

07 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Baisakh

Exam.	Back		
Level	BE	Full Marks	30
Programme	BCE	Pass Marks	12
Year / Part	II / II	Time	3 hrs.

Subject: - Building Drawing (AR556)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Necessary figures are attached herewith.
- ✓ Assume suitable data if necessary.

1. Mention the elements in superstructure and substructure of building? (2)
2. Fill in the blanks. (2)
 - a) Symbol of three pole one way switch in electrical layout plan is
 - b) Area of 0-5-0-0 plot is equal to Sq. ft.
 - c) The outlet pipe connected from commode/ pan is known as
 - d) The minimum width of staircase in a flight in residential building is as per NBC.
3. The proposed area of plot in a commercial zone is 1800 Sq. ft. and permissible ground coverage is 60% with permissible FAR value 1.5. Calculate the permissible built up area and maximum number of stories that can be built with utilization of maximum permissible plinth area. (4)
4. Draw vertical section at A-A of building as shown in figure using appropriate drawing techniques with description given below. All dimensions are in mm and use scale 1:50. (12)

Column size	: 300x300		
Wall thickness	: 230 (External), 110 (Internal)		
Slab thickness	: 100	Riser	: 160
Parapet wall height	: 1000	Tread	: 275
Size of beam	: 230x350	Stair width	: 1200
Sill height	: 750	Landing width	: 1200
Lintel height	: 2250	Door DW	: 2700x2250
Floor height	: 2880	Door D1	: 1050x2250
Size of sill and lintel band	: 50x230	Door D2	: 900x2250
Size of plinth beam	: 230x300	Door D3	: 800 x2100
Thickness of marble flooring	: 18	Window W	: 1800x1500
Thickness of P. C.C. (1:3:6)	: 75	Window W1	: 900x1500
Thickness of stone soling	: 150	Ventilation V	: 600x600
5. Differentiate between as built drawing and measured drawing. Also, list down necessary drawings to be submitted to municipality for approval before construction of building. (4)
6. Draw trench plan of given plan in Question No.4 in scale 1:50 with following information. (6)
 - The sizes of footing are 2m x 2m x 2m.
 - The width of wall foundation is 0.5m
 - Assume other data, if necessary.



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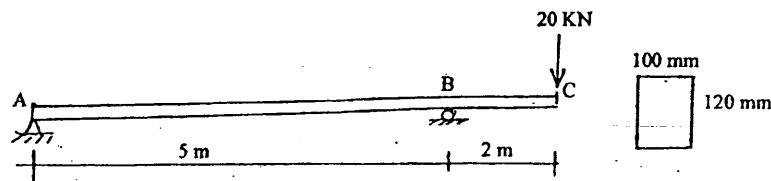
Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Theory of Structure (CE551)

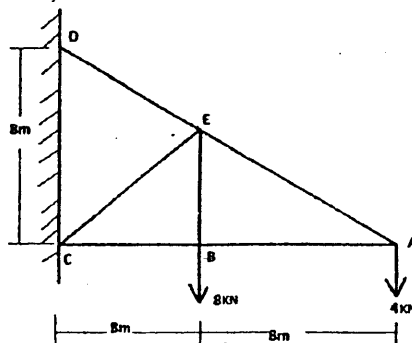
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) Explain linear and non linear behaviour of structure with suitable force displacement diagram. [4]
- b) Determine strain energies due to bending and shear in the overhanging beam shown in figure below and also determine deflection at C by using real work method. [12]

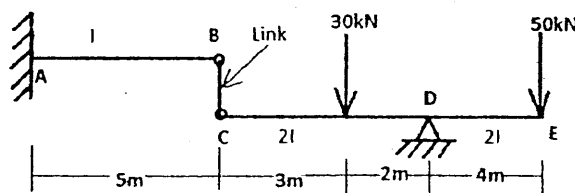
$E = 200 \text{ KN/mm}^2 \quad G = 80 \text{ KN/mm}^2$



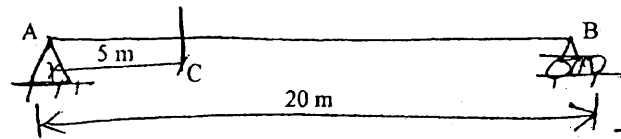
2. a) Explain the principle of super position with suitable example. [4]
- b) Determine the vertical deflection of joint E. All the top chord member are subjected to temperature rise 30°C and the members AE and EC are 5mm too long while fabrication. Take coefficient of the thermal expansion as $12 \times 10^{-6}/^\circ\text{C}$, modulus of elasticity as 200 kN/mm^2 , cross sectional area of each members is 1500 mm^2 . [12]



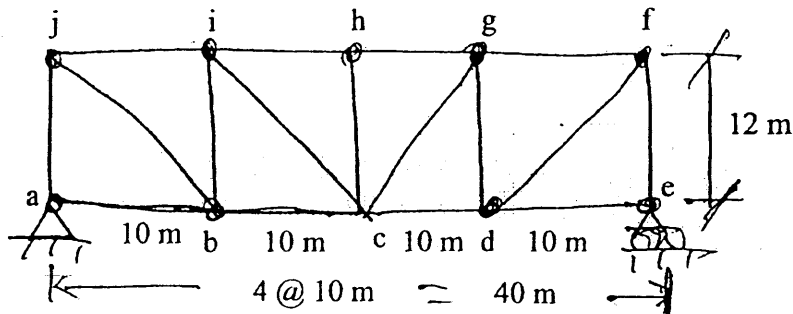
3. a) State and proof first theorem of moment area method. [4]
- b) For the beam shown in figure below, find the deflection and slope at E and B, take $I = 6 \times 10^7 \text{ mm}^4$ and $E = 200 \text{ kN/mm}^2$. [12]



4. a) Draw the influence lines for support reactions, shear force and bending moment at a section 5m from the left support of a simply supported beam of 20m span. [6]

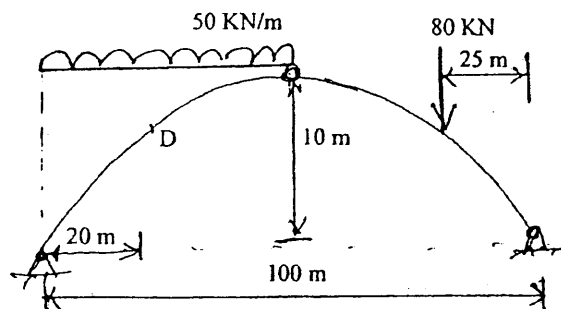


- b) Draw influence line diagrams for the forces in member bc, hg and df of the truss. The load moves in the upper chord of the truss. [10]



5. a) Explain graphical method to determine the reactions of a three hinged arch when it is subjected to a single concentrated load. [4]

- b) In the three hinged parabolic arch shown in figure below determine bending moment, normal thrust and radial shear force at section D. [12]



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Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE, BME, BIE, BAM	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Probability and Statistics (SH552)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Necessary tables are attached herewith.
- ✓ Assume suitable data if necessary.

1. What are the merits and demerits of mean? The expenditure of 1000 families is given as below:

Expenditure	40-59	60-79	80-99	100-119	120-139
No. of families	50	-	500	-	50

- If the median of frequency distribution is 87, find the missing frequencies. [6]
2. Define addition theorem of probability. In a group of equal number of men and women, 20% of men and 30% of women are unemployed. If a person selected in random,
- What is the probability that the selected person is an employed?
 - What is the probability that the selected person is men employed? [6]
3. Define Binomial probability distribution with an example. How does the negative binomial distribution differ from binomial distribution? [2+3]
4. In a certain factory turning out optical lenses, there is a small chance, 1/500 for any lens to be defective. The lenses are supplied in packets of 10 each. What is the probability that a packet will contain
- no defective lens
 - at least one defective lenses.
 - at most two defective lenses [5]
5. Define the normal distribution. Give the condition for normal approximation of binomial distribution. [2+3]
6. The mean elongation of steel bar under a particular tensile load has been established to be normally distribution with parameters $\mu = 0.06$ and $\sigma = 0.008$. Assuming the same distribution applies to new bar. find the probability that the mean elongation falls
- Above 0.08
 - Between 0.05 and 0.07
 - Either below 0.045 or above 0.065 [5]

OR

The distribution of amount of the gravel (in ton) sold by a particular construction supply company in a given week is continuous random variable X with the probability density function.

$$f(x) = \begin{cases} \left(\frac{3}{2}\right)(x^2 + 1) & \text{for } 0 \leq x \leq 1 \\ 0 & \text{Otherwise} \end{cases}$$

- Find the cumulative distribution function of sales.
- What is the expected value and variance of sales? [5]

7. Define sampling distribution of proportion with example. [4]
8. A population consists of the four numbers 12, 13, 14, 15. [6]
- (i) Write down all possible sample size of two without replacement.
- (ii) Verify that the population mean is equal to the mean of the sample mean.
- (iii) Calculate the standard error of the sampling distribution of the sample mean.
9. Write down the properties of regression coefficient and correlation coefficient. [5]
10. The following data gives the experience of machine operators in years and their performance as given by the number of good parts turned out per 100 pieces.

Experience (X)	16	12	18	4	3	10	5	12
Performance (Y)	87	88	89	68	78	80	75	83

- i) Fit the regression equation of performance ratings on experience and estimate the probable performance if an operator has 8 years experience.
- ii) Calculate coefficient of determination and interpret it. [5]

OR

A sample of 10 values of three variables X_1 , X_2 and X_3 were obtained as

$\sum X_1 = 10$	$\sum X_2 = 20$	$\sum X_3 = 30$
$\sum X_1^2 = 20$	$\sum X_2^2 = 68$	$\sum X_3^2 = 170$
$\sum X_1 X_2 = 10$	$\sum X_1 X_3 = 15$	$\sum X_2 X_3 = 64$

- Find (i) Partial correlation between X_1 and X_3 eliminating the effect of X_2 .
- (ii) Multiple correlation between X_1 , X_2 and X_3 assuming X_1 as dependent. [5]
11. A company produces automobile tyres, the manager of the company want to estimate the limits in which expected trend life of his tyres will probably lie. A test sample of 64 tyres was taken and a test run showed the average trend life of 50000 miles. Find the 95% and 99% confidence limits for population mean. Given that population standard deviation is 3000 miles. [4]
12. The following data represents the units of production per day turned out by three different brands of machines used by three mechanists:

Machines	Production			
1	15	14	19	18
2	17	12	20	16
3	16	18	16	17

Using ANOVA test whether the differences in performances of the three brands of machines are significant. Use $\alpha = 5\%$ [6]

OR

A sample of 15 beams of a grand complex are given below in feet³.

12.8	9.8	10.2	10.0	12.0
10.5	8.9	12.2	10.8	9.0
11.2	12.1	10.1	8.3	10.6

A civil engineer claimed that volumes of beams are greater than 10 feet³, test whether his claim is right or wrong. (Use $\alpha = 1\%$) [6]

13. Define critical value and critical region. A manufacturer claimed that at least 95% of the pumps supplied to the ABC company confirmed to specifications. However, the production manager at ABC company wasn't satisfied with the claim of the manufacturer. Hence, to test the claim, the manager examined a sample of 250 pumps supplied last month and found that 228 pumps as per the specifications. Can you conclude that the production manager is right to doubt on the claim of the manufacturer? ($\alpha=0.01$) [5]

(P.T.O)

hi-square distribution. A sample of 500 workers of a factory according to gender and nature of as follow: [5]

Nature of work	Gender	
	Male	Female
Technical	200	100
Non-technical	50	150

% level of significance whether there exist any relationship between gender and nature of work.

hts of male and female students are given below: [8]

Height	Sex of the person	
	Male	Female
150	0	3
155	2	8
160	6	15
165	17	12
170	21	4
175	10	0
80	2	0
85	2	0

Calculate mean height for male and female students

Calculate sample standard deviation and sample variance for given data.

