2013-14
B. Tech / Master (VIII Semester Examination)
(Architecture/Civil Engineering)
Construction Management
(CE-410)

Maximun Marks: 60

Note: (i) Answer ALL Questions
(ii) All parts of a question should be attempted in one continuation in one copy
(iii) All questions carry equal marks
(iv) Assume any data if not given

Q. 1 (a) Write down the definition of the project given by Project Management Institute USA and UNIDO (4)
(b) Define and discuss following types of estimates with degree of accuracy and its use
   (a) Order of Magnitude Estimate
   (b) Approximate Estimate
   (c) Detailed Estimate
   (c) Discuss the concept of Ceiling Limit with example (2)

Q. 2 (a) What do you understand by the term specification? Explain different types specification used in industry with example (6)
(b) What are the different general economic consideration to be kept in mind during purchasing (6)

Q. 2' (a) In what ways purchasing of capital equipment is different from routine Purchasing (4)
(b) What are the various issues to be examined during the purchase of construction equipment (8)
Q.3 (a) Discuss concept of wage and its types in detail
(b) Discuss basic philosophy of various types of rewards offered in lieu of achievement of a worker in the industry

OR

Q.3' (a) Write down detailed account on the evolution of HRM in India
(b) Discuss various elements of HR Planning

Q.4 (a) Define the following terms in detail
(i) Free Float
(ii) Total Float
(iii) Earliest Finish Time
(iv) Latest Start Time
(b) Number the following network diagram shown in Fig. 1 by Fulkerson Rule and then determine the Critical Path
Q.4 Calculate E.S.T, E.F.T, L.F.T, L.S.T, Free Float, Total Float and Interfering Float of the various activities of the following Project Network Shown in Fig. 2

![Fig. 2](image)

Q.5 Calculate CRASH COST and CRASH TIME of the following project network shown in Fig. 3. Assume normal cost of the project as Rs. 25000 and indirect cost is Rs. 30 per day

![Fig. 3](image)
<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>M.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(a)</td>
<td>Differentiate between Rankine’s and Coulomb’s theories of earth pressures. Derive a relation for depth of tensile crack and critical height of unsupported vertical cut.</td>
<td>[04]</td>
</tr>
<tr>
<td>1(b)</td>
<td>What do you understand by active and passive earth pressure of retaining wall? Find out the value of passive thrust and its point of application from the base of retaining wall shown in Fig. 1.</td>
<td>[08]</td>
</tr>
<tr>
<td>1'(a)</td>
<td>Explain the procedure of Rehmann’s graphical method to determine the active pressure on retaining wall and also show position of critical slip plane.</td>
<td>[04]</td>
</tr>
<tr>
<td>1'(b)</td>
<td>Determine the safe depth of embedment of cantilever sheet pile wall (Fig. 2.).</td>
<td>[08]</td>
</tr>
<tr>
<td>2(a)</td>
<td>What are the different methods of analysis of stability of slopes? Describe any one method in detail.</td>
<td>[04]</td>
</tr>
<tr>
<td>2(b)</td>
<td>What is stability number of slope? Determine the safe height for an embankment rising 70° to the horizontal and to be made with clayey soil having unit weight of 18 kN/m³, angle of shearing resistance of 15° and unit cohesion of 20 kN/m². From Taylor’s stability chart, corresponding to slope angle of 70° and angle of shearing resistance of 15°, the value of stability number, N=0.14. Take factor of safety as 3.</td>
<td>[08]</td>
</tr>
<tr>
<td>3(a)</td>
<td>Discuss the plate load test and its limitations for determining bearing capacity of soils.</td>
<td>[04]</td>
</tr>
<tr>
<td>3(b)</td>
<td>A foundation 2m×2m is resting at a depth of 1.0m from the ground surface. The soil has a unit cohesion of 15 kN/m², angle of shearing resistance of 24° and unit weight of 18 kN/m³. The water table was encountered at 1.25m below base of footing. Find out the ultimate and safe bearing capacity of soil by using Terzaghi’s approach. For $\phi = 24^\circ$, $N_c = 20.7$, $N_q = 10.7$ and $N_r = 6.8$.</td>
<td>[08]</td>
</tr>
<tr>
<td>4(a)</td>
<td>What are the circumstances under which the pile foundation used? Describe the methods for determining the load carrying capacity of a pile.</td>
<td>[04]</td>
</tr>
</tbody>
</table>
4(b) Explain the dynamic load empirical formulae for load carrying capacity of piles. Using Engineering News Formula, determine the safe design load on a pile given that the weight of drop hammer is 25 kN and penetration of pile under the last blow of the hammer is 7.5 mm. Also find out the safe design load for same data for another pile if steam hammer is used. Height of drop hammer in both cases is 50 cm.

