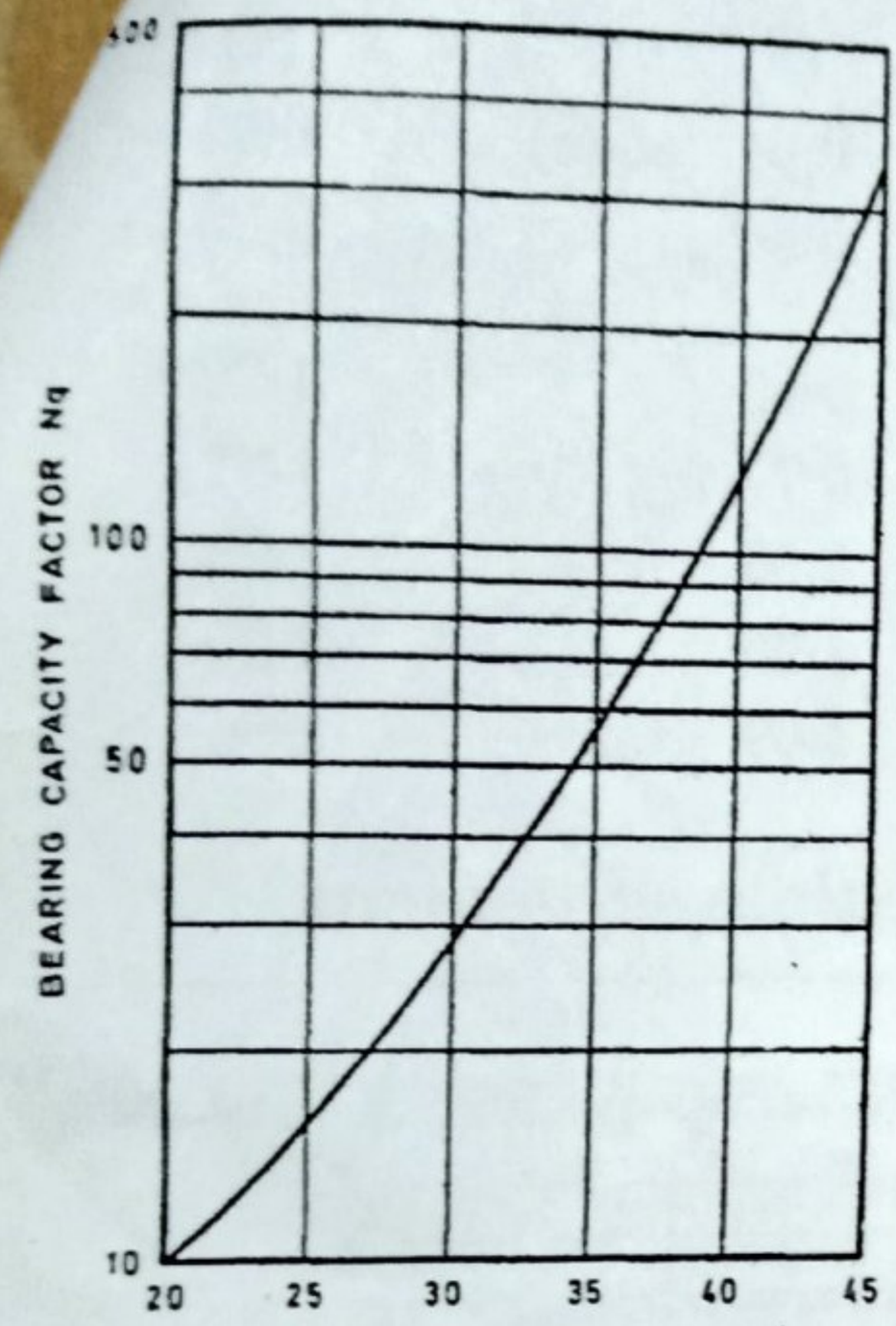