Check data for height is consistent?

Table A-5 Values of Z_{α}

α	$\alpha = 0.995$	$\alpha = 0.99$	$\alpha = 0.975$	$\alpha = 0.95$	$\alpha = 0.90$	$\alpha = 0.85$	$\alpha = 0.80$	$\alpha = 0.75$	$\alpha = 0.70$	$\alpha = 0.65$	$\alpha = 0.60$	$\alpha = 0.55$	$\alpha = 0.50$	$\alpha = 0.45$	$\alpha = 0.40$	$\alpha = 0.35$	$\alpha = 0.30$	$\alpha = 0.25$	$\alpha = 0.20$	$\alpha = 0.15$	$\alpha = 0.10$	$\alpha = 0.05$	$\alpha = 0.025$	$\alpha = 0.01$	$\alpha = 0.005$	α	
1	0.0000393	0.000157	0.000482	0.000933	0.00175	0.00287	0.00441	0.00635	0.00871	0.01149	0.01469	0.01829	0.02229	0.02659	0.03119	0.03609	0.04119	0.04649	0.05199	0.05769	0.06359	0.06969	0.07599	0.08259	0.08949	0.09659	1
2	0.0100	0.0201	0.0506	0.103	0.167	0.233	0.309	0.388	0.467	0.547	0.627	0.707	0.787	0.867	0.947	1.027	1.107	1.187	1.267	1.347	1.427	1.507	1.587	1.667	1.747	1.827	2
3	0.0717	0.115	0.216	0.352	0.511	0.688	0.881	1.089	1.311	1.544	1.787	2.039	2.299	2.567	2.844	3.129	3.421	3.719	4.024	4.336	4.654	4.977	5.304	5.635	5.969	6.306	3
4	0.207	0.297	0.484	0.711	0.948	1.143	1.347	1.548	1.747	1.944	2.139	2.331	2.521	2.709	2.894	3.077	3.258	3.437	3.614	3.789	3.962	4.133	4.302	4.469	4.634	4.797	4
5	0.412	0.554	0.831	1.145	1.507	1.823	2.091	2.311	2.488	2.662	2.833	2.999	3.162	3.322	3.479	3.633	3.784	3.932	4.077	4.219	4.359	4.496	4.631	4.764	4.895	5.024	5
6	0.676	0.872	1.237	1.635	2.076	2.559	3.084	3.651	4.259	4.907	5.594	6.321	7.087	7.891	8.732	9.609	10.522	11.471	12.455	13.474	14.527	15.614	16.735	17.889	19.076	20.296	6
7	0.989	1.239	1.690	2.167	2.677	3.219	3.794	4.401	5.039	5.707	6.404	7.131	7.887	8.672	9.485	10.324	11.189	12.080	12.997	13.939	14.906	15.897	16.912	17.951	19.013	20.097	7
8	1.344	1.646	2.180	2.733	3.307	3.901	4.524	5.175	5.854	6.561	7.295	8.055	8.841	9.652	10.487	11.346	12.229	13.136	14.066	15.019	16.004	17.021	18.069	19.148	20.257	21.396	8
9	1.735	2.088	2.700	3.325	3.971	4.637	5.324	6.031	6.757	7.502	8.266	9.048	9.848	10.666	11.501	12.353	13.222	14.108	15.011	15.931	16.867	17.819	18.796	19.798	20.825	21.876	9
10	2.156	2.558	3.247	3.940	4.657	5.397	6.159	6.943	7.749	8.576	9.423	10.290	11.176	12.081	12.995	13.928	14.879	15.848	16.835	17.839	18.860	19.897	20.950	22.018	23.099	24.193	10
11	2.603	3.053	3.816	4.575	5.357	6.161	6.987	7.834	8.701	9.587	10.492	11.415	12.356	13.314	14.288	15.278	16.284	17.305	18.341	19.391	20.455	21.532	22.622	23.724	24.837	25.961	11
12	3.074	3.571	4.404	5.226	6.077	6.955	7.859	8.788	9.741	10.708	11.689	12.684	13.693	14.715	15.749	16.795	17.852	18.920	19.998	21.086	22.184	23.291	24.407	25.532	26.666	27.808	12
13	3.565	4.107	5.009	5.892	6.811	7.755	8.723	9.714	10.727	11.752	12.788	13.835	14.892	15.959	17.036	18.122	19.218	20.324	21.439	22.563	23.696	24.837	25.986	27.143	28.307	29.478	13
14	4.075	4.660	5.629	6.571	7.537	8.527	9.540	10.565	11.602	12.649	13.706	14.773	15.849	16.934	18.028	19.131	20.242	21.361	22.487	23.620	24.760	25.907	27.060	28.219	29.383	30.552	14
15	4.601	5.229	6.262	7.261	8.287	9.337	10.409	11.493	12.589	13.695	14.811	15.936	17.069	18.209	19.356	20.509	21.668	22.832	23.999	25.170	26.345	27.524	28.707	29.893	31.082	32.273	15
16	5.142	5.812	6.908	7.962	9.037	10.131	11.243	12.363	13.490	14.623	15.761	16.903	18.049	19.199	20.352	21.508	22.667	23.829	24.993	26.159	27.327	28.497	29.669	30.843	32.018	33.194	16
17	5.697	6.408	7.564	8.672	9.807	10.969	12.147	13.331	14.520	15.713	16.910	18.111	19.315	20.522	21.731	22.942	24.155	25.369	26.584	27.799	29.015	30.232	31.450	32.668	33.886	35.103	17
18	6.265	7.015	8.231	9.390	10.577	11.781	12.991	14.206	15.425	16.647	17.872	19.099	20.328	21.558	22.788	24.018	25.248	26.478	27.707	28.936	30.164	31.392	32.619	33.846	35.072	36.298	18
19	6.844	7.633	8.907	10.117	11.361	12.627	13.904	15.181	16.457	17.732	19.007	20.281	21.554	22.826	24.097	25.367	26.636	27.903	29.169	30.434	31.698	32.961	34.223	35.484	36.744	38.003	19
20	7.434	8.260	9.591	10.851	12.139	13.445	14.758	16.069	17.377	18.682	19.984	21.284	22.581	23.876	25.169	26.460	27.749	29.036	30.321	31.603	32.883	34.161	35.437	36.711	37.983	39.253	20
21	8.034	8.897	10.283	11.591	12.917	14.251	15.581	16.907	18.228	19.544	20.855	22.161	23.462	24.758	26.050	27.338	28.622	29.902	31.178	32.451	33.720	34.986	36.248	37.506	38.761	40.013	21
22	8.643	9.542	10.962	12.338	13.681	15.031	16.377	17.718	19.054	20.385	21.711	23.032	24.348	25.659	26.965	28.266	29.562	30.853	32.139	33.421	34.698	35.970	37.237	38.500	39.758	41.011	22
23	9.260	10.196	11.649	13.091	14.457	15.827	17.191	18.549	19.901	21.247	22.587	23.921	25.250	26.574	27.893	29.207	30.516	31.820	33.119	34.413	35.702	36.986	38.265	39.539	40.808	42.071	23
24	9.886	10.856	12.401	13.848	15.289	16.734	18.172	19.603	21.027	22.444	23.855	25.260	26.660	28.055	29.445	30.830	32.210	33.585	34.955	36.320	37.680	39.035	40.385	41.730	43.070	44.404	24
25	10.520	11.524	13.120	14.611	16.097	17.587	19.070	20.546	22.015	23.478	24.935	26.386	27.831	29.270	30.703	32.130	33.551	34.966	36.375	37.778	39.175	40.567	41.954	43.336	44.712	46.083	25
26	11.160	12.198	13.844	15.379	16.865	18.354	19.836	21.311	22.779	24.241	25.697	27.147	28.591	30.029	31.461	32.887	34.307	35.721	37.129	38.531	39.927	41.317	42.701	44.080	45.453	46.820	26
27	11.808	12.879	14.573	16.151	17.637	19.126	20.607	22.081	23.548	25.009	26.464	27.913	29.356	30.793	32.224	33.649	35.068	36.481	37.888	39.289	40.684	42.073	43.456	44.833	46.204	47.569	27
28	12.461	13.565	15.308	16.928	18.457	19.986	21.505	23.014	24.513	26.001	27.478	28.945	30.402	31.849	33.286	34.713	36.130	37.540	38.943	40.339	41.728	43.111	44.488	45.859	47.224	48.583	28
29	13.121	14.256	16.047	17.708	19.267	20.825	22.372	23.909	25.436	26.953	28.460	29.957	31.444	32.921	34.388	35.845	37.292	38.729	40.157	41.575	42.983	44.381	45.770	47.152	48.527	49.895	29
30	13.787	14.953	16.791	18.493	20.081	21.638	23.184	24.719	26.244	27.759	29.264	30.759	32.244	33.719	35.184	36.639	38.084	39.519	40.944	42.359	43.764	45.159	46.544	47.919	49.287	50.648	30
40	20.707	22.164	24.433	26.509	28.485	30.361	32.137	33.912	35.686	37.450	39.203	40.945	42.676	44.396	46.104	47.800	49.484	51.156	52.816	54.464	56.099	57.721	59.331	60.928	62.512	64.083	40
50	27.991	29.707	32.357	34.764	37.035	39.267	41.459	43.611	45.723	47.795	49.827	51.828	53.798	55.737	57.644	59.519	61.362	63.173	64.951	66.696	68.417	70.114	71.787	73.435	75.058	76.656	50
60	35.534	37.485	40.482	43.188	45.798	48.312	50.730	53.052	55.277	57.405	59.536	61.669	63.704	65.741	67.770	69.791	71.794	73.778	75.743	77.688	79.613	81.518	83.403	85.268	87.113	88.938	60
70	43.275	45.442	48.758	51.739	54.584	57.293	59.966	62.593	65.174	67.709	70.198	72.641	75.038	77.389	79.694	81.953	84.166	86.333	88.454	90.529	92.558	94.541	96.478	98.369	100.214	102.013	70
80	51.172	53.540	57.153	60.391	63.554	66.641	69.652	72.587	75.445	78.216	80.900	83.497	86.007	88.529	91.053	93.579	96.006	98.433	100.860	103.287	105.714	108.141	110.568	112.994	115.419	117.844	80
90	59.196	61.754	65.647	69.126	72.584	75.921	79.137	82.232	85.206	88.059	90.791	93.402	95.892	98.261	100.518	102.663	104.696	106.617	108.426	110.123	111.707	113.178	114.535	115.778	116.907	117.921	90
100	67.328	70.065	74.222	77.929	81.584	85.187	88.738	92.236	95.681	99.072	102.409	105.692	108.920	112.093	115.211	118.274	121.281	124.232	127.127	130.000	132.851	135.680	138.487	141.271	144.032	146.771	100

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Soil Mechanics (CE552)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

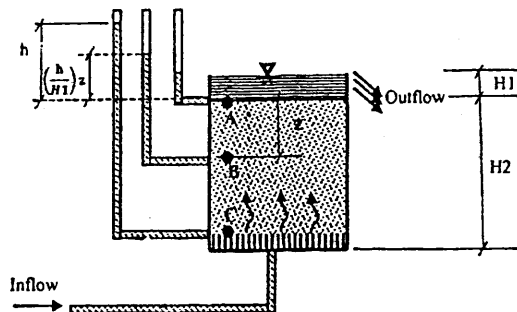
1. Differentiate between residual and transported soils. What would be a solution of different soil engineering problem? [2]
2. a) How does Index property of a soil differ from its Engineering property?
b) Mention Index tests those are generally done to find the properties of individual soil grains and soil mass as a whole.
c) Draw stress strain behaviour of different consistency states of soils.
d) An embankment is made by compacting the soil. For compaction, 1,00,000 m³ of the soil is excavated from the borrow pit having void ratio equal to 0.8. Calculate the volume of the embankment if its void ratio after compaction is 0.6. [1+2+2+3]
3. How is the plasticity chart useful for classifying fine-grained soils? a soil has the following characteristics:
a) Percentage of soil passing No. 200 sieve = 55
b) Percentage of coarse fraction passing No.4 sieve = 60
c) Liquid limit = 68%
d) Plastic limit = 22%
Classify given soil according to ISSCS. [2+6]
4. a) Describe basic structural units of clay minerals. Point out the difference between Silica sheet, Gibbsite sheet and Brucite sheet.
b) Briefly Describe flocculated and dispersed structures of soils in regard with compaction. [2+2]
5. In the construction of a road, the compaction specification required was 95% of Proctor maximum dry density at a field moisture content within 2% of the optimum moisture content. The maximum dry density and optimum moisture content obtained in the laboratory from the Standard Proctor test were 1.95 Mg/m³ and 13.5% respectively. A site engineer conducted sand cone test at two locations and obtained the following results.

