# University of Asia Pacific
## Department of Civil Engineering
## Final Examination Fall 2014
## Program: B.Sc. Engineering (Civil)

Course Title: Project Planning and Management | Course Code: CE401
Time: 3 hour | Full Marks: 50

(Answer any 5 out of 6 Questions)

1(a) Why is construction safety in Bangladesh not up to the standard? 2
(b) What is meant by hazard? Give examples in the view of construction management. 2
(c) Write down the 7 principles to prevent accident in construction site. 3
(d) Write down the differences between Traditional Quality Control and Modern Quality Control. 3

2 Write short notes of the following: 2x5
(a) ISO 9000
(b) 80/20 rule
(c) OSHA
(d) PPE
(e) WBS

3(a) What is meant by procurement? 2
(b) Briefly describe Limited Tendering Method (LTM) 3
(c) What are the criteria to find out the potential sources/bidders in procurement? 2
(d) What are the points to be remembered for procuring/purchasing? 3

4(a) Write down the difference between CPM and PERT 2
(b) A software firm has estimated the following time for its project. The company has quoted 35 days for the project to be completed. What would be the probability of success that the project will complete on time? 8

| Activity | Predecessor | Optimistic Time | Most likely Time | Pessimistic Time |
|---|---|---|---|---|
| a | - | 6 | 8 | 10 |
| b | - | 7 | 10 | 13 |
| c | a | 4 | 4 | 4 |
| d | b , c | 9 | 12 | 15 |
| e | a | 5 | 6 | 7 |
| f | b , c | 4 | 7 | 10 |
| g | e , f | 8 | 10 | 12 |
| h | d , e , f | 9 | 12 | 15 |

Also determine the total duration of the project and critical patch of the project.

... Continued

5(a) What do you understand by 'Time Value of Money'? 2

(b) What are major reasons that needed to be considered for 'Replacement'? 1

(d) An asset purchased 2 years ago for $40,000 is harder to maintain than expected. It can be sold now for $12,000 or kept for a maximum of 2 more years, in which case its operating cost will be $20,000 each year, with a salvage value of $9,000 two years from now. A suitable challenger will have a first cost of $60,000 with an annual operating cost of $4,100 per year and a salvage value of $15,000 after 5 years. Interest rate is 12%. What is the decision? 7

6(a) How will you apply "Project Planning and Management" subject in your professional career? Explain with specific examples. 2

(b) Write down the objectives of material management. 2

(c) A factory has a current market value of $60,000 and can be kept in service for 4 more years. With an MARR of 12%/year, when should it be abandoned? The following data are projected for future years: 6

| | Year 1 | Year 2 | Year 3 | Year 4 |
|---|---|---|---|---|
| Net revenue | $50,000 | $40,000 | $15,000 | $20,000 |
| Market value | $35,000 | $20,000 | $15,000 | $10,000 |
| Factory overhauling expenses | - | - | - | $15,000 |

## Z Score Table- chart value corresponds to area below z score.

| *z* | 0.09 | 0.08 | 0.07 | 0.06 | 0.05 | 0.04 | 0.03 | 0.02 | 0.01 | 0.00 |
|---|---|---|---|---|---|---|---|---|---|---|
| **–3.4** | 0.0002 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 |
| **–3.3** | 0.0003 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0005 | 0.0005 | 0.0005 |
| **–3.2** | 0.0005 | 0.0005 | 0.0005 | 0.0006 | 0.0006 | 0.0006 | 0.0006 | 0.0006 | 0.0007 | 0.0007 |
| **–3.1** | 0.0007 | 0.0007 | 0.0008 | 0.0008 | 0.0008 | 0.0008 | 0.0009 | 0.0009 | 0.0009 | 0.0010 |
| **–3.0** | 0.0010 | 0.0010 | 0.0011 | 0.0011 | 0.0011 | 0.0012 | 0.0012 | 0.0013 | 0.0013 | 0.0013 |
| **–2.9** | 0.0014 | 0.0014 | 0.0015 | 0.0015 | 0.0016 | 0.0016 | 0.0017 | 0.0018 | 0.0018 | 0.0019 |
| **–2.8** | 0.0019 | 0.0020 | 0.0021 | 0.0021 | 0.0022 | 0.0023 | 0.0023 | 0.0024 | 0.0025 | 0.0026 |
| **–2.7** | 0.0026 | 0.0027 | 0.0028 | 0.0029 | 0.0030 | 0.0031 | 0.0032 | 0.0033 | 0.0034 | 0.0035 |
| **–2.6** | 0.0036 | 0.0037 | 0.0038 | 0.0039 | 0.0040 | 0.0041 | 0.0043 | 0.0044 | 0.0045 | 0.0047 |
| **–2.5** | 0.0048 | 0.0049 | 0.0051 | 0.0052 | 0.0054 | 0.0055 | 0.0057 | 0.0059 | 0.0060 | 0.0062 |
| **–2.4** | 0.0064 | 0.0066 | 0.0068 | 0.0069 | 0.0071 | 0.0073 | 0.0075 | 0.0078 | 0.0080 | 0.0082 |
| **–2.3** | 0.0084 | 0.0087 | 0.0089 | 0.0091 | 0.0094 | 0.0096 | 0.0099 | 0.0102 | 0.0104 | 0.0107 |
| **–2.2** | 0.0110 | 0.0113 | 0.0116 | 0.0119 | 0.0122 | 0.0125 | 0.0129 | 0.0132 | 0.0136 | 0.0139 |
| **–2.1** | 0.0143 | 0.0146 | 0.0150 | 0.0154 | 0.0158 | 0.0162 | 0.0166 | 0.0170 | 0.0174 | 0.0179 |
| **–2.0** | 0.0183 | 0.0188 | 0.0192 | 0.0197 | 0.0202 | 0.0207 | 0.0212 | 0.0217 | 0.0222 | 0.0228 |
| **–1.9** | 0.0233 | 0.0239 | 0.0244 | 0.0250 | 0.0256 | 0.0262 | 0.0268 | 0.0274 | 0.0281 | 0.0287 |
| **–1.8** | 0.0294 | 0.0301 | 0.0307 | 0.0314 | 0.0322 | 0.0329 | 0.0336 | 0.0344 | 0.0351 | 0.0359 |
| **–1.7** | 0.0367 | 0.0375 | 0.0384 | 0.0392 | 0.0401 | 0.0409 | 0.0418 | 0.0427 | 0.0436 | 0.0446 |
| **–1.6** | 0.0455 | 0.0465 | 0.0475 | 0.0485 | 0.0495 | 0.0505 | 0.0516 | 0.0526 | 0.0537 | 0.0548 |
| **–1.5** | 0.0559 | 0.0571 | 0.0582 | 0.0594 | 0.0606 | 0.0618 | 0.0630 | 0.0643 | 0.0655 | 0.0668 |
| **–1.4** | 0.0681 | 0.0694 | 0.0708 | 0.0721 | 0.0735 | 0.0749 | 0.0764 | 0.0778 | 0.0793 | 0.0808 |
| **–1.3** | 0.0823 | 0.0838 | 0.0853 | 0.0869 | 0.0885 | 0.0901 | 0.0918 | 0.0934 | 0.0951 | 0.0968 |
| **–1.2** | 0.0985 | 0.1003 | 0.1020 | 0.1038 | 0.1056 | 0.1075 | 0.1093 | 0.1112 | 0.1131 | 0.1151 |
| **–1.1** | 0.1170 | 0.1190 | 0.1210 | 0.1230 | 0.1251 | 0.1271 | 0.1292 | 0.1314 | 0.1335 | 0.1357 |
| **–1.0** | 0.1379 | 0.1401 | 0.1423 | 0.1446 | 0.1469 | 0.1492 | 0.1515 | 0.1539 | 0.1562 | 0.1587 |
| **–0.9** | 0.1611 | 0.1635 | 0.1660 | 0.1685 | 0.1711 | 0.1736 | 0.1762 | 0.1788 | 0.1814 | 0.1841 |
| **–0.8** | 0.1867 | 0.1894 | 0.1922 | 0.1949 | 0.1977 | 0.2005 | 0.2033 | 0.2061 | 0.2090 | 0.2119 |
| **–0.7** | 0.2148 | 0.2177 | 0.2206 | 0.2236 | 0.2266 | 0.2296 | 0.2327 | 0.2358 | 0.2389 | 0.2420 |
| **–0.6** | 0.2451 | 0.2483 | 0.2514 | 0.2546 | 0.2578 | 0.2611 | 0.2643 | 0.2676 | 0.2709 | 0.2743 |
| **–0.5** | 0.2776 | 0.2810 | 0.2843 | 0.2877 | 0.2912 | 0.2946 | 0.2981 | 0.3015 | 0.3050 | 0.3085 |
| **–0.4** | 0.3121 | 0.3156 | 0.3192 | 0.3228 | 0.3264 | 0.3300 | 0.3336 | 0.3372 | 0.3409 | 0.3446 |
| **–0.3** | 0.3483 | 0.3520 | 0.3557 | 0.3594 | 0.3632 | 0.3669 | 0.3707 | 0.3745 | 0.3783 | 0.3821 |
| **–0.2** | 0.3859 | 0.3897 | 0.3936 | 0.3974 | 0.4013 | 0.4052 | 0.4090 | 0.4129 | 0.4168 | 0.4207 |
| **–0.1** | 0.4247 | 0.4286 | 0.4325 | 0.4364 | 0.4404 | 0.4443 | 0.4483 | 0.4522 | 0.4562 | 0.4602 |
| **–0.0** | 0.4641 | 0.4681 | 0.4721 | 0.4761 | 0.4801 | 0.4840 | 0.4880 | 0.4920 | 0.4960 | 0.5000 |