OR

4(a) Explain grip length, tilt and shift in relation to well foundation. Describe the procedure for collecting undisturbed and disturbed soil samples.

4(b) A pile group of 16 piles is arranged in a square pattern, @ 1.25 m c/c. The piles are circular in section, having 400mm diameter and 10.0m length each. If the cohesive strength of soil is 160 kN/m², determine if the failure would occur by a single pile failure, or as a block.

5(a) Why is vibration isolation required? Discuss the design criteria and degree of freedom for machine foundation block.

5(b) Define dynamic magnification factor and natural frequency of free vibration. The equation of motion in SI units for a machine foundation-soil system is as follows:

\[(4 \times 10^3) \frac{d^2z}{dt^2} + (2 \times 10^5) \frac{dz}{dt} + (1 \times 10^7) z = 0\]

Determine:

(i) Undamped and damped natural frequency
(ii) Logarithmic decrement
(iii) Whether the system is under damped, over damped or critically damped
(iv) Number of cycles elapsed for 75% reduction in amplitude.

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![Retaining Wall Diagram](image1)

![Sheet Pile Wall Diagram](image2)
2013-14
B.TECH. (WINTER SEMESTER) EXAMINATION
CIVIL ENGINEERING
ENGINEERING HYDRAULICS-II
CE-414

Maximum Marks: 60
Credits: 04
Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No. Question M.M.
1(a) Classify the following open channel flow situations with respect to space and time:
   (i) Flow in a long prismatic canal
   (ii) Flow over a spillway during flood
   (iii) Flow over a trench weir and
   (iv) Overland flow or surface runoff

1(b) A brick lined sewer has a semi-circular bottom and vertical side walls 0.6 m apart. If the depth of flow at a section where the flow is known to be critical is 0.6 m, estimate the discharge in the sewer.

1 (c) Show the variation of \( y_1 \) and \( y_2 \) with hump height in subcritical and supercritical flows with neat sketches.

OR

1'(a) If \( y_1 \) and \( y_2 \) are the alternate depths in a rectangular channel show that

\[
y_c^2 = \frac{2y_1^2y_2^2}{(y_1 + y_2)^2}
\]

1'(b) Water flows at a depth of 2 m and a velocity of 1.5 m/s in a 4 m wide rectangular channel. Find (i) the width at contraction which just causes critical flow without a change in the upstream depth and (ii) the depth in the contraction when the width at the throat is 50% more than the above value.

2(a) Show that the normal depth in a triangular channel of side slopes \( m \) horizontal : 1 vertical, is given by

contd...
\[ y_o = 1.1892 \left[ \frac{Q_n}{\sqrt{S_o}} \right]^{3/8} \left[ \frac{m^2 + 1}{m^5} \right]^{1/8} \]

2(b) It is required to convey 10 m³/s of water at a mean velocity of 1.25 m/s. Calculate the dimensions of the most efficient section of the channel whose shape is (i) triangular (ii) trapezoidal. Which of these has least and largest perimeter?

3(a) A sluice gate discharges 2 m³/s into a wide horizontal rectangular channel. The depth at the vena contracta is 0.15 m. The tail water depth is 1.85 m. Assuming the channel to have a Manning's \( n = 0.02 \), determine the location of the hydraulic jump.