Location No.	Mass of soil removed (gm)		Mass of sand used (gm)
	Wet	Dry	
1	43.86	38.46	39.51
2	37.38	32.21	32.39

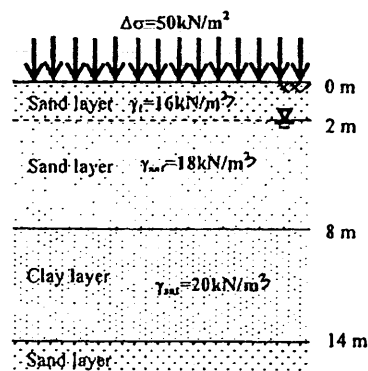
The density of sand used was 1.86 Mg/m³. Check whether the specification was satisfied or not. [6]

6. a) Explain the variation of effective stress due to the flow of water through the soil mass in downward and upward directions. What is discharge velocity? [2+1]
- b) In a variable head permeability test on a soil of length L_1 , the head of water in the standpipe takes 5 seconds to fall from 900 to 135 mm above the tail water level. When another soil of length $L_2 = 60$ mm is placed above the first soil, the time taken for the head to fall between the same limits is 150 seconds. The permeameter has a cross sectional area of 4560 mm² and a standpipe area of 130 mm². Calculate the permeability of the second soil. [7]

7. a) What do you understand by Flow net in regard with seepage through soils?
 b) Derive a Laplace equation for Two-dimensional flow in the soil.
 c) In the figure below, upward seepage is shown. The rate of water supply from the bottom is kept constant. The total loss of head during upward seepage between points B and A is h . Keeping in mind the total stress at any point in the soil is solely determined by the weight of the soil and the water above it, draw the variation of total stress, pore water pressure and effective stress with depth. Take points A, B and C as reference. [1+4+3]



8. What is Isobar Diagram? Draw Isobar Diagram of $0.1Q$. What is the limitation of Boussinesq's theory? [1+5+2]
9. a) What is compressibility and what are the possible causes of compression in the soil?
 b) Define consolidation settlement, preconsolidation pressure (maximum overburden pressure), degree of consolidation and coefficient of consolidation?
 c) A soil profile is shown in below figure. If a uniformly distributed load 50 kPa is applied on the ground surface having preconsolidation pressure, compression index and recompression index are 125 kPa, 0.36 and 0.06, respectively. Calculate the amount of settlement of the clay layer due to primary consolidation. Take $\gamma_w = 10 \text{ kN/m}^3$.
 d) How can you accelerate consolidation settlement? [2+3+4+1]



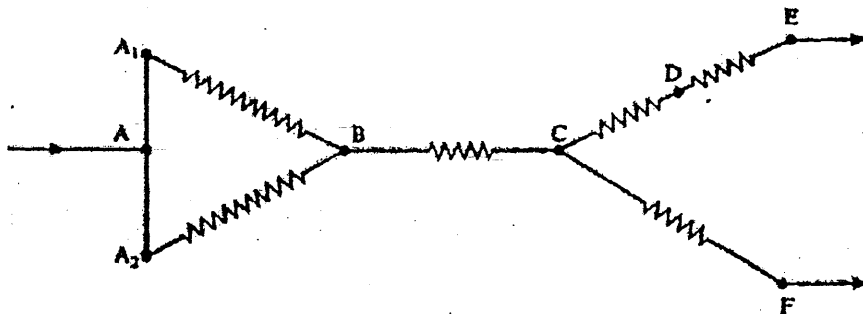
10. What is stress path? What are the limitations of direct shear test? A specimen of fine dry sand, when subjected to a triaxial compression test failed at a deviator stress of 500 kN/m^2 . It failed with a pronounced failure plane with an angle of 25° to the axis of sample. Compute the lateral pressure (σ_3) to which the specimen would have been subjected. [1+2+7]
11. What are the causes of the failure of earth slopes? A slope of very large extent of soil with properties $c' = 0$, $e = 0.7$, $G = 2.7$ and $\phi = 35^\circ$ is likely to be subjected to seepage parallel to the slope with water level at the surface. Determine the maximum angle of slope for a factor of safety of 2.0. What will be the factor of safety if the water level were to come down well below the surface for this angle of slope? [2+4]

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE, B.Agr.	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Hydraulics (CE555)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. A system of pipes conveying water is connected in parallel and in series as shown in figure below. The section DE represents the resistance of a valve for controlling the flow, which has a resistance coefficient $K_{DE} = \left(\frac{4000}{n}\right)^2$, where n is the percentage valve opening.



The friction factor f in the Darcy formula is 0.024 for all pipes, and their lengths and diameters are given by

Pipe	Length (m)	Diameter (m)
AA ₁ B	30	0.1
AA ₂ B	30	0.125
BC	60	0.15
CD	15	0.1
CF	30	0.1

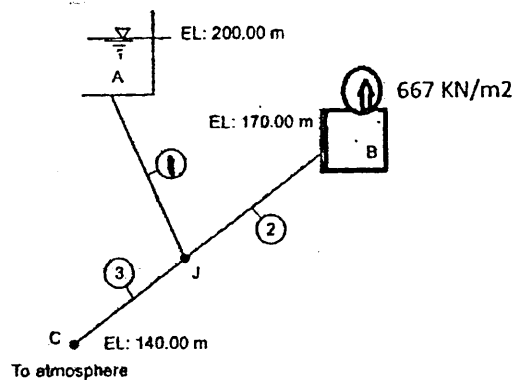
The head at A is 100m, at E is 40 m and at F is 60m. If the valve is adjusted to give equal discharge rates at E and F, calculate the head at C, the discharge through the system and percentage valve opening. Neglect all losses except those due to friction. [10]

2. A cast iron pipe of 300 mm diameter and 8 mm thick is 1500 m long. The pipe is to convey 200 litres per sec of water.
- Estimate the maximum time of closure of a valve at the downstream end that would be recognized as rapid closure?
 - What is the peak water hammer pressure produced by rapid closure?
 - What is the length of the pipe subjected to peak water hammer pressure if the time of closure is 2.0 sec? (For water $E = 2200 \text{ MPa}$; for cast iron $E = 80 \times 10^9 \text{ Pa}$) [2.5+2.5+3]

3. For the reservoir system shown in figure, determine the flow in each pipe. At C, the pipe discharges into the atmosphere at a elevation of 140.00 m and at Tank B, the top is closed with pressure of 667 KN/m² of Hg. Take $f=0.02$ for all pipes and use following data:

[8]

Pipe	Diameter	Length
1	15 cm	800 m
2	20 cm	500 m
3	30 cm	600 m



4. Pipes of 75 mm are to be used to syphon water from a main canal to branch canal, the difference of water level between the two canals being 15m. The length from the main canal to the summit of the pipe line is 20m. The total length of the pipe being 50m.

- Determine the number of pipes required to discharge at least 50 l/sec of water to the branch canal.
- Find also the maximum height of the summit above the water level of the main canal in order the pressure at the summit may not fall below 25 KPa (absolute). Take $f=0.03$ and ignore minor loss.

[4+4]

5. Explain variation of hydraulic radius with respect to depth in a very deep rectangular channel with suitable illustration.

[6]

6. A 3m wide rectangular channel carries a discharge of 15m³/s at a depth of 2 m. What will be the minimum height of hump at which the depth over the hump will be critical? Calculate the height of hump for which upstream water depth will be 2.5 m. What will be the depth of flow on the upstream and on the hump when its height is 0.2 m?

[8]

7. A 3.6 m wide rectangular channel had badly damaged surfaces and had a Manning's $n = 0.030$. As a first phase of repair, its bed was lined with concrete with $n = 0.015$. If the depth of flow remains the same at 1.2 m before and after the repair, what is the increase of discharge obtained as result of repair.

[7]

8. A rectangular channel section has a change in slope as shown in figure below. The channel is 4m wide having Manning's $n = 0.0165$. The bed slope $S_{02} = 0.0024$ and the flowing discharge is 16 m³/sec.

- Calculate the depth that must exist in the downstream channel for a hydraulic jump to terminate at uniform flow condition.

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Surveying II (CE554)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Explain significance of traversing and describe about the accuracy parameters of horizontal and vertical control of traverse. [4]
2. Explain about the method of plotting of traverse in a standard grid sheet. [4]
3. Prepare the Gale's Table and find the co-ordinates of all the points if the co-ordinate of C is (1000N, 1500E) from the following data. [8]

S.No	Line	Length (m)	Bearing (WCB)
1	AB	66.60	30° 30'
2	BC	135.70	102° 48'
3	CD	66.30	95° 40'
4	DE	76.60	198° 8'
5	EA	214.30	284° 1'

4. Explain the principle of Tacheometric survey and also derive the formula to determine the horizontal distance and RL of the object with respect to instrument station when the staff is held in vertical. [8]
5. A tacheometer fitted with an anallatic lens and having multiplying constant of 100 was setup at station 'P'. The following readings were taken with the staff held vertically.

S.N	Staff Station	Bearing	Vertical Angle	Staff intercept	Axial hair reading
1	X	40° 35'	- 10° 20'	2.25	1.987
2	Y	70° 10'	+ 7° 30'	2.05	1.500

Calculate the distance XY and the gradient between X and Y. [8]

6. What are the important characteristics of contour? Explain with sketches. [5]
7. Explain about the reciprocal trigonometrical levelling and express the formula for computing elevation difference. [4]
8. Stations A, B and C have the following respective coordinates (2876.24 mE, 8754.11 mN), (3810.80 mE, 7997.25 mN) and (2959.39 mE, 7487.09 mN) respectively. Station 'O' was established and following observations were recorded by a theodolite.

Pointing towards	Horizontal Circle Readings
A	90° 00' 00"
B	230° 58' 51"
C	313° 17' 05"
A	90° 00' 30"

Determine the coordinates of resection point 'O'. [7]

9. It is required to join two straights having a total deflection angle $18^{\circ} 36'$ by a central circular curve of radius 450 m with two ends cubic spiral transition curves. The design velocity is 70 kmph and rate of change of radial acceleration is 30 cm/sec^3 . Chainage of IP = 2524.20 m. Take Peg interval for circular and transition curve = 20 m for both. [8]
10. A grade of -0.7% is followed by another grade of + 0.5%. The two ends of these portions are connected by a parabolic vertical curve. The chainage and RL of intersection point are 1000 and 650 m respectively. Calculate RLs of all the points on the curve. Take peg interval of 20 m and rate of change of grade is 0.1% per 20 m. [8]
11. Write short notes on: (Any Four) [4×4]
- a) Importance of GPS and GIS
 - b) Scale of vertical photograph and uses of photo grammetry
 - c) Features of total station and its uses
 - d) Types of remote sensing and its application
 - e) Setting out of circular curve by Rankine's method

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Examination Control Division
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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Surveying II (CE554)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) How a linked traverse is balanced? How total misclosure is balanced by Transit Rule? [6]
- b) Calculate the omitted quantities in the closed traverse ABCDE given below. [10]

Line	Length	Bearing
AB	282.20	61°30'
BC	?	151°24'
CD	324.70	201°02'
DE	381.60	280°14'
EA	359.60	?