| Interest Rate | 12.00% | | | | | | | | 12.00% |
|---|---|---|---|---|---|---|---|---|---|
| n | F/P | P/F | A/F | A/P | F/A | P/A | A/G | P/G | n |
| 1 | 1.120 | 0.8929 | 1.0000 | 1.1200 | 1.000 | 0.893 | 0.000 | 0.000 | 1 |
| 2 | 1.254 | 0.7972 | 0.4717 | 0.5917 | 2.120 | 1.690 | 0.472 | 0.797 | 2 |
| 3 | 1.405 | 0.7118 | 0.2963 | 0.4163 | 3.374 | 2.402 | 0.925 | 2.221 | 3 |
| 4 | 1.574 | 0.6355 | 0.2092 | 0.3292 | 4.779 | 3.037 | 1.359 | 4.127 | 4 |
| 5 | 1.762 | 0.5674 | 0.1574 | 0.2774 | 6.353 | 3.605 | 1.775 | 6.397 | 5 |
| 6 | 1.974 | 0.5066 | 0.1232 | 0.2432 | 8.115 | 4.111 | 2.172 | 8.930 | 6 |
| 7 | 2.211 | 0.4523 | 0.0991 | 0.2191 | 10.089 | 4.564 | 2.551 | 11.644 | 7 |
| 8 | 2.476 | 0.4039 | 0.0813 | 0.2013 | 12.300 | 4.968 | 2.913 | 14.471 | 8 |
| 9 | 2.773 | 0.3606 | 0.0677 | 0.1877 | 14.776 | 5.328 | 3.257 | 17.356 | 9 |
| 10 | 3.106 | 0.3220 | 0.0570 | 0.1770 | 17.549 | 5.650 | 3.585 | 20.254 | 10 |
| 11 | 3.479 | 0.2875 | 0.0484 | 0.1684 | 20.655 | 5.938 | 3.895 | 23.129 | 11 |
| 12 | 3.896 | 0.2567 | 0.0414 | 0.1614 | 24.133 | 6.194 | 4.190 | 25.952 | 12 |
| 13 | 4.363 | 0.2292 | 0.0357 | 0.1557 | 28.029 | 6.424 | 4.468 | 28.702 | 13 |
| 14 | 4.887 | 0.2046 | 0.0309 | 0.1509 | 32.393 | 6.628 | 4.732 | 31.362 | 14 |
| 15 | 5.474 | 0.1827 | 0.0268 | 0.1468 | 37.280 | 6.811 | 4.980 | 33.920 | 15 |
| 16 | 6.130 | 0.1631 | 0.0234 | 0.1434 | 42.753 | 6.974 | 5.215 | 36.367 | 16 |
| 17 | 6.866 | 0.1456 | 0.0205 | 0.1405 | 48.884 | 7.120 | 5.435 | 38.697 | 17 |
| 18 | 7.690 | 0.1300 | 0.0179 | 0.1379 | 55.750 | 7.250 | 5.643 | 40.908 | 18 |
| 19 | 8.613 | 0.1161 | 0.0158 | 0.1358 | 63.440 | 7.366 | 5.838 | 42.998 | 19 |
| 20 | 9.646 | 0.1037 | 0.0139 | 0.1339 | 72.052 | 7.469 | 6.020 | 44.968 | 20 |
| 21 | 10.804 | 0.0926 | 0.0122 | 0.1322 | 81.699 | 7.562 | 6.191 | 46.819 | 21 |
| 22 | 12.100 | 0.0826 | 0.0108 | 0.1308 | 92.503 | 7.645 | 6.351 | 48.554 | 22 |
| 23 | 13.552 | 0.0738 | 0.0096 | 0.1296 | 104.603 | 7.718 | 6.501 | 50.178 | 23 |
| 24 | 15.179 | 0.0659 | 0.0085 | 0.1285 | 118.155 | 7.784 | 6.641 | 51.693 | 24 |
| 25 | 17.000 | 0.0588 | 0.0075 | 0.1275 | 133.334 | 7.843 | 6.771 | 53.105 | 25 |
| 26 | 19.040 | 0.0525 | 0.0067 | 0.1267 | 150.334 | 7.896 | 6.892 | 54.418 | 26 |
| 27 | 21.325 | 0.0469 | 0.0059 | 0.1259 | 169.374 | 7.943 | 7.005 | 55.637 | 27 |
| 28 | 23.884 | 0.0419 | 0.0052 | 0.1252 | 190.699 | 7.984 | 7.110 | 56.767 | 28 |
| 29 | 26.750 | 0.0374 | 0.0047 | 0.1247 | 214.583 | 8.022 | 7.207 | 57.814 | 29 |
| 30 | 29.960 | 0.0334 | 0.0041 | 0.1241 | 241.333 | 8.055 | 7.297 | 58.782 | 30 |
| 31 | 33.555 | 0.0298 | 0.0037 | 0.1237 | 271.293 | 8.085 | 7.381 | 59.676 | 31 |
| 32 | 37.582 | 0.0266 | 0.0033 | 0.1233 | 304.848 | 8.112 | 7.459 | 60.501 | 32 |
| 33 | 42.092 | 0.0238 | 0.0029 | 0.1229 | 342.429 | 8.135 | 7.530 | 61.261 | 33 |
| 34 | 47.143 | 0.0212 | 0.0026 | 0.1226 | 384.521 | 8.157 | 7.596 | 61.961 | 34 |
| 35 | 52.800 | 0.0189 | 0.0023 | 0.1223 | 431.663 | 8.176 | 7.658 | 62.605 | 35 |
| 36 | 59.136 | 0.0169 | 0.0021 | 0.1221 | 484.463 | 8.192 | 7.714 | 63.197 | 36 |
| 40 | 93.051 | 0.0107 | 0.0013 | 0.1213 | 767.091 | 8.244 | 7.899 | 65.116 | 40 |
| 48 | 230.391 | 0.0043 | 0.0005 | 0.1205 | 1911.59 | 8.297 | 8.124 | 67.41 | 48 |
| 50 | 289.002 | 0.0035 | 0.0004 | 0.1204 | 2400.02 | 8.304 | 8.160 | 67.76 | 50 |
| 52 | 362.524 | 0.0028 | 0.0003 | 0.1203 | 3012.70 | 8.310 | 8.189 | 68.06 | 52 |
| 60 | 897.597 | 0.0011 | 0.0001 | 0.1201 | 7471.64 | 8.324 | 8.266 | 68.81 | 60 |
| 70 | 2787.80 | 0.0004 | 0.0000 | 0.1200 | 23223.3 | 8.330 | 8.308 | 69.21 | 70 |
| 72 | 3497.02 | 0.0003 | 0.0000 | 0.1200 | 29133.5 | 8.331 | 8.313 | 69.25 | 72 |
| 80 | 8658.48 | 0.0001 | 0.0000 | 0.1200 | 72145.7 | 8.332 | 8.324 | 69.36 | 80 |
| 84 | 13624.3 | 0.0001 | 0.0000 | 0.1200 | 113527. | 8.333 | 8.327 | 69.39 | 84 |
| 90 | 26891.9 | 0.0000 | 0.0000 | 0.1200 | 224091. | 8.333 | 8.330 | 69.41 | 90 |
| 96 | 53079.9 | 0.0000 | 0.0000 | 0.1200 | 442324. | 8.333 | 8.332 | 69.43 | 96 |
| 100 | 83522.3 | 0.0000 | 0.0000 | 0.1200 | 696011. | 8.333 | 8.332 | 69.43 | 100 |
| inf. | inf. | 0.0000 | 0.0000 | 0.1200 | inf. | 8.3333 | 8.333 | 69.44 | inf. |

# University of Asia Pacific
# Department of Civil Engineering
# Final Examination Fall 2014 (Set A)
# Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering III — Course Code: CE 411
Time: 3hrs — Full Marks: 10X10=100

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

1. For the truss shown in *Fig. 1*, ignore the zero-force members and apply the boundary conditions to determine the value of unknown joint displacements [Given: $S_x$ = 1000 k/ft].

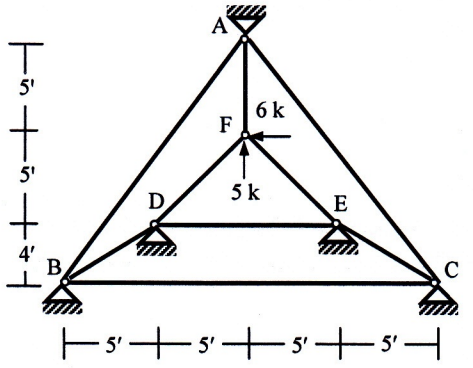



*Fig 1*

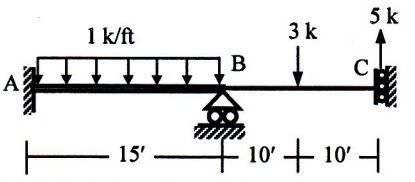



*Fig. 2*

2. Use Stiffness Method (neglecting axial deformations) to calculate the joint deflection and rotation of the beam shown in *Fig. 2* [Given: $EI_{AB} = 40\times10^3$ k-ft$^2$, $EI_{CD} = 20\times10^3$ k-ft$^2$].