3(b) Show that the GVF profile in a frictionless rectangular channel is given by

\[ X = \frac{y}{S_o} \left[ 1 + \frac{1}{2} \left( \frac{y_o}{y} \right)^3 \right] + \text{const}. \]

OR

3'(a) Classify the hydraulic jump on the basis of Froude number, \( F_r \).

3'(b) If, in a hydraulic jump occurring in a horizontal rectangular channel, the Froude number before the jump is 10.0 and the energy loss is 3.20 m. Estimate the (i) sequent depths (ii) the discharge intensity and (iii) the Froude number after the jump.

3'(c) Derive the basic differential equation of gradually varied flow. Write its other forms.

4(a) Derive relation for celerity of a small wave.

4(b) What are the advantages and disadvantages of distorted models?

4(c) The speed of travel of a tidal bore up an estuary is 6 m/s. The depth and velocity prior to the arrival of bore were 1.2 m/s and 3.5 m respectively. Estimate the height of the bore.

OR

4'(c) A spillway 200 m long and 6 m high without piers discharges 560 m³/s under approximately a head of 1.2 m. The necessary tail water to form the hydraulic jump on the apron is to be determined by model test. The laboratory channel is 0.4 m wide and 0.5 m deep with a water supply of 60 liters per second. Design a suitable model for the spillway.
B.TECH. (WINTER SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
IRRIGATION ENGINEERING
(CE-415)

Maximum Marks: 60
Credits: 04
Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.
Khosla's curves are attached herewith.

Q.No. | Question | M.M.
--- | --- | ---
1(a) | List the various methods of irrigation. What are the advantages of sprinkler irrigation? Discuss sprinkler method of irrigation with its suitability conditions. | [07]
1(b) | Write note on the following:

(i) Silt control in irrigation canals
(ii) Furrow irrigation
(iii) Drip irrigation.

OR

1' | What are the functions of the canal outlet? What are the requirements of a good outlet? What is meant by proportionality of a canal outlet? Design an irrigation outlet for the following data:

Full supply discharge = 0.06 cumec
F.S.L. in distributary on u/s of outlet = 400.00m
F.S.L. in water course on d/s of outlet = 399.97
F.S. depth in distributary on u/s of outlet = 1.1 m
Take \( C_d = 0.8 \) | [15]

2(a) | What are the type of irrigation losses which occur in irrigation canal? What are the remedial measures to prevent them? Design a lined irrigation canal to carry a
discharge of 40 cusec at a slope of 1 in 4000. The side slopes of the canal are 1.25 (H) : 1 (V). Take Manning’s coefficient ‘n’ equal to 0.03.

2(b) Discuss the frequency of irrigation and efficiency of irrigation.
After how many days will you supply water to soil in order to ensure efficient irrigation of the given crop, if:
(i) Field capacity of soil = 27.5%
(ii) Permanent wilting point = 14%
(iii) Density of soil = 1.6 g/cm³
(iv) Effective depth of root zone = 72.0 cm
(v) Daily consumptive use of water = 12 mm
(ii) Field capacity = 35%

OR

2(a) What is cash crop? What is the importance of crop rotation?
A watercourse commands an irrigation area of 810 hectares. The intensity of irrigation of rice in this area is 55%. The transplantation of rice crop takes 15 days and total depth of water required by the crop is 60 cm on the field during the transplantation. Assuming losses of water to be 20% in the watercourse, calculate the discharge required in the watercourse. Take the value of time factor as 0.75.

2(b) Define bed load, suspended load and total bed material load in alluvial channels.
Design an unlined irrigation channel by Lacey’s theory for the following data:
Full supply discharge = 55 cusec
Side slopes = 1/2.1
Average bed material size = 0.3 mm

3(a) Draw a neat layout plan of diversion Headworks labelling its different component parts. Explain the function of underslides and fish ladder.

OR

3(a) What is river training? Discuss in brief with neat sketch the following river training works:
(i) Spurs (ii) Guide bund and (iii) Pitched islands

3(b) Discuss the criteria for the safety of hydraulic structures against the piping and...
What is a canal fall? What is the necessity of a canal fall? Discuss the criteria of location of a canal fall.