2. a) Compute RL of a hill station 'P' from two instrument stations A and B at very different level with same line of sight to that of target from the following informations. [5]

Inst St ⁿ	Inst ht		Zenith angle		Distance & Target ht and RL
		Target	FL	FR	
A	1.42	P	65°18'	304°36'	Distance between A and B = 120.00 m RL of B = 1280.00 m Target ht at B = 1.50 m
B	1.47	P	69°52'	290°00'	
A	1.42	B	102°52'	257°16'	

- b) What is stadia interval factor and additive constant? How these constants are determined? [3]
- c) Following observations were made in a Tacheometric survey a station A of RL 1086.550, the height of instrument being 1.385 m. [8]

Inst. Station	H.I.	Staff Station	Bearing	Zenithal Angle	Staff Reading
A	1.385	B	18°00'	71°30'	1.295, 1.820, 2.345
		C	127°00'	96°00'	1.010, 1.790, 2.570

The instrument is fitted with an anallactic lens and the multiplying constants is 100. Determine the R.L of B and C and the gradient of line BC, and bearing of BC.

3. a) How do you define contour interval, contour gradient and index contour? Explain the main characteristics of Contours with neat sketch. [6]
- b) What is the different between Intersection and Resection? Explain three point Resection Method to determine the unknown co-ordinate of a point. [4]

- c) The co-ordinates of three known stations Swoyambhu (S), Harisiddhi (D) and Chovar Temple (C) are given below. A traverse point "O" is set outside of this triangle and observations are taken for horizontal angle to these known co-ordinate points. Calculate the co-ordinate of station point "O". [6]

Known Station	Horizontal Angle	Easting, m	Northing, m
Swoyambhu (S)	<SOD = 40°20'21"	627465.718	3066929.474
Harisiddhi (D)	<DOC = 98°56'41"	629603.054	6065364.275
Chovar Temple (C)	<COS = 220°42'58"	627612.753	3061479.468

4. a) Two roads BA and AC intersect at an angle of 150°. They are to be connected by a 4° circular curve. The chainage of point of intersection A is (138+20.3) chains. Compute all data necessary (i.e deflection angle, tangent length, apex distance, mod ordinate, length of curve, long chord for laying out the curve if only 30 m chain is used. [6]

- b) State the function of transition curves. Derive the expression for deflection angle in transition curve that $\alpha = \frac{573\ell^2}{RL} \text{ min}$

where, ℓ = chord length

R = Radius

L = Length of transition curve [5]

- c) A grade of 3.5% meets another grade of -0.5%. The elevation and chainage of intersection pt are 1267.00 m and 780.00 m respectively. Field condition requires that vertical curve should pass through a point of elevation 1266.00 m at chainage 780.00 m. Compute a suitable equal tangent vertical curve and full station elevation including highest point. Take peg interval = 30m. [5]

5. Write short notes on: (Any four) [4×4]

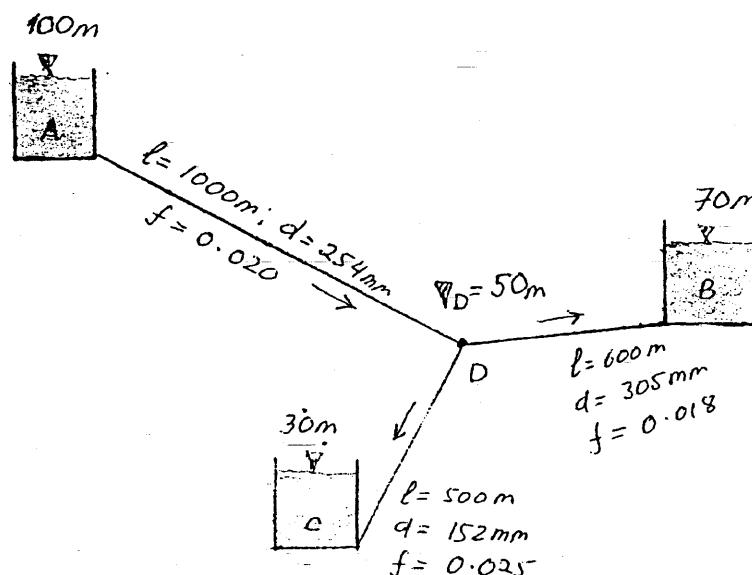
- Planning and taking of photographs and interpretation of aerial photograph
- Application of Remote sensing in surveying and mapping
- Working principle and Components of GPS
- Application of GIS in Civil Engineering
- Features and precautions taken in Total Station

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, B.Agr.	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Hydraulics (CE555)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

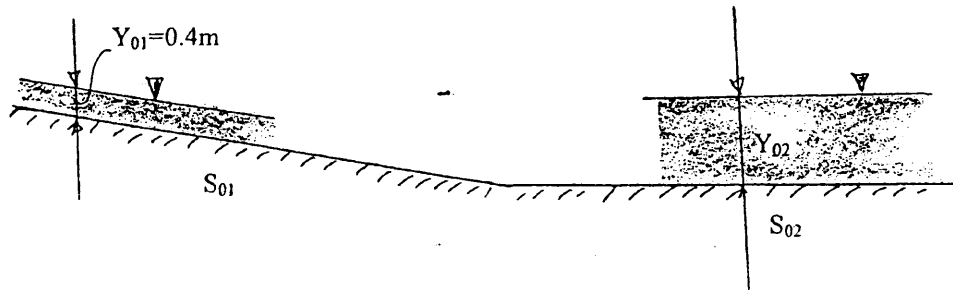
1. Determine the discharge rate in each pipeline for the following three-reservoir problems. [10]



2. In a pipe of length 500 m and uniform circular cross-section, water flows at a steady velocity of 2 m/s and discharges to atmosphere through a valve. Under steady conditions the static head just before the valve is 300 m. Calculate the ratio of internal diameter to wall thickness of the pipe so that, when the valve is completely and instantaneously closed, the increase in circumferential stress is limited to 20 MPa, and determine the maximum time for which the closure could be described as rapid. The bulk modulus of water = 2 GPa, and the elastic modulus of the pipe material = 200 GPa. [8]
3. Petrol of kinematic viscosity $0.6 \text{ mm}^2/\text{s}$ is to be pumped at the rate of $0.8 \text{ m}^3/\text{s}$ through a horizontal pipe 500 mm diameter. However, to reduce pumping costs a pipe of different diameter is suggested. Assuming that the absolute roughness of the walls would be the same for a pipe of slightly different diameter, and that, for $Re > 10^6$, f is approximately proportional to the cube root of the roughness, determine the diameter of pipe for which the pumping costs would be halved. Neglect all head losses other than pipe friction. How are the running costs altered if n pipes of equal diameter are used in parallel to give the same total flow rate at the same Reynolds number as for a single pipe? [8]

4. Difference in level between two reservoir is 100 m and distance between them is 10 km. The reservoir is connected by a single pipe to carry 200 lps. Calculate the diameter of the pipe and length of second pipe, which is connected to increase the rate of flow by 5×10^6 lit/day with same diameter pipe. Take friction factor for all pipes 0.03. [8]
5. Define gradually varied, rapidly varied and spatially varied of flow with examples. [2×3]
6. A 3.5 m wide rectangular channel carries a discharge of $10 \text{ m}^3/\text{s}$ at a depth of 1.75m. If the width of the channel is reduced to 2.25 m and bed level is lowered by 0.97 m, determine the difference in water level elevation between upstream and contracted section. Assume no energy loss. [8]
7. A circular culvert has a capacity of $0.5 \text{ m}^3/\text{s}$ when flowing full. Velocity should not be less than 0.7 m/s if the depth is one-fourth the diameter. Assuming uniform flow, determine diameter and slope taking manning's $n = 0.012$. [7]
8. A rectangular channel carrying a discharge of $40 \text{ m}^3/\text{sec}$ a 16m wide having slope 1/5000 and Manning's coefficient $n = 0.024$. The depth of flow in a particular section is 1.5 m. Find how far upstream of downstream of this section the flow depth is 2.5m. Determine the type of flow profile and using direct step method calculate the length of profile taking 3 steps for calculation. [10]
9. Define specific force. Derive momentum equation for rectangular channel section. Draw a hydraulic jump profile and indicate conjugate depths using the specific force diagram. [8]
10. Write down the design procedures of mobile boundary channel using maximum permissible velocity method with appropriate expressions. Also describe Shield's approach of predicting critical tractive force. [4+3]

- b) If upstream depth $Y_{01} = 0.4\text{m}$, calculate the length of hydraulic jump using at least three increments of depth in a step calculation. [5+5]



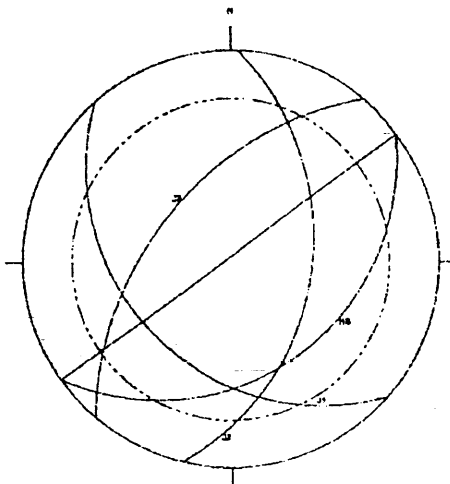
9. Draw a hydraulic jump profile and indicate conjugate depths and energy loss using specific energy and specific force diagram. Hence derive momentum equation for the hydraulic jump in rectangular channel. [8]
10. Distinguish between Rigid boundary and Mobile boundary channels with respect to design principle. Explain the procedures of designing rigid boundary channel by minimum permissible velocity approach. [3+4]

Exam.	Regular		
Level	BE	Full Marks	40
Programme	BCE	Pass Marks	16
Year / Part	II / II	Time	1 ½ hrs.

Subject: - Engineering Geology II (CE553)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. How engineering Geological Map prepared? Mention the components of engineering Geological map. [1+2]
2. What are the geological problems of Lesser Himalaya and Terai zone? What are the Preventive measure for landslide? Describe. [1+1+1]
3. What are the geological factors for formation of hydrogeological condition? How do you differentiate aquifer and confining bed? [1+2]
4. a) Describe direct method of sub-surface site investigation. [3]
- b) What are the geological consideration for selection of road and dam site. How do you investigate the foundation site for building and bridge? Mention in brief. [2+1.5+1.5]
5. a) How GLOF occurred? What are the types of movement according to varne? Describe in brief. [2+3]
- b) Classify engineering evaluation of hazard. How absolute hazard assessment carried out? Describe. [3+2]
6. a) What are the parameters for RMR-system of rockmass classification? Describe meaning of rockmass class w.r.t. shear parameter? [4+1]
- b) Interpretate the stability condition of rock slope where canal alignment have to be pass. The orientation discontinuities and hill slope and internal friction angle are as follow: [5]
 $HS = 138^\circ/45^\circ, J_1 = 234^\circ/38^\circ, J_2 = 098^\circ/58^\circ, J_3 = 315^\circ/60^\circ$ and $\phi = 25^\circ$



7. a) Define reserve. How do you estimate the reserve for construction material to construct highway project? [1]
- b) Apparent dip amounts of Quartzite bed rock along $N20^\circ E$ and $N65^\circ E$ are 1:9 and 1:12 respectively. The vertical thickness of bedrock is 105 m. Calculate the reserve of construction material for an engineering project.