3. For the frame shown below in *Fig. 3*, assemble the global stiffness matrix considering boundary conditions and neglecting axial deformation. Also write down the global load vector [Given: EI = $40\times10^3$ ksf, A = 1ft$^2$].

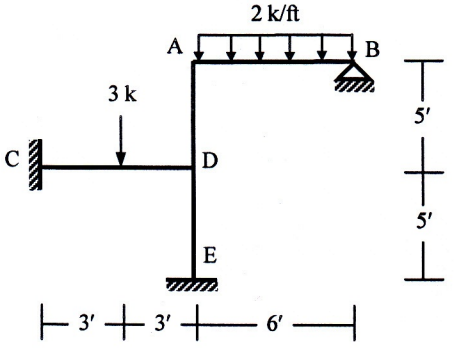



*Fig. 3*

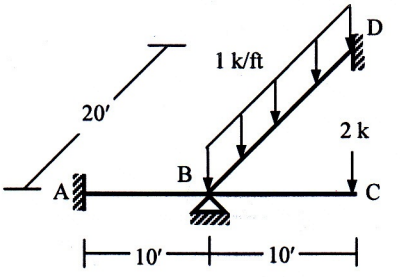
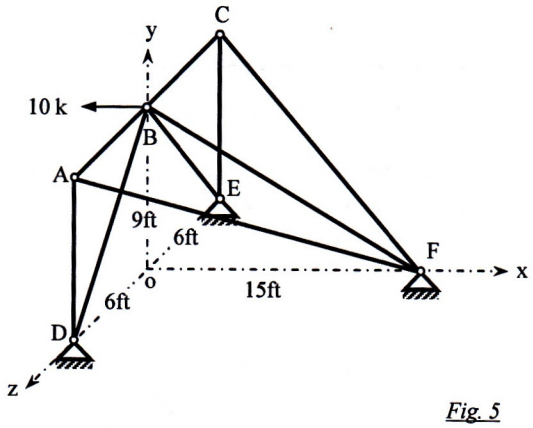



*Fig. 4*

4. For the grid loaded as shown in *Fig. 4*, use the stiffness method to calculate the rotations at joint B [Given: EI = $40\times10^3$ k-ft$^2$, GJ = $30\times10^3$ k-ft$^2$].

5. In the three-dimensional truss shown in *Fig. 5*, ignore zero-force members and formulate the stiffness matrix, load vector and write down the boundary conditions [Given: EA/L = 500 k/ft].




| Nodal Coordinates (ft) |
|---|
| A (0, 9, 6), B (0, 9, 0), C (0, 9, –6) |
| D (0, 0, 6) , E (0, 0, –6), F (15, 0, 0) |

*Fig. 5*

6. Use Stiffness Method to calculate the unknown joint rotations and displacement for the beam ABC loaded as shown in *Fig. 6*, considering flexural deformations only with geometric nonlinearity [Given: EI = $50\times10^3$ k-ft$^2$].

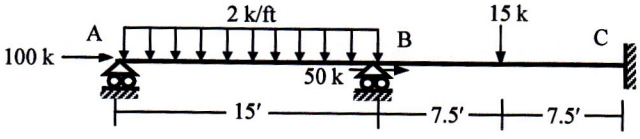



*Fig. 6*

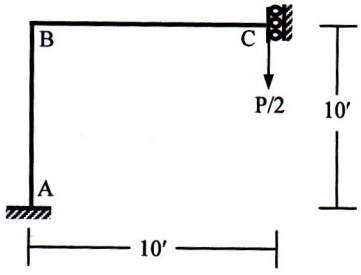



*Fig. 7*

7. Use the Stiffness Method (considering geometric nonlinearity) to calculate the approximate first critical buckling load for the frame loaded as shown in *Fig. 7* [Given: EI = $50\times10^3$ k-ft$^2$].

8. Use the Energy Method to calculate the plastic moment $M_p$ needed to prevent the development of plastic hinge mechanism in the beam ABCD loaded as shown in *Fig. 8* [Given: $M_{p(ABCD)} = M_p$].

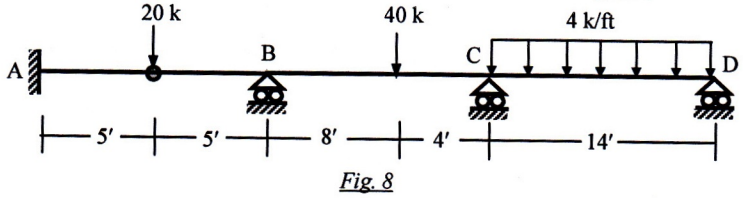



*Fig. 8*

9. Use bending moment diagram to calculate the force *P* needed to develop plastic hinge mechanism in the beam ABCD loaded as shown in *Fig. 9* [Given: $\sigma_{yp}$ = 40 ksi].

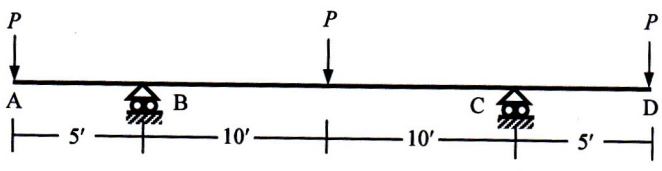
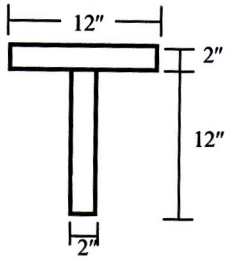



*Fig. 9*



10. For the plane truss shown in *Fig. 1*, applying boundary conditions calculate its natural frequencies using consistent mass matrices [Given, E = 30000 ksi, A = 2 $in^2$, m = $1.5\times10^{-6}$ k-$sec^2/in^2$].

11. For the beam shown in *Fig. 2*, calculate the approximate first natural frequency in transverse direction using consistent mass matrices [Given, EI = $54\times10^3$ k-$ft^2$, m = 0.0045 k-$sec^2/ft^2$].

12. For the beam loaded as shown in *Fig. 10*, use the Stiffness Method to calculate the rotation at joint B and vertical displacement of joint C, if B is supported by a circular foundation of radius 2-ft on sub-soil (half-space) [Given: Unit weight of soil = 0.12 k/$ft^2$, shear wave velocity ($v_s$) = 500 ft/sec, Poisson's ratio =0.25, EI = $40\times10^3$ k-$ft^2$].

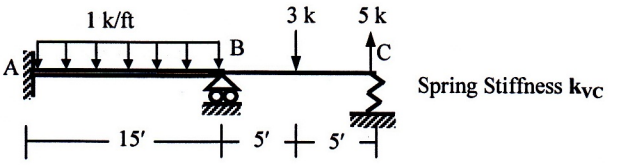
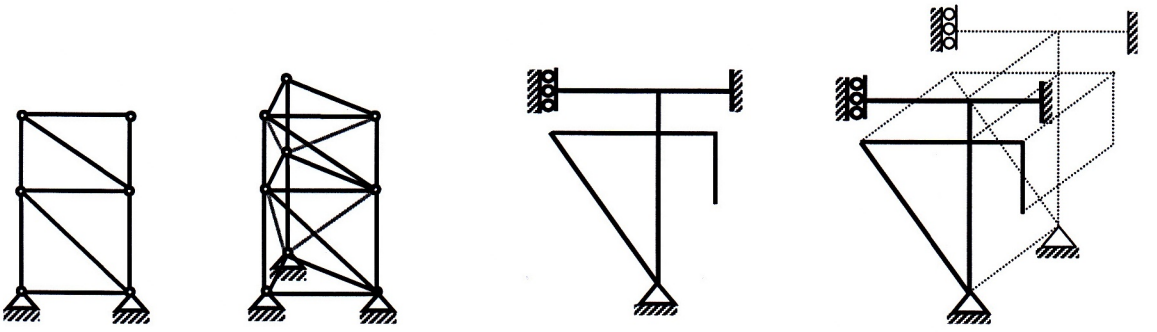



*Fig. 10*

13. Briefly explain why
   i. a truss member hinged at both ends is a zero-force member
   ii. axial deformations are sometimes neglected for the structural analysis of frames but not trusses
   iii. stiffness matrix of a 3D truss member is (6 × 6) while that of a 3D frame member is (12 × 12)
   iv. the effect of foundation flexibility can be beneficial or harmful to the structure
   v. a structure becomes unstable at buckling load (explain in terms of stiffness matrix)

14. Determine the size of the stiffness matrices (with and without considering boundary conditions) of the trusses and frames shown in *Fig. 11*. Also determine the size of the stiffness matrices of the frames if axial deformations are neglected.



2D Truss | 3D Truss | 2D Frame | 3D Frame

*Fig. 11*

# University of Asia Pacific
# Department of Civil Engineering
# Final Examination Fall 2014 (Set B)
# Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering III
Time: 3hrs

Course Code: CE 411
Full Marks: 10X10=100

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

1. For the truss shown in *Fig. 1*, ignore the zero-force members and apply the boundary conditions to determine the value of unknown joint displacements [Given: $S_x$ = 1000 k/ft].