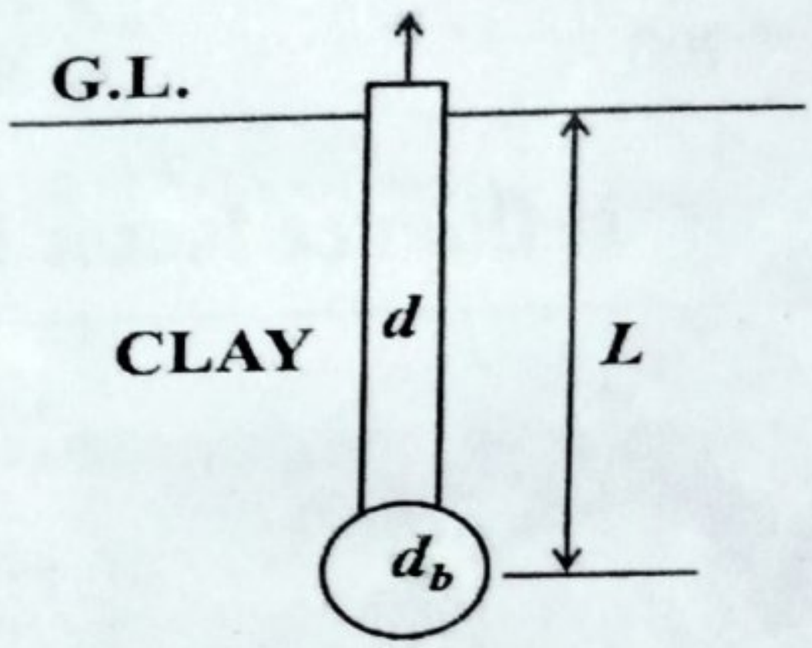
# Annexure