Exam.	Back		
Level	BE	Full Marks	40
Programme	BCE	Pass Marks	16
Year / Part	II / II	Time	1 ½ hrs.

Subject: - Engineering Geology II (CE553)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. What are the rock forming minerals? Mention civil engineering significance of calcite 'w.r.t.' reservoir site selection. [2+1]
2. Outline the major engineering Geological problems of Siwalik and Higher Himalaya zone. What are the mitigation measures of erosion? Describe. [1+1+1]
3. Describe relation between hydraulic gradient and hydraulic conductivity in groundwater movement. How an artesian formed? [2+1]
4. a) What do you mean by geophysical exploration? [3]
- b) For hydropower project, tunnel alignment have to be selected. The overburden material depth is confirmed from drilling of three boreholes, where top of the bedrock is encountered as follow. [5]

Location of borehole	Depths of bedrock at		
From BH ≠ 1 - BH ≠ 2, at distance of 1000m along N32°E	BH ≠ 1	BH ≠ 2	BH ≠ 3
	-200 m	-300 m	-500 m
From BH ≠ 1 - BH ≠ 3 at distance of 800 m along S73°E			

Select suitable alignment of tunnel, w.r.t. attitude of bedrock.

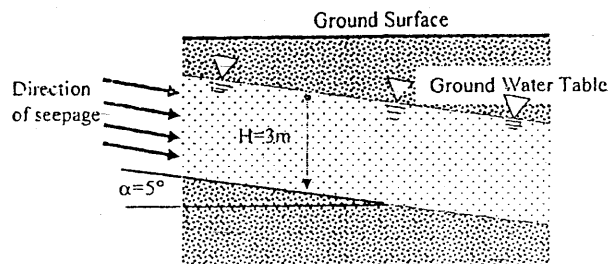
5. a) What is the mechanism of mass movement? What are the consequences of GLoF as geological hazard, describe. [3+2]
- b) How do you differentiate hazard and risk? Describe relative hazard. [3+2]
6. a) How do you select support type for underground opening? Describe with justification. [4]
- b) What are the support system and excavation method of poor rock class according to RMR system? Mention. [3+3]
7. a) What are the requirements for selection of borrow area for construction material exploration? Mention. Describe types of resource. [1]
- b) The attitude of sandstone bedrock is N44°W / 36°. The difference of top and bottom of bedrock is 82 m. Calculate the reserve of aggregate in 2.7 km strike length and 0.62 km. dip length of rock quarry site. [2]

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	II / II	Time	3-hrs.

Subject: - Soil Mechanics (CE552)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. What do you understand by soil mechanics and why do you need to study this? What would be a solution of different soil Engineering problem? [2]
2. A relative density test conducted on a sandy soil obtained the following results: maximum void ratio = 1.25, minimum void ratio = 0.45, relative density = 40% and $G = 2.65$. Find the dry density of the soil in the present state. If a 3 m thickness of this stratum is densified to a relative density of 60%, how much will the soil reduce in thickness? What will be the new density in dry and saturated conditions? [8]
3. a) How do you identify fine grain soils in the field?
b) Write down the types of soil classifications.
c) For finding the suitability of soils as subgrade for highways, which soil classification is generally used? Write down the name of each group according to that classification. Show the general rating of those groups as a suitability of subgrade.
d) Draw the plasticity chart in incorporated in an USCS and give the group symbols of the various region in the chart. [1+2+2+3]
4. What is specific surface area and what is its effect on fine grained soil? [3+1]
5. a) What is Zero Airvoid (ZAv)?
b) Write down the factors that affect soil compaction.
c) The maximum dry unit weight of a compacted soil mass is found to be 18 kN/m^3 with optimum water content being 15%. Find the values of porosity and degree of saturation of this compacted soil. Also, find the value of the maximum dry unit weight on the zero air void line at that optimum water content? Take specific gravity of soil solid as 2.7. [1+2+3]
6. a) Define the meaning of capillarity in regard with normal soil ground. Also, explain the effect of water table variation on the effective stress.
b) As shown in below figure, an inclined permeable soil layer is underlain by an impervious layer. The coefficient of permeability of the permeable soil layer is equal to $4.8 \times 10^{-5} \text{ m/sec}$. If seepage of water in this soil layer occurs in the direction shown in the figure below, then calculate (i) Hydraulic gradient and (ii) rate of water flow (seepage) for that soil layer. Take the thickness of soil layer, $H = 3 \text{ m}$ and the angle of inclination of that soil layer, $\alpha = 5^\circ$. Assume any other necessary conditions.



- c) Write down the names of testing method for determining coefficient of permeability in the laboratory and field.
- d) Differentiate between discharge velocity and seepage velocity. [2+4+2+2]
7. What are the properties of flow net? Prove that flow lines intersect the equipotential line at right angles. [2+6]
8. a) Vertical stress due to a point load can be calculated based on Boussinesq's and Westergaard's solutions. What is the basic difference between these two solutions?
 b) Briefly explain Newmark's Influence Chart. What is the main use of this Chart?
 c) Describe approximate stress distribution methods for loaded areas. [2+3+3]
9. a) What are the methods of accelerating consolidation settlement? What are the different causes of preconsolidation of soil? [1+2]
 b) Derive a governing differential equation for one dimensional consolidation theory by Terzaghi? [7]
10. a) Write down the names of shear strength tests that can be performed in the laboratory? How do you calculate shear strength in direct shear test?
 b) If direct shear is conducted for loose and dense sands, then plot graphs of Shear stress and Change in height of specimen versus Shear displacement.
 c) Unconfined compression test is a special type of unconsolidated undrained triaxial test. Why?
 d) Derive an expression for principal stresses at failure conditions. [2+2+1+5]
11. a) Explain finite slope and infinite slopes in regard with slope stability.
 b) Find Factor of Safety of slope using $\phi = 0$ analysis method. Assume necessary conditions. [2+4]

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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BME, BIE, BAM	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Probability and Statistics (SH552)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Necessary tables are attached herewith.
- ✓ Assume suitable data if necessary.

1. What are the merits and demerits of mean? The expenditure of 1000 families is given as below:

Expenditure	40-59	60-79	80-99	100-119	120-139
No. of families	50	-	500	-	50

If the median of frequency distribution is 87, find the missing frequencies.

[6]

2. Define conditional probability. Two sets of candidates are competing for the positions on the Board of Directors of a company. The probability that the first and second sets will win are 0.6 and 0.4 respectively. If the first set wins the probability of introducing a new product is 0.8 and the corresponding probability if the second set wins is 0.3. What is the probability that the product will be introduced?
3. Define hypergeometric distribution with an example. Describe the conditions for the binomial approximation to hypergeometric distribution?
4. An office switchboard receives telephone calls at a rate of 3 calls per minute on an average. Find the probability of receiving (i) no calls in one minute interval;
(ii) at least 3 calls in an one minute interval;
(iii) at most 2 calls in a five minute interval
5. The mean elongation of steel bar under a particular tensile load has been established to be normally distribution with parameters $\mu = 0.06$ and $\sigma = 0.008$. assuming the same distribution applies to new bar, find the probability that the mean elongation falls
- a) Above 0.08
b) Between 0.05 and 0.07
c) Either below 0.045 or above 0.065

[6]

[2+3]

[5]

[5]

OR

The distribution of amount of the gravel (in ton) sold by a particular construction supply company in a given week is continuous random variable X with the probability density function.

$$f(x) = \begin{cases} \left(\frac{3}{2}\right)(x^2 + 1) & \text{for } 0 \leq x \leq 1 \\ 0 & \text{Otherwise} \end{cases}$$

- a) Find the cumulative distribution function of sales.
b) What is the expected value and variance of sales?

[5]

6. The amount of distilled water dispensed by a certain machine is normally distributed with mean value 64 oz and standard deviation 0.78 oz. What container size will ensure that overflow occurs only 0.5% of the time? [4]
7. Define parameter and statistic with examples. [4]
8. A population consists of the four numbers 5, 6, 9, 12. [6]
- Write down all possible sample size of two without replacement.
 - Verify that the population mean is equal to the mean of the sample mean.
 - Calculate the standard error of the sampling distribution of the sample mean.
9. Define correlation and regression with examples. Write down the properties of correlation coefficient and regression coefficient. [5]
10. The following data gives the experience of machine operators in years and their performance as given by the number of good parts turned out per 100 pieces.

Experience (X)	16	12	18	4	3	10	5	12
Performance (Y)	87	88	89	68	78	80	75	83

- Fit the regression equation of performance ratings on experience and estimate the probable performance if an operator has 8 years experience. [5]
11. Describe the procedure of the test of significance of difference of two means for small sample. [5]
12. Shyam and Co. produces three varieties of products: deluxe, fine and ordinary. A recent market survey is conducted for preference of products. The preference was found as follow:

Product	Production			
Deluxe	15	14	19	18
Fine	17	12	20	16
Ordinary	16	18	16	17

- Is there a significant difference in the preference of products using ANOVA test. Use $\alpha = 5\%$. [6]
13. Define type I and II error. A manufacturer claimed that at least 95% of the pumps supplied to the ABC Company confirmed to specifications. However, the production manager at ABC Company wasn't satisfied with the claim of the manufacturer. Hence, to test the claim, the manager examined a sample of 250 pumps supplied last month and found that 228 pumps as per the specifications. Can you conclude that the production manager is right to doubt on the claim of the manufacturer? ($\alpha = 0.01$) [5]
14. Define chi-square distribution. From the following data can you conclude that there is association between the purchase of brand and geographical region? (Use 5% level of significance) [5]

P.T.O.

15. As part of a study monitoring acid rain, measurements of sulfate deposits (kg/hectare) are recorded for different locations on the Eastern Terai of Nepal. The results are listed in the following table for 15 recent and consecutive years:

Acid Rain: Sulfate Deposited (kg/hectare)

[8]

Year	Location 1 (x)	Location 2 (y)	Location 3 (z)
1	11.94	13.09	7.96
2	11.28	10.88	12.84
3	10.38	12.19	7.38
4	8.00	10.75	7.26
5	12.12	17.21	10.12
6	10.27	10.26	8.89
7	14.80	15.49	11.60
8	13.52	11.61	9.02
9	10.55	10.53	7.78
10	9.81	12.50	8.70
11	11.27	9.94	10.50
12	12.12	11.21	9.95
13	11.68	9.71	15.59
14	11.77	9.37	10.54
15	17.29	13.87	13.64

- Find sample mean, sample standard deviation and coefficient of variation for Sulfate deposits of each location.
- Give your conclusion about variability and uniformity from the analysis.