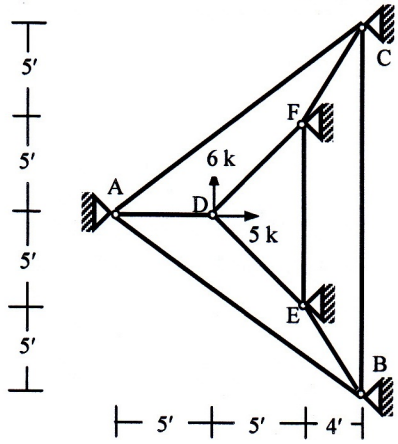



Fig 1

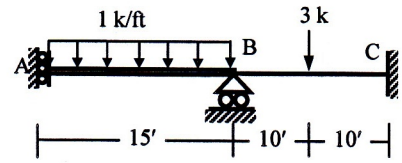



*Fig. 2*

2. Use Stiffness Method (neglecting axial deformations) to calculate the joint deflection and rotation of the beam shown in *Fig. 2* [Given: $EI_{AB} = 40\times10^3$ k-ft$^2$, $EI_{CD} = 20\times10^3$ k-ft$^2$].

3. For the frame shown below in *Fig. 3*, assemble the global stiffness matrix considering boundary conditions and neglecting axial deformation. Also write down the global load vector [Given: EI = $40\times10^3$ ksf, A = 1ft$^2$].

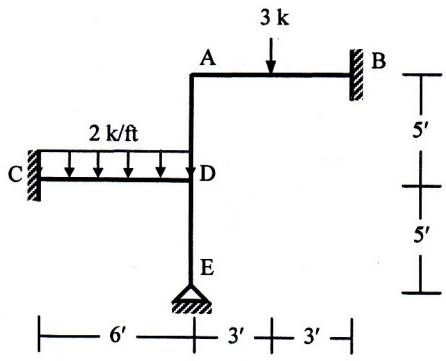



*Fig. 3*

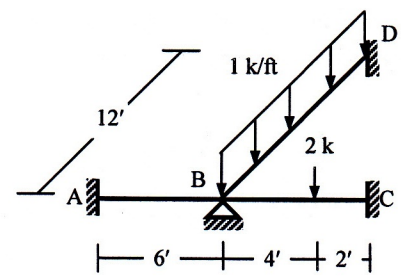
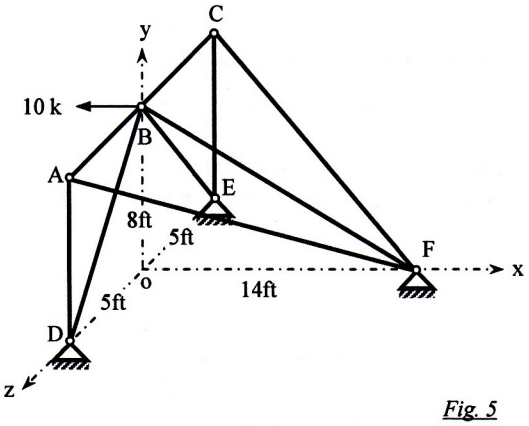



*Fig. 4*

4. For the grid loaded as shown in *Fig. 4*, use the stiffness method to calculate the rotations at joint B [Given: EI = $40\times10^3$ k-ft$^2$, GJ = $30\times10^3$ k-ft$^2$].

5. In the three-dimensional truss shown in *Fig. 5*, ignore zero-force members and formulate the stiffness matrix, load vector and write down the boundary conditions [Given: EA/L = 500 k/ft].




| Nodal Coordinates (ft) |
|---|
| A (0, 8, 5), B (0, 8, 0), C (0, 8, –5) |
| D (0, 0, 5) , E (0, 0, –5), F (14, 0, 0) |

*Fig. 5*

6. Use Stiffness Method to calculate the unknown joint rotations and displacement for the beam ABC loaded as shown in *Fig. 6*, considering flexural deformations only with geometric nonlinearity [Given: EI = $50\times10^3$ k-ft$^2$].

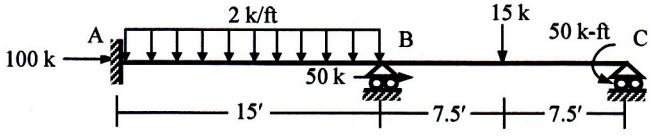



*Fig. 6*

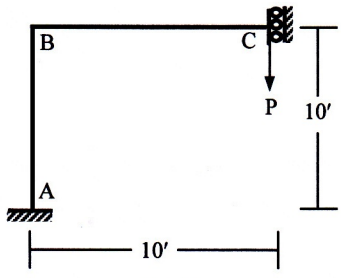



*Fig. 7*

7. Use the Stiffness Method (considering geometric nonlinearity) to calculate the approximate first critical buckling load for the frame loaded as shown in *Fig. 7* [Given: EI = $50\times10^3$ k-ft$^2$].

8. Use the Energy Method to calculate the plastic moment $M_p$ needed to prevent the development of plastic hinge mechanism in the beam ABCD loaded as shown in *Fig. 8* [Given: $M_{p(ABCD)} = M_p$].

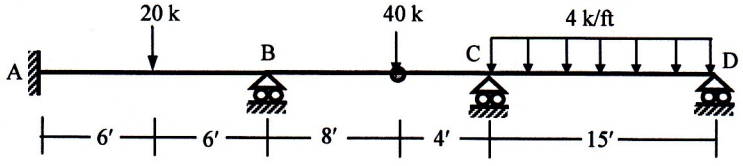



*Fig. 8*

9. Use bending moment diagram to calculate the force *P* needed to develop plastic hinge mechanism in the beam ABCD loaded as shown in *Fig. 9* [Given: $\sigma_{yp}$ = 40 ksi].

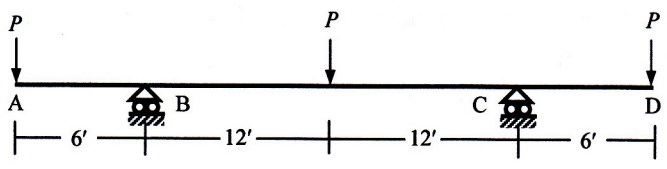
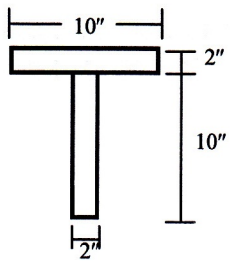



*Fig. 9*



10. For the plane truss shown in *Fig. 1*, applying boundary conditions calculate its natural frequencies using consistent mass matrices [Given: E = 30000 ksi, A = 2 $in^2$, m = $1.5\times10^{-6}$ k-$sec^2/in^2$].

11. For the beam shown in *Fig. 2*, calculate the approximate first natural frequency in transverse direction using consistent mass matrices [Given: EI = $54\times10^3$ k-$ft^2$, m = 0.0045 k-$sec^2/ft^2$].

12. For the beam loaded as shown in *Fig. 10*, use the Stiffness Method to calculate the rotation at joint B and vertical displacement of joint C, if B is supported by a circular foundation of radius 2-ft on sub-soil (half-space) [Given: Unit weight of soil = 0.12 k/$ft^2$, shear wave velocity ($v_s$) = 500 ft/sec, Poisson's ratio =0.25, EI = $40\times10^3$ k-$ft^2$].

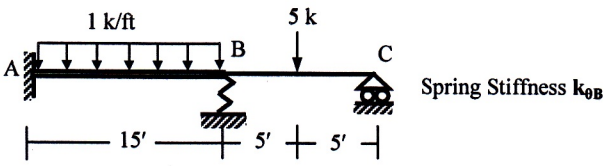



*Fig. 10*

13. Briefly explain why
   i. a truss member hinged at both ends is a zero-force member
   ii. axial deformations are sometimes neglected for the structural analysis of frames but not trusses
   iii. stiffness matrix of a 3D truss member is (6 × 6) while that of a 3D frame member is (12 × 12)
   iv. the effect of foundation flexibility can be beneficial or harmful to the structure
   v. a structure becomes unstable at buckling load (explain in terms of stiffness matrix)

14. Determine the size of the stiffness matrices (with and without considering boundary conditions) of the trusses and frames shown in *Fig. 11*. Also determine the size of the stiffness matrices of the frames if axial deformations are neglected.