Determine the crest level, cistern elements and length & thickness of impervious floor for a Sarada type fall with the following data:

- Full Supply discharge = 12 cumec
- Drop = 1.0 m
- F.S.L. u.s./d.s = 101.5/100.5
- Full supply depth u.s./d.s = 1.7m/1.7m
- Bed width = 8.0 m
- Bligh's coefficient = 7

OR

What is the necessity of a cross drainage work?

Design a suitable cross drainage work using the following data:

**Canal data**

- Full supply discharge = 30 cumec
- Bed width = 20 m
- Depth of flow = 1.5 m
- Full supply level = 351.5 m
- Canal bed level = 350.0 m

**Drain data**

- High flood discharge = 300 cumec
- H.F.L. = 347.0 m
\[ \Phi_e = \left( \frac{1}{\pi} \right) \cos^{-1} \left( \frac{A - 1}{A} \right) \]
\[ \Phi_c = \left( \frac{1}{\pi} \right) \cos^{-1} \left( \frac{A + 1}{A} \right) \]
\[ \Phi_d = \left( \frac{1}{\pi} \right) \cos^{-1} \left( \frac{A}{A} \right) \]

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

Thus, \( \Phi_e \) for \( b_1/b = 0.4 \) and \( \alpha = 4 \),
\[ = 100 - \Phi_c \text{ for } b_1/b = 0.6 \text{ and } \alpha = 4, \]
\[ = 100 - 29.1 = 70.9\% \]

To get \( \Phi_d \) for values of \( b_1/b \) less than 0.5, read \( \Phi_d \) for base ratio \( (1 - b_1/b) \) and subtract from 100.

Thus, \( \Phi_d \) for \( b_1/b = 0.4 \) and \( \alpha = 4 \)
\[ = 100 - \Phi_d \text{ for } b_1/b = 0.6 \text{ and } \alpha = 4, \]
\[ = 100 - 44.8 = 55.2 \]

Contd... 5
1(a) Explain the behaviour of arch and suspension bridge through diagrams

1(b) Design the cantilever portion of the slab for Class A loading with average thickness of the slab as 200mm. The details are shown in Figure 2 and 3.

2. A riveted deck-type plate girder bridge has the following section at the mid-span:
   - Two cover plates of sizes 500 mm x 12 mm (provided at top and bottom flanges)
   - Two angles I5A 200 x 200 x 15 (provided at top and bottom flanges)
   - Web of size: 1800 mm x 10 mm

   The bridge is to be used for a single broad gauge main line loading. The effective span of the girder is 20 m. The two girders are located at c/c distance of 2 m. The floor is open deck type. Take wind pressure = 1.5 kN/m² and f₀ = 147 N/mm². How the cover plates of plate girder be curtailed? Draw a neat sketch showing the curtailment. Also design the connection of the flange angles with web. Use 22 mm diameter rivets.

OR

2. Design the end stiffeners and also intermediate stiffeners if any.

3. Design the stringer of a through type single lane truss bridge for broad gauge main line loading. The effective span of bridge is 30 m. Spacing of the trusses is 5.5 m c/c. The truss is standard Warren type with six panels @ 5.0 m each.

OR

3'. Design a member U₁U₅ of a through type single lane truss bridge shown in Fig.1. for broad gauge main line loading. The effective span of the bridge is 36.0 m. Take equivalent uniformly distributed live load as 83 kN/m and impact factor as 0.34.

Figure 1
Dimensions of cross-section of T-beam bridge and the cantilever portion of the deck are shown in Figure 2 and 3. Clear carriage way width is 7.5m. The cross girders are 250mm thick and spaced at 3.5m c/c. There are three longitudinal beams spaced at 3.0m intervals. The rib of the beam is 300mm and the depth of slab is 220mm. The footpath is 200mm above the wearing coat. The cantilever slab is 230mm thick at its fixity which reduces to 120 mm at free end Assume M25 grade concrete mix and Fe415 grade steel. The clear cover to steel is 40mm. The height of railing is 1.2m. Design the interior panel for Class AA tracked vehicle. Show neat reinforcement sketch.