BEARING CAPACITY FACTORS

| ϕ (Degrees) | $N_c$ | $N_q$ | $N_\gamma$ |
|---|---|---|---|
| 0 | 5·14 | 1·00 | 0·00 |
| 5 | 6·49 | 1·57 | 0·45 |
| 10 | 8·35 | 2·47 | 1·22 |
| 15 | 10·98 | 3·94 | 2·65 |
| 20 | 14·83 | 6·40 | 5·39 |
| 25 | 20·72 | 10·66 | 10·88 |
| 30 | 30·14 | 18·40 | 22·40 |
| 35 | 46·12 | 33·30 | 48·03 |




Under reamed pile

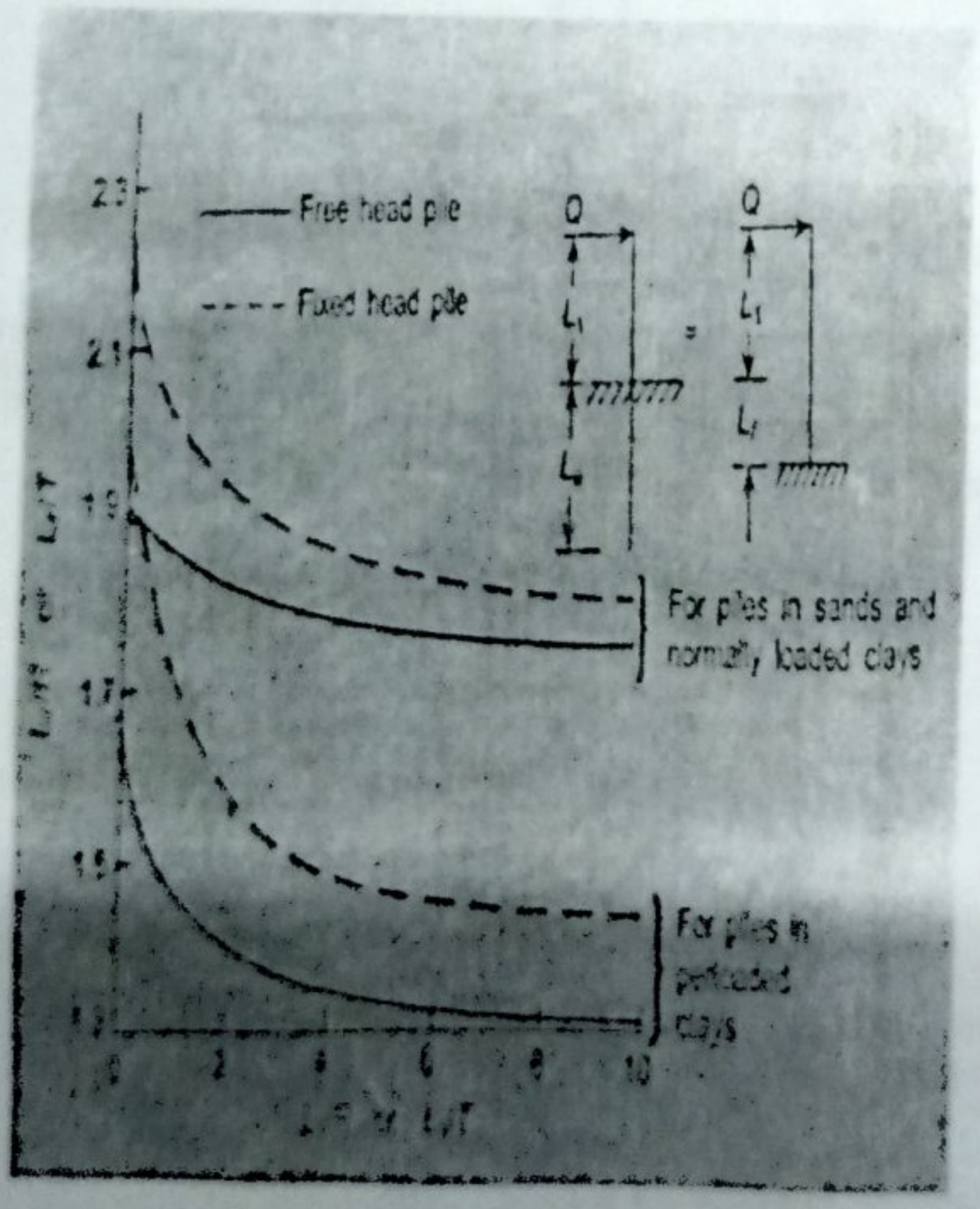
| Sl No. | Soil Type | N (Blows/30 cm) | Range of $\eta_h$ kN/m³ × 10³ | |
|---|---|---|---|---|
| | | | Dry | Submerged |
| (1) | (2) | (3) | (4) | (5) |
| i) | Very loose sand | 0-4 | < 0.4 | < 0.2 |
| ii) | Loose sand | 4-10 | 0.4-2.5 | 0.2-1.4 |
| iii) | Medium sand | 10-35 | 2.5-7.5 | 1.4-5.0 |
| iv) | Dense sand | > 35 | 7.5-20.0 | 5.0-12.0 |

NOTE — The $\eta_h$ values may be interpolated for intermediate standard penetration values, *N*.