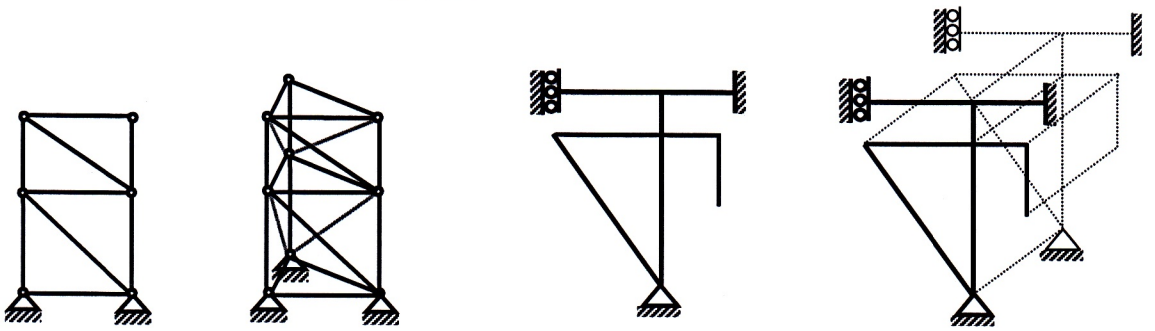



*Fig. 11*

# University of Asia Pacific
## Department of Civil Engineering
## Final Examination Fall – 2014
## Program: B. Sc. Engineering (Civil)

Course Title: Geotechnical Engineering II — Course Code: CE 441
Time: 3 hours — Full Marks: 120 (20 X 6 = 120

**Answer any 6 (six) of the following 8 (eight) questions**

1. (a) What is subsurface exploration in terms of geotechnical engineering? Mention four purposes of geotechnical subsurface exploration. **6**

(b) What preliminary information should be available to a good geotechnical engineer to execute a subsurface exploration program for a multi-span bridge project. **2**

(c) Write down any four general guidelines used for the selection of depth of boreholes for different civil engineering projects. **4**

(d) Write short notes (any two): **4 x 2 = 8**

(i) Site reconnaissance
(ii) Any one in-situ test, except SPT
(iii) Observation of ground water table

2. (a) A geotechnical site investigation was conducted at a site near Munshiganj. The field blow counts as obtained at the site for a particular boring are tabulated below. Estimate the Field SPT values. Apply necessary corrections and calculate corrected SPT values as required (Use Appendix, as necessary). Ground water table was found to be located at a depth of 5 feet below the existing ground surface. Also determine undrained cohesion and angle of internal friction for clay and sand, as applicable, at corresponding depths. Assume $CF_{60}$ to be equal to 1.0. **7**

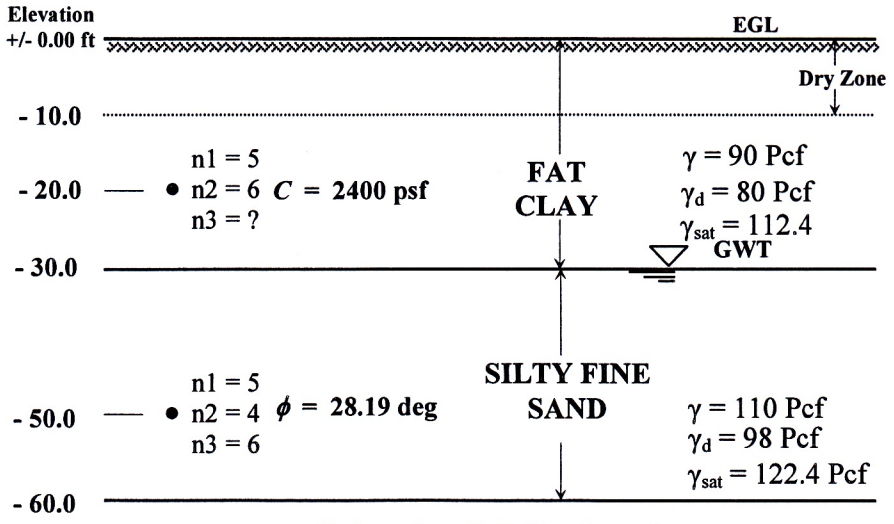
| Soil Type as Obtained | $\gamma$ (pcf) | $\gamma_{sat}$ (pcf) | Depth below EGL (feet) | Blow Counts | | |
|---|---|---|---|---|---|---|
| | | | | 1st six inches | 2nd six inches | 3rd six inches |
| **CLAY** up to a depth of 7.5 feet | 115 | 125 | 5 | 1 | 3 | 4 |
| **SAND** below 7.5 to a depth of 12.5 feet | 118 | 120 | 10 | 3 | 5 | 5 |
| **CLAY** below 12.5 to a depth of 15 feet | 110 | 112 | 15 | 3 | 4 | 5 |

(b) Column load at a location for a site is estimated to be 288 Kips. The site is explored to a depth of 40 feet below EGL. Assuming an anticipated bearing capacity of 2.0 ksf for a square footing check whether the exploration is sufficient or not. Assume the foundation level to be about 5 feet below EGL. Justify your answer in terms of significant induced stress. **6**

(c) A geotechnical site investigation was conducted at a site in Bangladesh. From the sub-surface soil information as provided below and in the next page, estimate n3 at corresponding depth. Use Appendix A in conjunction with the following information: **7**

(i) Borehole dia = 4 inches (ii) No liner was used during drilling

n1 = SPT blow counts for first 6-inch penetration
n2 = SPT blow counts for second 6-inch penetration
n3 = SPT blow counts for third 6-inch penetration




**Subsurface Soil Stratigraphy**

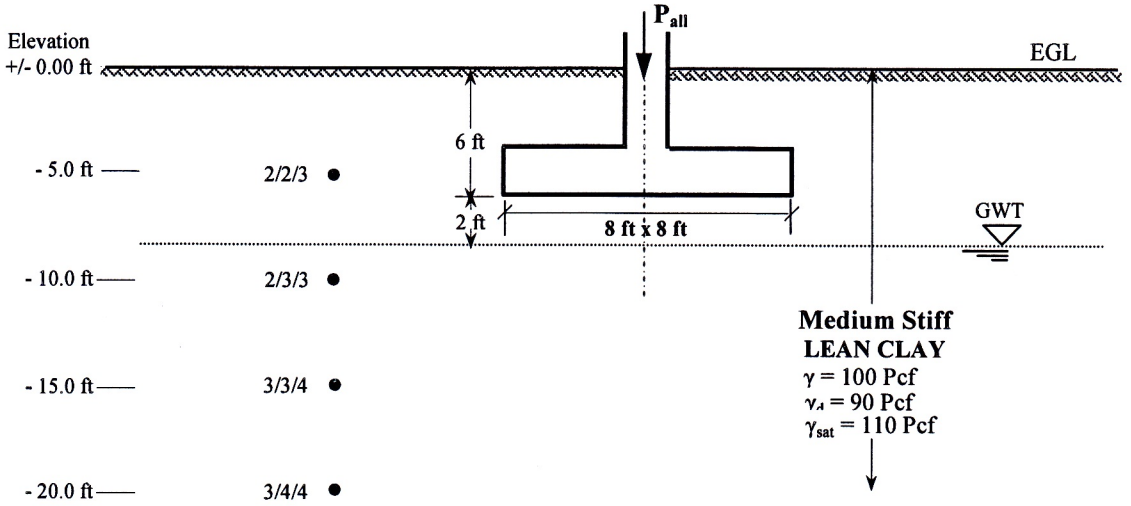
3. (a) Write the names of any five (5) in-situ testing performed in the field under the field investigation phase of a sub-surface exploration program. Write a very short note on the one frequently used in Bangladesh? 4

(b) The outside and inside diameters of a split-spoon sampler are 2 inches and 1.4 inches, respectively and those of a Shelby tube sampler are 3 inches and 2.85 inches, respectively. Estimate the degree of disturbances for two soil samples; one obtained using the split-spoon sampler and the other using the Shelby tube. Also determine whether the samples are disturbed or undisturbed. 4

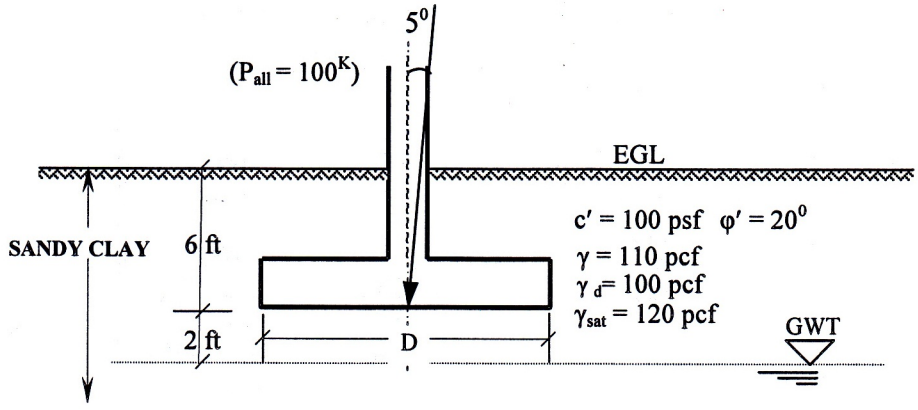
(c) Depict and write short notes on general and local shear failure patterns for shallow foundation. 5

(d) From a preliminary field investigation, the subsurface condition obtained is shown in the figure below. SPT-N values were obtained at each 5-foot depth intervals. Using Terzaghi's bearing capacity equation (as appropriate), determine the allowable column load ($P_{all}$) for the individual column rectangular footing founded as shown below. Use F.S =3. 7

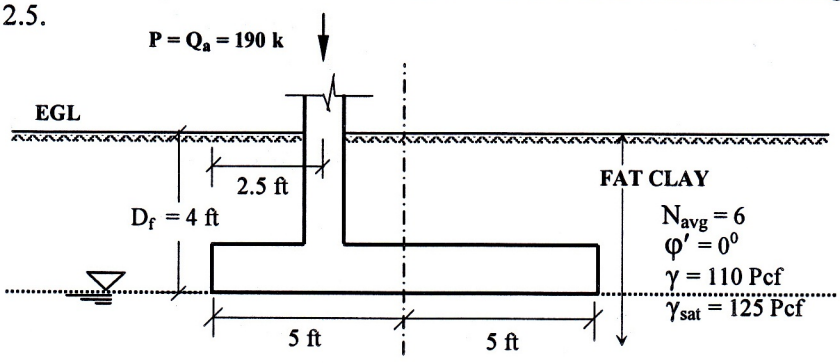
**NOTE:** No laboratory tests were conducted to obtain the shear strength of the clay formation. So, use empirical correlation to estimate the average shear strength below the foundation level.