Figure 2 The cross section of deck

Figure 3 Cantilever portion of deck
Q.No. | Question | M.M.
--- | --- | ---
1. | Consider a thin steel plate as shown in Fig. 1. The plate has a uniform thickness \( t = 1 \) in, Young's modulus \( E = 30 \times 10^6 \) psi, and weight density \( \rho = 0.2836 \) lb/in\(^3\). In addition to its self-weight, the plate is subjected to a point load \( P = 100 \) lb at its midpoint. <br>(a) model the plate with three finite elements <br>(b) write down the expression for the element stiffness matrices and element body force vector. <br>(c) assemble the structural stiffness matrix and global load vector <br>(d) using the elimination approach, solve for the global displacement vector <br>(e) evaluate the stresses in each element <br>(f) determine the reaction force at the support | [15] |

![Fig. 1](image)

2. | Using the finite element concept, show that the stiffness matrix of a prismatic bar using formal approach method is | [15] |

\[
k = \int_V (B^T EB) \, dV
\]
For the plane truss shown above,

\[ P = 1000 \text{ kN}, \quad L = 1 \text{ m}, \quad E = 210 \text{ GPa}, \quad A = 6.0 \times 10^{-4} \text{ m}^2 \text{ for element 1 and 2,} \quad A = 6 \sqrt{2} \times 10^{-4} \text{ m}^2 \text{ for element 3.} \]

Determine displacement and reaction forces.

3(a) Derive equations of compatibility in terms of cartesian coordinate system for the general state of stress in the presence of the body forces.

3(b) The component of stress in a body subjected to 3-dimensional state of stress are given by

\[
\begin{align*}
\sigma_x &= x^2 + y^2 \\
\sigma_y &= y^2 + z^2 \\
\sigma_z &= z^2 + x^2 \\
\tau_{xy} &= xy \\
\tau_{xz} &= yz \\
\tau_{zx} &= xz
\end{align*}
\]

verify whether this is a possible stress field or not at a point whose coordinates are (3, -2, 1). Take Poisson's ratio \( \nu = 0.3 \). If not then calculate the value of body force to achieve state of equilibrium.

OR

3(a) Suggest and validate stress function for the following stress conditions:

(i) Pure shear 
(ii) Pure bending 
(iii) Pure tension

3(b) Following stress function is given as:

\[ \Phi = -\frac{F}{d^3} \ xy^2 \ (3d-2y) \]

Determine the stress components and sketch their variation in a region bounded by \( y = \pm d \) and \( x = \pm 1 \)

4(a) What do you understand by geometric, kinematic and dynamic similitude in model analysis?

4(b) Briefly explain how the scale factor is obtained while preparing a model.
2013-14  
B.TECH. (WINTER SEMESTER) EXAMINATION  
(CIVIL ENGINEERING)  
ADVANCED FOUNDATION ENGINEERING  
(CE-441)  

Maximum Marks: 60  
Credits: 04  
Duration: Three Hours  

*Answer all the questions.*  
*Assume suitable data if missing.*  
*Notations used have their usual meaning.*  