TABLE A-4 Chi-Square (χ^2) Distribution										
Degrees of Freedom	Area to the Right of the Critical Value									
	0.995	0.99	0.975	0.95	0.90	0.10	0.05	0.025	0.01	0.005
1	—	—	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	1.610	9.236	11.071	12.833	15.086	16.750
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.299
13	3.565	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
21	8.034	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	14.042	30.813	33.924	36.781	40.289	42.796
23	9.260	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.559
25	10.520	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290
27	11.808	12.879	14.573	16.151	18.114	36.741	40.113	43.194	46.963	49.645
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993
29	13.121	14.257	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336
30	13.787	14.954	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169

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Degrees of Freedom

- $n - 1$ for confidence intervals or hypothesis tests with a standard deviation or variance
- $k - 1$ for multinomial experiments or goodness-of-fit with k categories
- $(r - 1)(c - 1)$ for contingency tables with r rows and c columns
- $k - 1$ for Kruskal-Wallis test with k samples

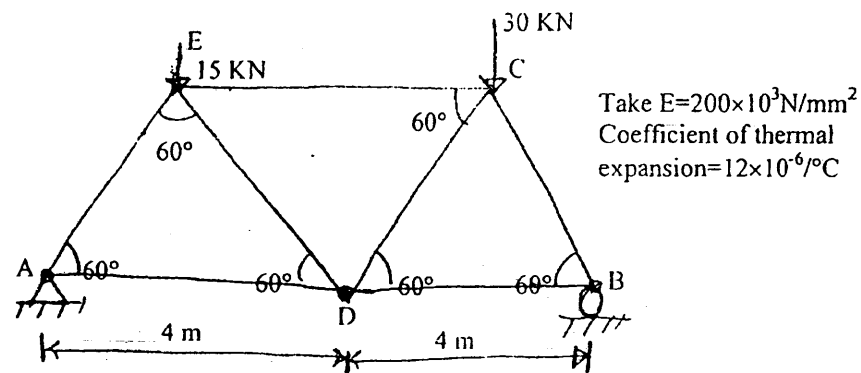
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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

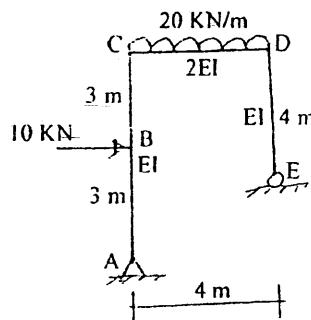
Subject: - Theory of Structure (CE551)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

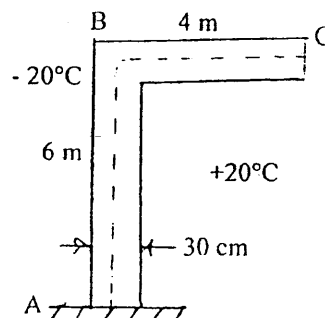
1. a) Determine the vertical deflection of Joint 'D' of the truss due to (i) loading shown (ii) members DE and DC being 5 mm too long and (iii) temperature of member CD along is rise up by 20°C . [12]



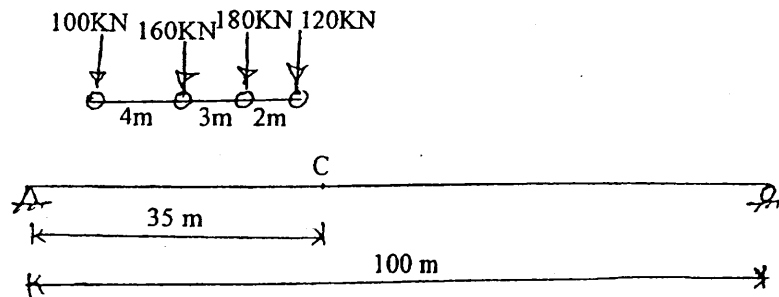
- b) Explain the material non-linearity and Geometrical non-linearity with neat sketches. [4]
2. a) Determine horizontal deflection at E of the frame shown in figure below. [10]



- b) Determine horizontal and vertical deflection of point C of the frame shown in figure below due to the temperature variation. [6]



3. a) Define influence line diagram. Explain its use. [4]
 b) Determine maximum bending moment at section C and also the absolute maximum bending moment when the set of concentrated loads moves from left to right of the girder shown in figure below. [12]



4. A three hinged circular arch has a span of 100m and a rise of 10m. Two point loads of 20 kN and 30 kN, spaced 5m apart, roll over the arch from left to right with 20 kN load leading. Using the influence line diagram, find the maximum bending moments at a section 25m from the left support. Also find normal thrust and radial shear at the same section corresponding to the maximum bending moment. [16]
 5. a) Enlist the different components of a suspension bridge. [4]
 b) The stiffening girder of suspension bridge of span 120m has hinged at the end and in the middle span, the cable is suspended between two points separated horizontally by 120m and vertically by 6m. The maximum deep of the cable is 12m from upper end point. Two points loads 200kN and 100kN are concentrated at 30m and 55m from higher end. Calculate and draw shear force diagram and bending moment diagram for girder. [12]

07 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Bhadra

Exam.	Regular		
Level	BE	Full Marks	30
Programme	BCE	Pass Marks	12
Year / Part	II / II	Time	3 hrs.

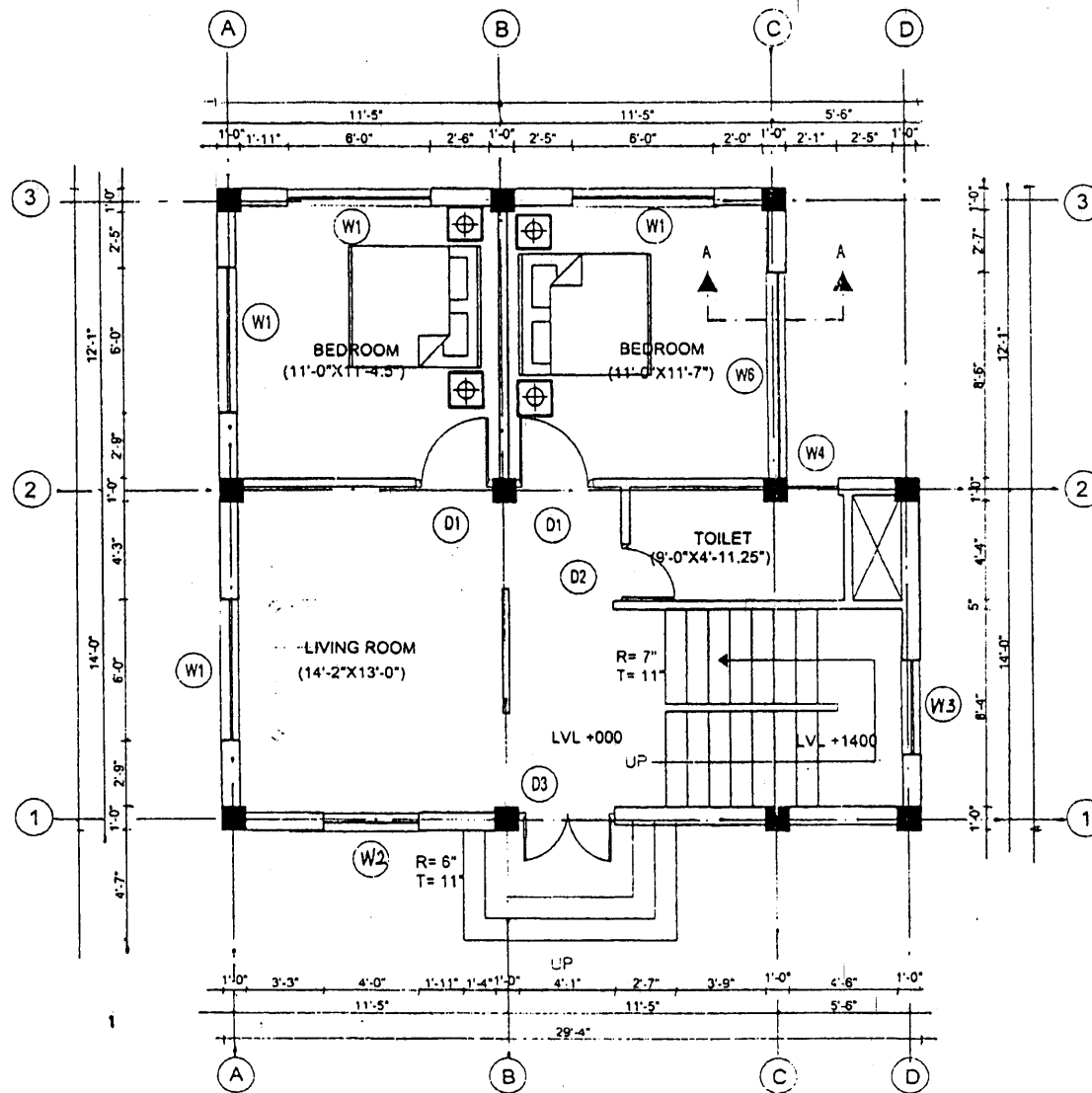
Subject: - Building Drawing (CE556)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Necessary figures are attached herewith.
- ✓ Assume suitable data if necessary.

1. Calculate the permissible built up area and maximum no. stories if the plot area is 0-5-3-1, permissible ground coverage is 60% and floor area ratio (FAR) is 1.5. [2]
2. Draw a light plane and right of way (ROW) as per building bye-laws. [2]
3. Fill in the blank spaces: [2]
 - a) Beam above the opening is called.....
 - b) Minimum width of the stair in residence is.....
 - c) The size of the single shutter wooden frame is.....
 - d) The standard size of Nepali brick is.....
4. Redraw the given Floor Plan with appropriate drafting techniques with all necessary information. Use scale 1"= 4'- 0". [12]
5. Draw a Wall Section through foundation to parapet level at A-A shown in given plan of two storied building. Mention the levels, floor details (ground and upper), Toe wall detail and walls with 12mm plaster on both sides. Use scale 1:24 [12]

Descriptions:

1. Column size : 12" x 12"
2. Wall thickness (ext./int.): 9"/4"
3. Plinth height : 1'-6"
4. Sill Height : 3"
5. Lintel Height : 7'
6. Floor Height : 9'-4"
7. Slab Thickness : 5"
8. Parapet Height : 3'
9. Plinth Beam : 9" X 9"
10. Floor Beam : 9" X 14"
11. Slab projection : 1'-6"
12. Lintel Band : 6"
13. Sill Band : 3"
14. Riser : 7"
15. Tread: 11"
16. Window Height: 4'



GROUND FLOOR PLAN

AREA : 889.23 SQ.FT

Exam.	Regular		
Level	BE	Full Marks	40
Programme	BCE	Pass Marks	16
Year / Part	II / II	Time	1 ½ hrs.

Subject: - Engineering Geology II (CE553)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

- Define engineering geological map. Mention engineering significance of quartz mineral w.r.t hydropower project when sediment analysis has been carried out. [1.5+1.5]
- Define discontinuity. Outline major engineering problems of lesser Himalaya. [1+2]
- Differentiate aquifer and confining bed. Mention geological factors for formation of hydrogeological conditions. [1+1]
- What are the purposes of site investigation? Describe geophysical and geotechnical exploration. [2+4]
 - Describe the geological consideration for reservoir site selection. [3]
- Define Hazard and risk. Describe mechanism of mass movement. [2+2]
 - Describe parts of landslide with labelled diagram. Mention types of movement with reference to varne's classification. [2+3]
- Three boreholes A, B and C were drilled for limestone reserve calculation. Bore hole A lies at 600 m distance due N28°E from borehole B. Bore hole C lies at 400m distance due S 10°W from bore hole B. The top and bottom of limestone bed was encountered at the following depth of given bore holes. [5]

Bore hole	Top (m)	Bottom (m)
A	200	260
B	220	280
C	240	300

Calculate the true thickness of limestone bed.