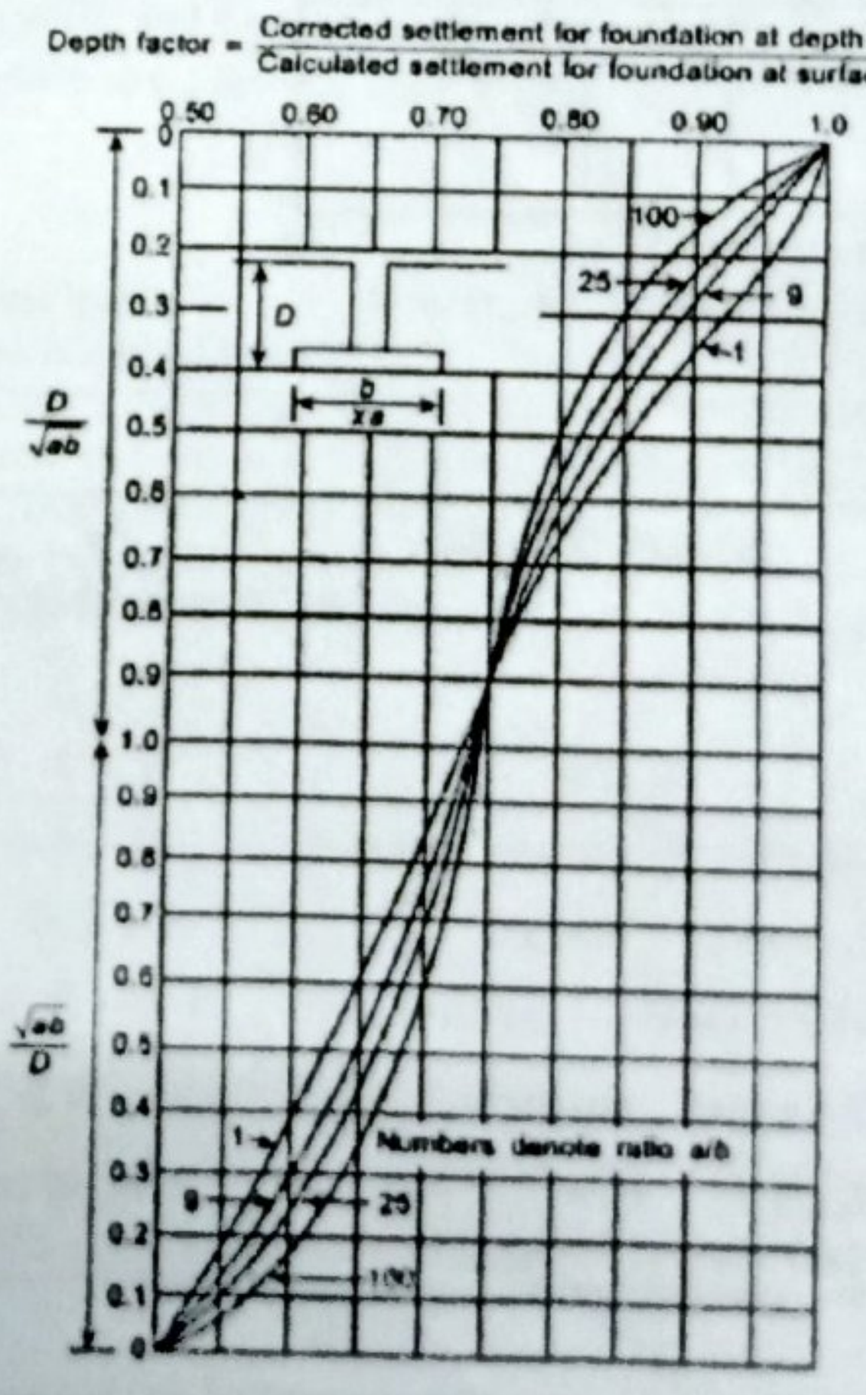
Horizontal subgrade reaction of sand.

| Shape | Influence Factor (*I*) | | |
|---|---|---|---|
| | Centre | Corner | Average |
| (1) | (2) | (3) | (4) |
| Circle | 1·00 | 0·64 (edge) | 0·85 |
| Square | 1·12 | 0·56 | 0·95 |
| Rectangle: | | | |
| $L/B$ = 1·5 | 1·36 | 0·68 | 1·20 |
| 2 | 1·53 | 0·77 | 1·31 |
| 5 | 2·10 | 1·05 | 1·83 |
| 10 | 2·52 | 1·26 | 2·25 |
| 100 | 3·38 | 1·69 | 2·96 |

**Influence factor for immediate settlement.**




**Laterally loaded pile analysis-as per IS code**




**Depth correction factor**