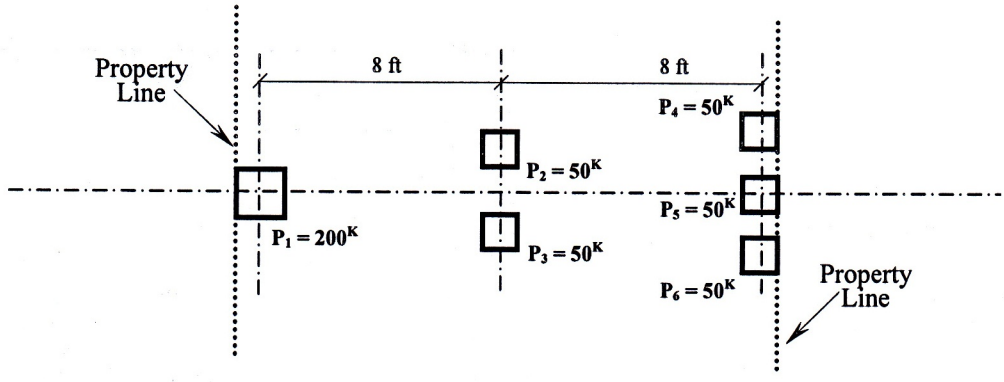
4. (a) A shallow circular foundation is to be constructed in sandy clay soil as shown in the figure below. Design the size of the circular footing (Use GBCE) for the allowable column load of 100 Kips. Use FS = 2.5 and assume Df/B < or = 1). 11



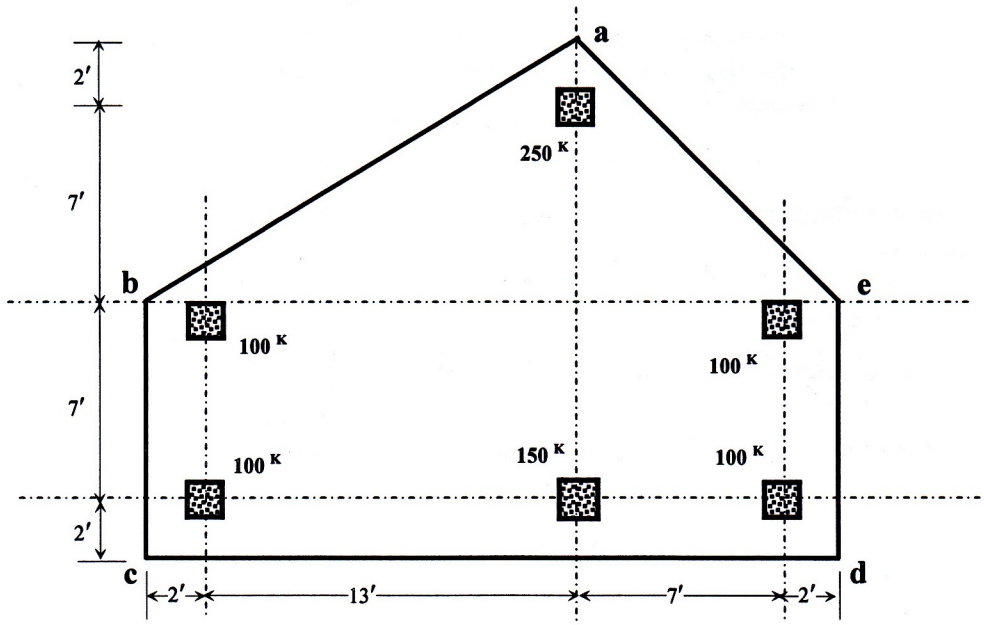

(b) Allowable load of an eccentrically loaded rectangular footing (as shown below) using Meyerhof's effective area method is calculated to be 190 k. Determine the length of the footing. Use FS = 2.5. 9



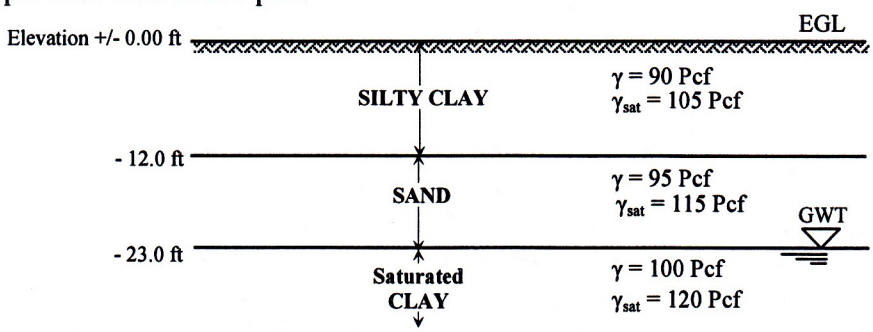

5. (a) For the following loading, geometric and boundary conditions a trapezoidal combined footing is designed. According to analysis, the dimension of the longer parallel of the trapezoid was estimated to be of 13.2 feet. Estimate the other dimension of the longer parallel and allowable bearing capacity for the system. Use bigger column dimensions as 18-inch by 18-inch and shorter dimensions as 12-inch by 12-inch. 8



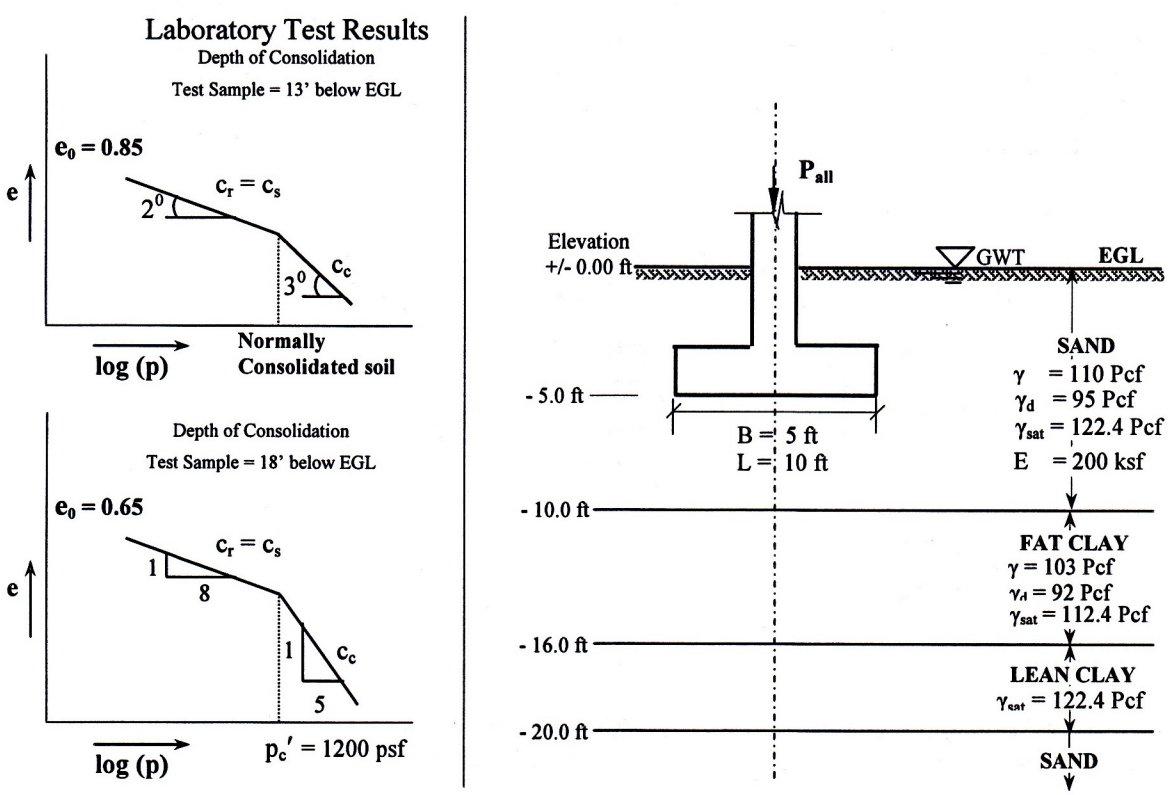

(b) The plan of a mat foundation is shown in the figure in the next page. Calculate the soil pressures at points a, c and at the geometric centroid of the foundation (all the columns are 15 by 15 inches in size). 12