- What are the conditions of plane failure of rock slope. [2]
 - What are the parameters of Q-system for rockmass classification? [2]
 - How do you calculate RQD from drill core method? [2]
- Define reserve. Calculate reserve for aggregate of quartzite bedrock having vertical thickness 300 m at S 72°W/43° and in an area of 437 km². [3]

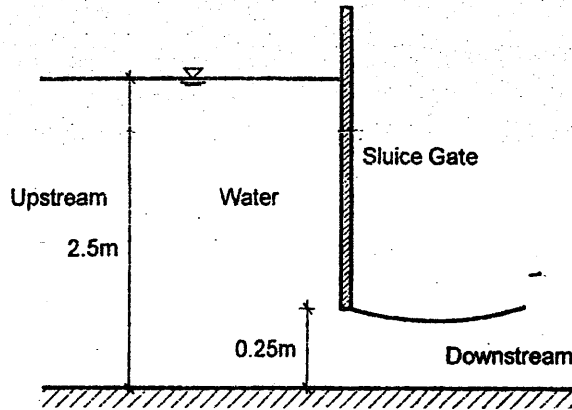
Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, B. Agri.	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Hydraulics (CE555)

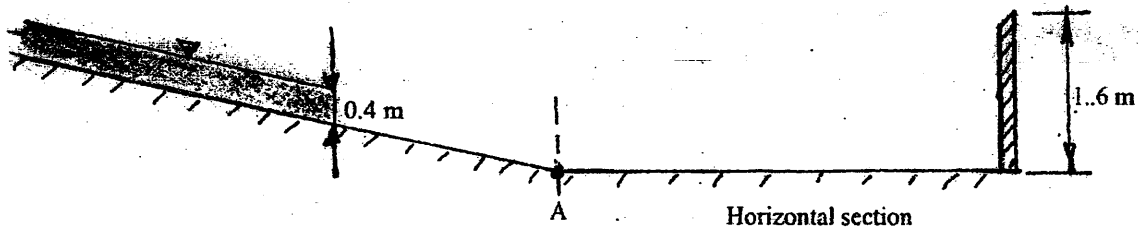
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. In a hydro dynamically rough pipe of 100 mm diameter, the ratio of velocities at 10 mm and 30 mm from the pipe wall is 0.838. Determine the average height of the wall roughness, shear stress at the wall and mean velocity of flow if velocity at 30 mm is 1.90 m/s. [8]
2. A single uniform pipe joins two reservoirs. Calculate the percentage increase of flow rate obtainable if, from the mid-point of this pipe, another of the same diameter is added in parallel to it. Assume equal friction factor for both pipes and neglect minor losses. [8]
3. A reservoir A feeds two lower reservoirs B and C through a single pipe 10 km long, 750 mm diameter having a downward slope of 2.2×10^{-3} . This pipe then divides into two branch pipes, one 5.5 km long laid with a downward slope of 2.75×10^{-3} (going to B), the other 3 km long having a downward slope of 3.2×10^{-3} (going to C). Calculate the necessary diameters of the branch pipes so that the steady flow rate in each shall be $0.24 \text{ m}^3/\text{s}$, when the level in each reservoir is 3 m above the end of the corresponding pipe. Neglect all losses except pipe friction and take $f = 0.025$ throughout. [10]
4. Discuss Water hammer phenomenon. Develop Euler's equation as well as continuity equation for unsteady flow. [8]
5. Define steady Non uniform and spatially varied flow. Give at least two examples of each flows. [3]
6. a) Design an economical trapezoidal channel with a velocity of 0.6 m/s. The side slope Z of channel is 1.5 and conveys a discharge of $3 \text{ m}^3/\text{s}$. Take manning's coefficient as 0.003. Also find the required bed slope. [6]
b) Define hydraulic exponent. Show that the value of hydraulic exponent for rectangular section is equal to $10/3$. [4]
7. a) Water flows in a 4 m wide rectangular channel at a depth of 1.8 m and velocity 1.4m/s. The channel is contracted to a width of 1.25m in particular reach. Is the flow possible in given specific energy? If not, what should be the discharge in channel so that flow is possible in the given specific energy? Also determine the depth of flow at contracted section and upstream of contracted section. [2+2+3]

- b) Figure shows flow through the sluice gate provided in a rectangular channel of width 10 m. If the discharge in the channel is $7 \text{ m}^3/\text{s}$, determine the force exerted by water in the gate. Take momentum correction factor equals to 1.15. [5]



8. What is a mild slope? Justify analytically the nature of surface profiles (both upstream and downstream end) for mild slope. [1+4]
9. The partial water surface profile shown in figure below is for a rectangular channel of 3 m width in which water is flowing at a discharge of $5 \text{ m}^3/\text{sec}$.
- a) Does a hydraulic jump occur in a channel? If so, is it located upstream or downstream at point A? [5]
- b) Draw and name water surface profile. [5]



10. Why shear stress reduction factor "K" is necessary while designing the mobile boundary channel? Explain the design procedures (step by step) of mobile boundary channel by maximum permissible velocity approach. [2+4]

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Surveying II (CE554)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. a) What is omitted measurement? Explain the case when two affected sides are not adjacent. [4]

- b) A link traverse was run between main traverse stations "B" and "M". Clockwise angles of link traverse taken were: $ABX = 135^{\circ}00'30''$, $BXY = 98^{\circ}07'55''$, $XYM = 209^{\circ}45'02''$ and $YMN = 64^{\circ}39'33''$ respectively. Lengths of link traverse are: $BX = 31.612$, $XY = 22.260$ m and $YM = 36.153$ m respectively. The coordinates of main traverse stations given are: A (42.360 mN, 18.820mE), B (20.000mN, 30.000mE) and M (50.000mN, 100.000mE), N (70.600mN, 65.6670mE) respectively. Calculate the final coordinates of stations X and Y. Adjust any misclosure by Bowditch method. [12]

2. a) What is tacheometry? Explain the booking and plotting details in tacheometric surveying. Calculate the gradient between station A and station B from the following observations taken from tacheometer fitted with anallactic lens. The RL and HI of instrument station P are 1275m and 1.55m respectively. [4+6]

Inst. Station	Target Station	Bearing	Vertical angle	Staff readings (m)
P	A	$30^{\circ}30'$	$6^{\circ}30'$	1.115, 1.735, 2.355
	B	$75^{\circ}30'$	$9^{\circ}15'$	1.250, 2.000, 2.750

- b) Calculate the RL of top of tower P, base of which was not accessible from the two instrumentation stations X and Y. The top of the tower and the instrument stations were not in the same vertical plane. The observed zenithal angles from X to P and Y to P were $30^{\circ}30'$ and $29^{\circ}20'$ respectively. H.I. of instruments at X and Y were 1.57m and 1.50 m respectively and distance between them was 200 m. The horizontal angles observed were: $PXY = 45^{\circ}45'$ $XYP = 60^{\circ}30'$ respectively. The back sights taken to BM with RL of 1000.00m were 1.8m and 0.8m from X and Y respectively. [6]
3. a) What is contour index? What are the different methods of interpolating contours? Explain them with appropriate examples and sketches. [8]
- b) What is resection? Explain the two point problem. What is intersection? The coordinates of known stations A (7492 mN, 3932mE) and station B (7487mN, 2960mE). Calculate the coordinate of unknown point P, where the observed horizontal angles taken to P from A is $44^{\circ}52'36''$ and to P from B is $75^{\circ}33'22''$ respectively. [4+4]

4. a) Explain the setting out of simple circular curve by offsets from long chord. [4]
- b) It is proposed to insert a circular curve of 300m radius with a transition curve of length 60 m long each end of the circular curve. Prepare necessary data for setting out the combined curve in tabular form. Deflection angle between two alignments of road is 45° and chainage of intersection point is 2000m. Peg interval for transition and circular curve are 20 m and 30 m respectively. Take chainage at multiple of peg interval. [6]
- c) A grade of -3.5% meets another grade of +0.5%. The elevation and chainage of IP are 1267.00m and 780 m respectively. Field condition requires that the vertical curve should pass through a point of elevation 1268m at chainage 780m. Compute a suitable equal tangent vertical curve and full-stations elevations when normal chord = 30 m. [6]
5. Explain the following: (any four) [4×4]
- i) Principle of stereoscopy, importance of aerial mapping
 - ii) Application of remote sensing
 - iii) Working principle and components of GPS
 - iv) GIS and its components and subsystem
 - v) Features of total station and its importance.

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BME, BIE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Probability and Statistics (SH552)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ **Necessary tables are attached herewith.**
- ✓ Assume suitable data if necessary.

1. What are graph and diagrams? What are the importance and limitation of diagrammatic and graphical representation of statistical data? [2+4]
2. Define Axiomatic approach of probability. In a bolt Factory, machine A, B and C manufacture 60%, 25% and 15% respectively. Of the total of their output 1%, 2% and 1% are defective bolts. A bolt is drawn at random from the total production and found to be defective. From which machines the defective bolt is expect to have been manufactured? [6]
3. What are the chief characteristics of Negative Binomial Distribution? How does it differ from Binomial Distribution? [4+1]
4. Define poisson distribution. A survey report shows that the probability 0.001 that a car will have a flat tyre while driving over a certain bridge. What is the probability that among 2000 cars driven over this bridge (i) not more than one will have a flat tyre; (ii) more than three will have a flat tyre; (iii) exactly 4 will have a flat tyre. [5]
5. A random variable X has the probability density function f(x) as [5]

$$f(x) = \begin{cases} kxe^{-\frac{x}{2}}, & \text{for } 0 \leq x < \infty \\ 0 & \text{otherwise} \end{cases}$$
 - i) Find the value of constant k if f(x) is probability density function
 - ii) Find the distribution function F(x)
 - iii) Also find the mean of random variable X
6. Define Normal distribution. Give the condition for normal approximation to Binomial distribution with an example. [5]
7. Define the standard error of mean. Write the expression for standard error of mean when: [5]
 - i) Sample is drawn from large population
 - ii) Sampling is done without replacement from a finite population
8. A population consists of the four numbers 12,13,14,15. [5]
 - i) Write down all possible sample size two without replacement.
 - ii) Verify that the sample mean is unbiased estimator for population mean.
 - iii) Calculate the standard error of mean.
9. Define the correlation coefficient and mention its important properties. What does the coefficient of determination measure? [5]

10. Past experience shows the following result of productivity per hectare with the respective uses of chemical fertilizers and seeds. Fit the multiple linear regression equation of Y and X1 and X2 from the given data. [5]

Fertilizer kgs (X1):	45	30	70	75	65	80
Seeds kgs (X2):	2	1.8	3	2.5	2	3
Productivity kgs (Y):	2000	2100	1800	1900	2400	2500

OR

A simply supported beam carries a concentrated load X (Kg) at its mid point. The following table gives maximum deflection Y (cm) corresponding to various value of X. [5]

X:	100	120	140	160	180	200
Y:	0.45	0.55	0.60	0.70	0.80	0.85

Calculate the two regression equations and estimate the value of maximum deflection when X = 170 kg.

11. Describe the procedure of the test of significance for paired t-test. [5]

12. Three training methods were compared to see if they led to greater productivity after training. The following are productivity measures for individuals trained by each method: [5]

Method 1	45	40	50	39	52	44
Method 2	59	43	47	51	39	49
Method 3	41	37	43	40	52	39

Perform an Analysis of variance to test at the 0.05 level of significance whether the three training methods lead to different levels of productivity?