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<tbody>
<tr>
<td>1(a)</td>
<td>What are the various clay minerals which are responsible for expansive soils? Draw a neat sketch of the basic structure unit of montmorillonite mineral. Suggest the various types of foundations which are suitable in expansive soils.</td>
<td>[06]</td>
</tr>
</tbody>
</table>
| 1(b)  | Find out the load carrying capacity in compression and tension from the following data and show the detail of reinforcement:  
   i) Diameter of the pile (Stem) = 600 mm  
   ii) Diameter of under-reamed bulb (D_o) = 1200 mm  
   iii) No. of under-reamed bulb = 3  
   iv) The cohesion at the ground level is 75 kN/m² and at tip of pile is 125 kN/m²  
   v) Length of pile = 6.0 m  
   vi) Adhesion factor (α) = 0.65                                                                                                                                                                                                                                                                               | [09] |
| 2(a)  | Differentiate between Hansen's and Vesic's theories of bearing capacity of soils. Briefly explain the Static and dynamic cone penetration tests for finding the load carrying capacity of soils.                                                                                                                | [07] |
| 2(b)  | Compute the safe load of a foundation 2.5 m square resting at a depth of 1.5 m below the ground level. Use the IS: 6403-1981 method for the soil having \( \gamma = 21 \text{ kN/m}^3 \), \( c = 16 \text{ kN/m}^2 \) and \( \phi = 30^\circ \). The water table is encountered at 1.25 m below the base of the footing. Taking \( S_e = 1.30 \), \( S_q = 1.2 \), \( S_r = 0.8 \), \( d_e = 1.23 \), \( d_q = d_r = 1.11 \). | [08] |

**OR**

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>2'(a)</td>
<td>Describe the plate load test to determine the safe bearing capacity of soil. Under what conditions would you take the test results trustworthy?</td>
<td>[07]</td>
</tr>
</tbody>
</table>
| 2'(b) | Explain the over burden and dialatancy corrections for SPT N-values. A 1.5 m wide, 2.5 m long and 0.6 m deep spread footing is underlain by a soil with the properties:  
   \( \gamma = 20 \text{ kN/m}^3 \), \( c = 5.0 \text{ kN/m}^2 \), \( \phi = 28^\circ \). The ground water is at a great depth, using Vesic's  | [08] |

contd..
method, compute the column load required to cause a bearing capacity failure.

3(a) Discuss in detail the Indian standard pile load test for the estimation of load carrying capacity of piles.

3(b) A group of 12 precast RCC piles having diameter of 300 mm is driven by 10.0 m into sandy bed. The standard penetration test results performed on the ground are given below:

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>1.5</th>
<th>3.0</th>
<th>4.5</th>
<th>6.0</th>
<th>7.5</th>
<th>9.0</th>
<th>10.5</th>
<th>12.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPT (N-value)</td>
<td>4</td>
<td>6</td>
<td>12</td>
<td>12</td>
<td>20</td>
<td>24</td>
<td>35</td>
<td>39</td>
</tr>
</tbody>
</table>

Compute the load carrying capacity and factor of safety of pile group if 7500 kN of compressive load is applied on it.

OR

3(a) What are the field conditions where a pile foundation is more suitable than shallow foundation? How would you estimate the load carrying capacity of pile group in cohesive and cohesionless soils?

3(b) Compute the total settlement of pile group, assuming the load is transferred at 2/3 length of the pile. Unit weight of soil = 18 kN/m³, unconfined compressive strength = 80 kN/m², liquid limit of clay = 60%, specific gravity=2.7, water content of clay=15% and factor of safety against shear failure = 3.0. (Fig. 1)

4(a) If $\phi$ and $\psi$ are two potential functions in $x$ and $z$ directions respectively, then derive relation between potential functions and velocity of p-wave and s-wave.

4(b) Explain the seismic refraction test. How it is different from seismic reflection test. A loose deposit of over consolidated clay is underlain by bedrock. A seismic reflection test shows that the arrival of distinct p-waves at a geophone 40 msec and 220 msec after an impulsive load is applied at a point 20 m from the geophone. Determine the thickness and the p-wave velocity of the clay deposit. Assume that the bedrock surface is horizontal.

4(c) A vertically propagating shear wave travels upward through a layered soil deposit. Compute the amplitudes of the reflected and transmitted waves that develop when the shear wave reaches the boundary as shown in Fig 2.
Fig. 1

Clayey Soil

Layer I

Layer II

Layer III

Hard Strata

Q3(c)

$V_s = 400 \text{ m/s}$
$\gamma = 17.6 \text{ Mg/m}^3$

& 4(c)

$V_s = 750 \text{ m/s}$
$\gamma = 22.4 \text{ Mg/m}^3$

Incident wave:

Stress amplitude = 100 Kpa
Frequency = 2 Hz