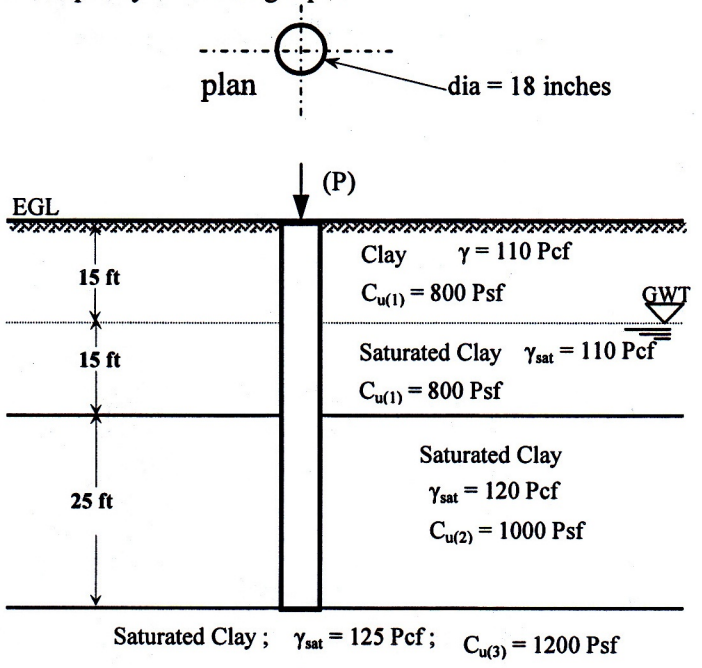

6. (a) For a fully compensated condition (floating foundation), if the depth of the mat foundation is selected to be 25 ft. below EGL, determine the number of stories that could be built. Consider uniform per floor load of 250 psf. 6



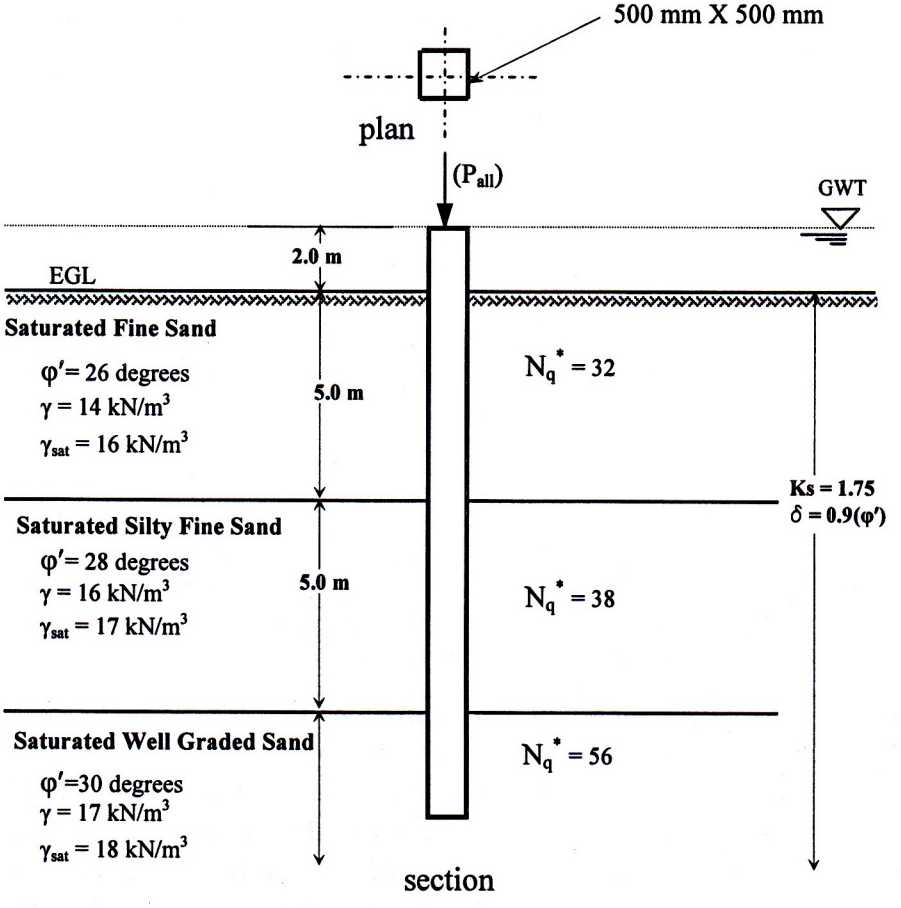

(b) A footing designed as per allowable bearing capacity based on shearing failure is shown in the following figure. Estimate settlements for both sand and clay layers. Use $q_a = p = 2.4$ ksf . 14



7. (a) For the soil stratigraphy as shown below, a concrete bored pile having diameter of 18 inches was installed. Calculate the capacity of the single pile. 9




(b) The plan and X-section of a 15-meter long single pre-cast concrete pile (square) driven in different sand deposits are shown below. Estimate the allowable capacity of the single pile. 11



8. (a) Draw arrangement of group piles for the following sets of piles. 4

(i) 7 piles (ii) Triple row for a wall

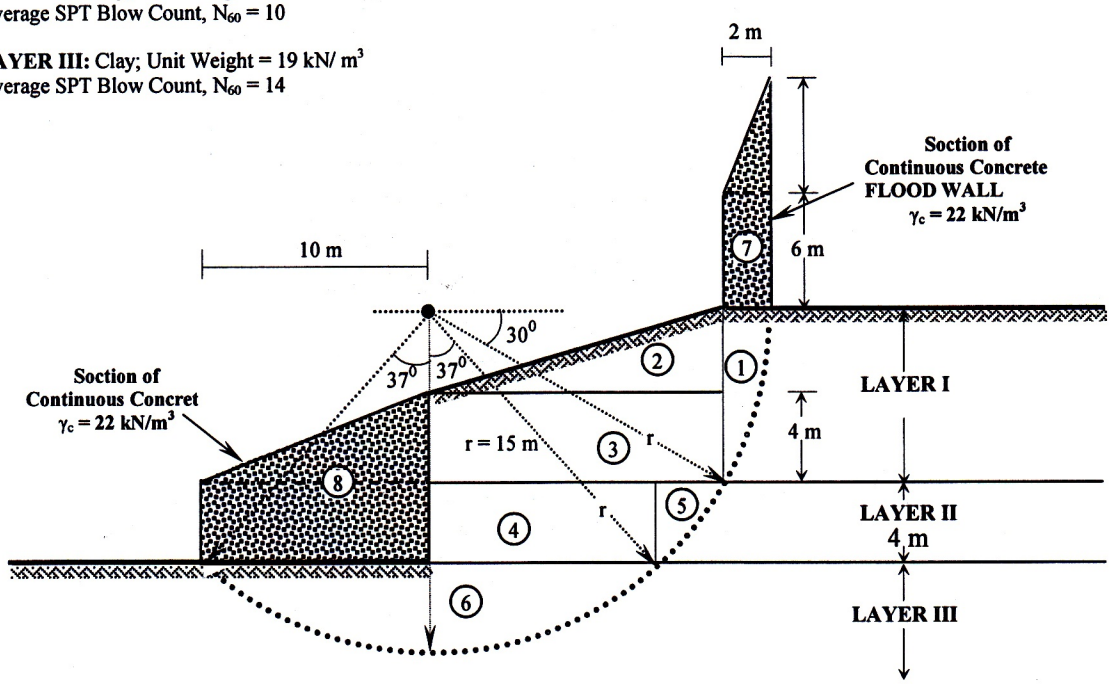
(b) Mention a few civil engineering features where slope stability problems are frequently encountered. 2

(c) Determine the factor of safety (slope stability) against the failure arc through the slope as shown below. 14

**LAYER I:** Sandy Clay; Unit Weight = 17 kN/m$^3$
Average SPT Blow Count, $N_{60}$ = 7

**LAYER II:** Clay; Unit Weight = 18.0 kN/ m$^3$
Average SPT Blow Count, $N_{60}$ = 10

**LAYER III:** Clay; Unit Weight = 19 kN/ m$^3$
Average SPT Blow Count, $N_{60}$ = 14



**University of Asia Pacific**
**Department of Civil Engineering**
**Final Examination Fall 2014**
**Program: B.Sc. Engineering (Civil)**

Course Title: Transportation Engineering II | Course Number: CE 451

Time: 3 hours | Full Marks: 150

## Section: A

**Answer any 3 (three) questions from the following 4 (four) questions (3x25=75)**

1. (a) What is interlocking? What are the essential principles of interlocking? (4)
   (b) Sketch various types of wear on rails with proper labeling. (6)
   (c) Name the main constituents of a set of points or switches? (5)
   (d) Explain: Minimum depth of Ballast Cushion (4)
   (e) Write down the main considerations/requirements for design of ideal rail section components. (6)

2. (a) Define: Calendar System of Maintenance (3)
   (b) Demonstrate fish plate and combination fish plate with proper diagram. (7)
   (c) Briefly describe the main constituents of details of crossing. (6)
   (d) What is tractive power? Describe briefly the resistance due to friction. (4)
   (e) Find out the length of transition curve for a B. G. curve of four degrees, having a cant of 15 cm. The maximum permissible speed on the curve is 120 kmph. And the maximum permissible value of super-elevation is 165, 102 and 76 mm for B.G., M.G., and N.G. respectively. (5)

3. (a) What are the comparisons between block and non-block stations? (3)
   (b) Write down the typical layout of signals at junctions with diagram. (4)
   (c) What is grade compensation on curves? Explain. (5)
   (d) What is shift? What are the reasons of curve resistance? (5)
   (e) A transition curve is to be used to join the ends of three degree circular curve with the straight. The length of the transition curve is 180 m. Work out the shift and offsets at every 60 m in interval and also sketch a free-hand diagram. (8)

4. (a) Write down the comparisons between compressed air brakes and vacuum brakes. (3)
   (b) What are the methods to improve embankment stability? (5)
   (c) What are the requirements of a good spike? (4)
   (d) Write down the classification of stations as per functional consideration. (5)
   (e) What should be the equilibrium cant on a M. G. curve of 5° for an average speed of 60 kmph? Also find out the maximum permissible speed after allowing the maximum cant deficiency 5.10 cm. (8)

## Section: B

**Answer any 3 (three) questions from the following 4 (four) questions (3x25=75)**

1. (a) What is resilient modulus? (2)
   (b) Briefly demonstrate the Asphalt Institute Method for thickness design of a variety of asphalt pavements. (13)
   (c) Calculate Equivalent 18000-lb Standard Axle Load Applications during the first year of service of a pavement, the pavement is expected to accommodate the following number of vehicles in the classes shown below:

| Vehicle type | Number of vehicles | Truck factor |
|---|---|---|
| Two-axle, four-tire | 94000 | 0.03 |
| Two-axle, six-tire | 23600 | 0.19 |
| Three-axle or more | 7300 | 0.56 |
| Three-axle | 4500 | 0.61 |
| Four axle or more | 7350 | 0.62 |
| Five axle | 50200 | 1.09 |
| Six-axle or more | 8900 | 1.23 |

   Also determine Design ESAL for 25-Year Design Period if the traffic using the pavement grows at an annual rate of 5%. (10)

2. (a) Write down the comparisons between joint filler and joint sealer. (5)
   (b) Briefly demonstrate various types of joints in case of pavement. (10)
   (c) The amount of lime required for coarse grained soil in lime stabilization is lower than that of plastic soils. Why? Explain. (3)
   (d) Write down the comparisons among prime coat, tack coat and seal coat. (4)
   (e) What is surface dressing? Write down the functions of surface dressing. (3)

3. (a) Write down the comparisons among three types of concrete pavements. (5)
   (b) Briefly describe the design criteria and design factors of Portland Cement Association Method in case of thickness design of a concrete pavement. (12)
   (c) Describe various types of load on pavement with relevant examples. (3)
   (d) Name separate steps sequentially for construction of a typical concrete pavement. (5)

4. (a) Define: Stability, Durability (3)
   (b) Briefly demonstrate the general steps used in determining the job-mix formula. (12)
   (c) The percentage by weight for coarse aggregate, fine aggregate and mineral filler is 50, 35 and 10 respectively. The bulk specific gravity of coarse and fine aggregates is 2.61 and 2.69 respectively, while the apparent specific gravity of mineral filler is 3.10. What is the bulk specific gravity of aggregate? If the maximum specific gravity of the paving mix is 2.40 and specific gravity of asphalt cement is 1.05, calculate the effective specific gravity of aggregate, asphalt absorption of aggregate and effective asphalt content of the paving mix. (10)

## Equations:

1. $S=\frac{L^2}{24R}$
2. $D=\frac{1746.50}{R}$
3. $D=\frac{5730}{R_1}$
4. $y=\frac{x^3}{6RL}$
5. L= 7.20*e
6. $L=0.073\,C_d\,V_{max}$
7. $L=0.073\,e\,V_{max}$
8. $V=4.4\sqrt{(R-70)}$
9. $V=3.6\sqrt{(R-6)}$
10. $S.E.=1.315\,\frac{V^2}{R}$
11. $S.E.=0.60\,\frac{V^2}{R}$
12. $S.E.=0.80\,\frac{V^2}{R}$
13. $T=\left[\frac{(1+r)\text{^}n-1}{r}\right]T_1$
14. $G_{se}=\frac{P_{mm}-P_b}{\frac{P_{mm}}{G_{mm}}-\frac{P_b}{G_b}}$
15. $G_{sb}=\frac{P_1+P_2+P_3}{\frac{P_1}{g_1}+\frac{P_2}{g_2}+\frac{P_3}{g_3}}$
16. $P_{ba}=100\frac{G_{se}-G_{sb}}{G_{sb}G_{se}}G_b$
17. $P_a=100\frac{G_{mm}-G_{mb}}{G_{mm}}$
18. $P_{be}=P_B-\frac{P_{ba}}{100}P_S$

**All the parameters have their usual meanings.

# University of Asia Pacific
# Department of Civil Engineering
# Final Examination Fall 2014
# Program: B.Sc. Engineering (Civil)

Course title: Irrigation and Flood Control | Course code: CE 461
Time: 3 hours | Full marks: 100

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

## SECTION A
MARKS: 75

**There are SIX questions. Answer question no. 01 (COMPULSORY) and any THREE from the rest. (Assume any missing data.)**

1. a) Define irrigation. Write the benefits of irrigation and the harmful effects of excess irrigation. 2+4
   b) What are the different methods of irrigation water distribution? Describe basin flooding method along with its advantages and disadvantages. 2+4
   c) What are cross-drainage works? Explain the necessity of cross-drainage works. 4
   d) Define spillway. Explain the procedures for determining the required discharge capacity and number of spillways. 1+4

2. a) Explain river training works. What are the purposes of marginal bunds? 2+2
   b) Determine the time required to irrigate a strip of land of 0.04 hectares in area from a tube-well with a discharge of 0.02 $m^3$/sec. The infiltration capacity of the soil may be taken as 5 cm/h and the average depth of flow on the field as 10 cm. Also determine the maximum area that can be irrigated from this tube well. 7
   c) Wheat has to be grown at a certain place, the useful climatological conditions of which are tabulated below. Determine the evapo-transpiration and consumptive irrigation requirement of wheat crop. Also determine the field irrigation requirement if the water application efficiency is 80%. Use Blaney-Criddle equation and a crop factor is 0.8. 7

| Month | Monthly temperature (°C) averaged over the last 5 years | Monthly percent of day time hour of the year computed from the Sun-shine | Useful rainfall in cm averaged over the last 5 years |
|---|---|---|---|
| November | 18.0 | 7.20 | 1.7 |
| December | 15.0 | 7.15 | 1.42 |

| | | | |
|---|---|---|---|
| January | 13.5 | 7.30 | 3.01 |
| February | 14.5 | 7.10 | 2.75 |

3. a) Derive the relationship between Duty and Delta for a given base period. 3
   b) Explain the following with neat sketch: i) Aqueduct ii) Super passage iii) Level crossing. 6
   c) A stream of 130 liters per second was diverted from a canal and 100 liters per second were delivered to the field. An area of 1.6 hectares was irrigated in 8 hours. The effective depth of root zone was 1.7 m. The runoff loss in the field was 420 $m^3$. The depth of water penetration varied linearly from 1.7 m at the head end of the field to 1.1 m at the tail end. Available moisture holding capacity of the soil is 20 cm per meter depth of soil. Irrigation was started at a moisture extraction level of 50% of the available moisture. 9
   Find out the following:
   - water conveyance efficiency
   - water application efficiency
   - water storage efficiency

4. a) Draw the schematic diagram of soil-water-plant relationship. 3
   b) Graphically demonstrate the following (in one figure): 5
   - Capillary water
   - Hygroscopic water
   - Optimum moisture content
   - Readily available moisture
   - Permanent wilting point
   - Field capacity

   c) After how many days will you supply water to soil in order to ensure sufficient irrigation of the given crop, if, 10
   - Field capacity of the soil = 30%
   - Permanent wilting point = 15%
   - Dry density of soil = 1.3 gm/cc
   - Effective depth of root zone = 77 cm
   - Daily consumptive use of water for the given crop = 12 mm
   - Readily available moisture is 75% of the available moisture.

5. a) Explain free board and berms. What are the purposes of free board? 2
   b) Draw the typical layout of diversion head works. What are the objectives of diversion head works? 4
   c) Describe how centrifugal pump works with neat sketch. 3
   d) Calculate the balancing depth for a channel section having a bed width equal to 18 m and side slopes of 1:1 in cutting and 2:1 in filling. The bank embankments are kept 3.0 m higher than the ground level (berm level) and crest width of banks is kept as 2.0 m. 9

6. a) Distinguish between weir and barrage with neat sketch. 2.5
b) What is groyne? Explain different types of groyne with neat sketch. 3.5
c) Explain the following: i) Coefficient of rugosity ii) Critical velocity ratio iii) Hydraulic mean depth iv) Non-alluvial soil 6
d) Design a lined canal having the following data: 6
Full supply discharge = 40 $m^3$/sec
Side slope = 1:1
Bed slope = 1 in 5000
Rugosity coefficient = 0.0225
Assume other reasonable data for the design.

## SECTION B
MARKS: 25

**There are FOUR questions. Answer <u>question no. 07 (COMPULSORY)</u> and any TWO from the rest. (Assume any missing data.)**

7. What are the types of measures of flood management? Distinguish between them. Write down the methods of flood management under each type. 2+2+5

8. a) Explain the following (any three) 8
   i. Integrated Water Resources Management
   ii. Embankment
   iii. Flood plain
   iv. Polder

9. a) Write down the names of the major studies and plans that shaped the water resources development of Bangladesh. 4
   b) Write down the FAP guiding principles of flood management. 4

10. a) What are the advantages and disadvantages of flood control projects? 5
    b) Define integrated flood management. 3