13. The results of a survey regarding "radio listeners" preference for different types of music are given in the following table, is there any association between listeners classified by age group and preference of type of music influence by age? [5]

Types of music	Age Group		
	19-25	26-35	above 36
Folk Music	80	60	9
Modern music	210	325	44
Indifferent	16	45	32

14. From a lot of units produced by machine A, a sample of 500 is drawn and tested for a quality characteristics. It is found that 16 units are not meeting the specification. Another sample of size 100 is drawn from the lot of similar units produced by machine B and tested. In this case, only 3 units are found to be not meeting the specification. Obtain a 99% confidence intervals for the difference of the properties of defective units produced by the two machines. [5]

15. Following data reveals the sample of 27 pairs of observation (X,Y) drawn from large population. [8]

X	46	55	49	57	56	46	66	47	51
Y	27	37	24	43	43	50	49	48	29
X	61	56	68	68	48	58	68	45	50
Y	46	43	40	18	39	32	48	18	45
X	59	45	66	62	57	57	57	69	47
Y	32	26	27	29	47	37	37	27	30

Find the

- Sample mean for each variable X and Y
- Which series is more consistent and why?
- Standard error of the difference of mean in the population
- Find the coefficient of Karl Person Correlation

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Soil Mechanics (CE552)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. What are the various field of application of soil mechanics? Write the factors that determine the characteristics of a residual soil. [1+1]
2. Define thixotropy and flow index. A sample of saturated clay has a volume of 97 cm^3 and mass of 202 gm. When completely dried, its volume is 87 cm^3 and mass of 167 gm. Determine: [2+6]
 - i) Initial water content
 - ii) Specific gravity of soil solids
 - iii) Shrinkage limit
3. Classify the following soils a, b and c as per unified soil classification system: [3+3+2]
 - i) Soil passing from 75μ sieve = 4%, soil passing from 4.75mm sieve (Coarse fraction) = 62%, coefficient of uniformity = 5, coefficient of curvature = 2.6
 - ii) Soil passing from 75μ sieve = 62%, liquid limit = 54%, plastic limit = 23%
 - iii) Soil passing from 75μ sieve = 39%, liquid limit = 33%, plastic limit = 18%
4. What is isomorphous substitution? Compare between 1:1 and 2:1 minerals. [1+3]
5. a) Draw compaction curve for a soil showing maximum dry density, optimum water content, zero-air void line, dry side and wet side of optimum water content.
b) Compare the compaction characteristic curve for sand and clay. [3+3]
6. What are the factors that influence the height of capillary rise in soils? Establish the relationship between seepage velocity and superficial velocity. A soil stratum having thickness of 1.15 m, porosity = 30% and $G = 2.7$ is subjected to an upward seepage head of 1.95 m. Determine the thickness of coarse material required above the soil stratum to provide a factor of safety of 2 against piping assuming that the coarse material has the same specific gravity and porosity as the soil and head loss in the coarse material is negligible. [1+3+6]
7. a) Derive the relationship for the seepage discharge through anisotropic soil.
b) If the upstream and downstream heads of an impervious dam are 8 m and 1 m respectively, then find the seepage discharge when seepage of water takes place from upstream to downstream via the isotropic soil lying below the impervious dam. Take total number of flow channels and equipotential drops as 9 and 12, respectively. Also, take coefficient of permeability of the soil layer, $k = 3 \times 10^{-4} \text{ cm/s}$. [4+4]
8. What is Newmarks influence chart? A water tank is supported by a ring foundation having outer diameter of 10 m and inner diameter of 7.5 m. The ring foundation transmits uniform load intensity of 160 kN/m^2 . Compute the maximum vertical stress induced at a depth of 4 m below the foundation using Boussinesq's theory. [2+6]

9. Distinguish between normally consolidated and over consolidated soil deposits. A 5 m thick saturated soil layer has a compression index of 0.25 and coefficient of permeability 3.2×10^{-3} mm/s. If the void ratio is 1.9 at vertical stress of 0.15 N/mm^2 , calculate the void ratio when the vertical stress is increased to 0.2 N/mm^2 . Also calculate settlement due to above stress increase and time required for 65% consolidation. [2+8]
10. a) Write down the names of shear strength tests. [2]
- b) Consolidated undrained triaxial test was performed for a normally consolidated saturated clay and cell pressure, $\sigma_3 = 200 \text{ kN/m}^2$, axial stress, $\sigma_1 = 550 \text{ kN/m}^2$ and pore water pressure, $u_w = 80 \text{ kN/m}^2$ were measured. Answer the followings: [2+2+2+2]
- Plot the Mohr circle of stresses in regard with Total stress.
 - Plot the Mohr circle of stresses in regard with effective stress.
 - Assume the condition of normal consolidation and $c'=0$. Then obtain the value of ϕ' .
 - If Mohr-Coulomb's failure criterion is assumed to be valid, then determine the direction of failure plane that might occur within the specimen
11. An infinite slope is made of clay with the following properties: [6]
- $\gamma_t = 18 \text{ kN/m}^3$, $\gamma' = 9 \text{ kN/m}^3$, $c = 25 \text{ kN/m}^2$ and $\Phi' = 28^\circ$. If the slope has an inclination of 35° and height equal to 12m, determine the stability of the slope, when (a) the slope is submerged and (b) there is seepage parallel to the slope.

Exam.	Regular		
Level	BE	Full Marks	30
Programme	BCE	Pass Marks	12
Year / Part	II / II	Time	3 hrs.

Subject: - Building Drawing (CE556)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Necessary figures are attached herewith.
- ✓ Assume suitable data if necessary.

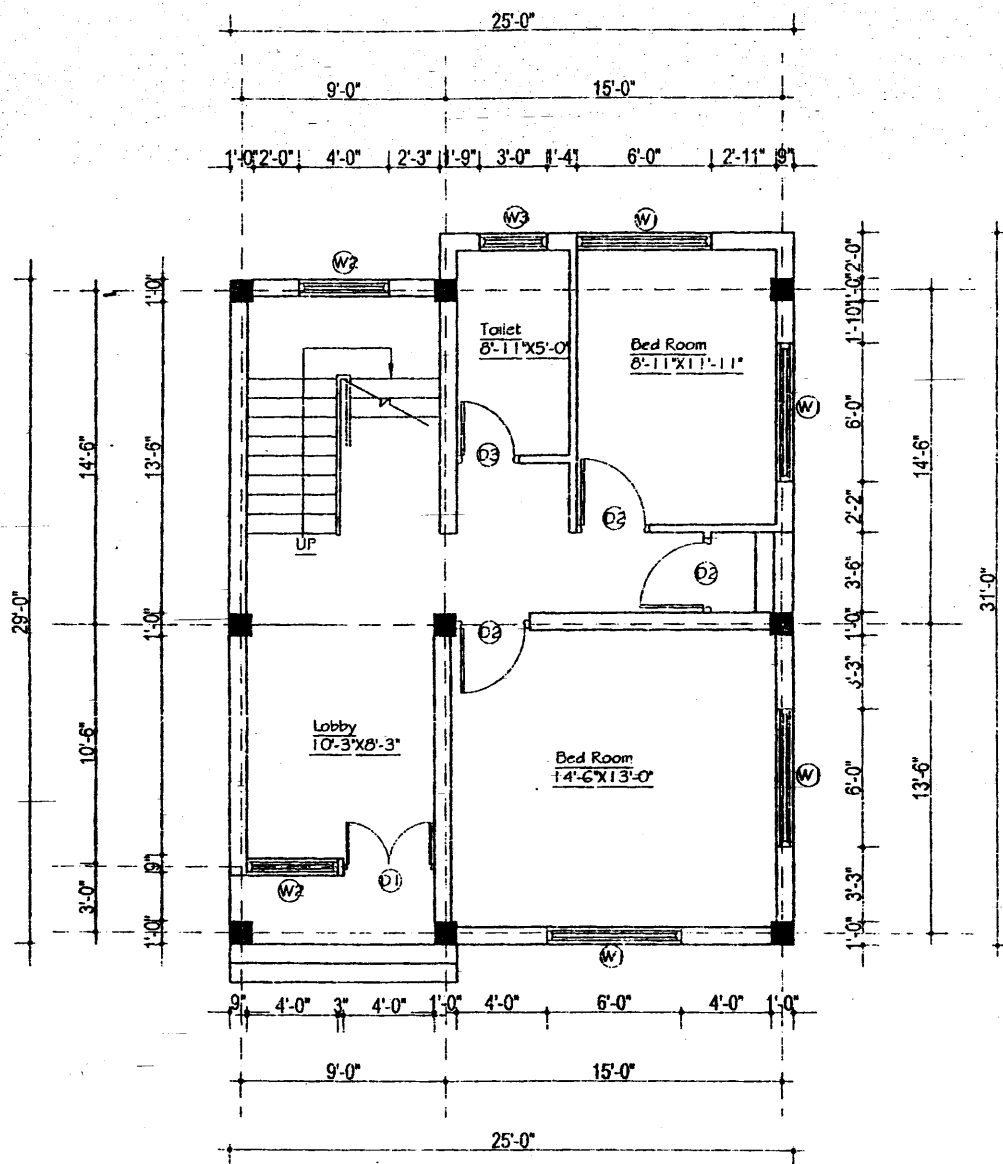
1. Mention all the building components of sub structure and super structure. [2]
2. Draw hatching pattern for the following materials in a box of 5 cm×5cm. [2]
 - i) Concrete in section
 - ii) Stone in section
 - iii) Brick in section
 - iv) Earth compaction
3. Explain with drawing: [2]
 - i) Right of Way (ROW)
 - ii) Light plane
4. Redraw Ground Floor Plan of a providing drawing, based on the description below with three layers of complete dimensions. Scale 1" = 8'0" [12]

S.N	Description	Dimension	Remarks
1.	Wall thickness	9"	External
2.	"	4.5"	Internal
3.	Column size	12"×12"	
4.	Plinth height	1'6"	
5.	Sill height	3' 0"	
6.	Lintel height	7' 0"	
7.	Floor height	9' 5"	
8.	Slab thickness	5"	
9.	Parapet height	3' 0"	
10.	Plinth beam	9"×9"	
11.	Floor beam	9"×14"	
10.	Plinth beam	9"×9"	
12.	Slab projection	1'6"	
13.	Lintel Band	6"	RCC
14.	Sill Band	4"	PCC
15.	Riser height	7"	
16.	Tread width	11"	

Opening Schedule

S. N.	Description	Symbol	Nos.	Width	Height	Remarks
1.	Panel Door	D1	1	4'0"	7'0"	Main Door
2.	Flush Door	D2	3	3'0"	7'0"	
3.	Flush Door	D3	2	2'6"	7'0"	Sun mica from inside
4.	Glazed Window	W1	2	6' 0"	4'0"	Two panel window
5.	Glazed Window	W2	2	4' 0"	4'0"	Two panel window
6.	Glazed Window	W3	2	3' 0"	4'0"	Single panel window

5. Draw detail elevations and vertical sections of Door D2 and window W1 in scale 1" = 2'0". [6]
6. Draw detail plan and section of any one isolated footing of given ground floor plan. Footing size: 6×6', footing depth: 5×6", column size: 12"×12" column reinforcement: 16mmdia. 8 number, plinth height: 2'-0". Scale: 1"=1'. Assume necessary dimensions. [6]



GROUND FLOOR PLAN

AREA : 756.50 SQ.FT.

STAIRCASE WIDTH=4'-0"

RISER=7"

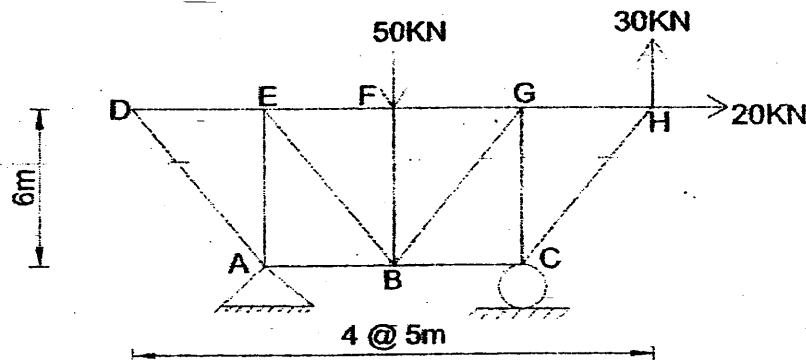
TRADE=11"

Exami.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Theory of Structure I (CE551)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

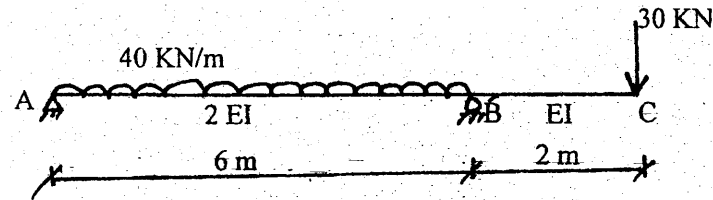
1. a) Describe the types of structures based on material used. [4]
- b) A suspension bridge, 150 m span, has two three hinged stiffening girders supported by two cables with a central dip of 20 m. If four point loads of 200 kN, 150 kN, 300 kN and 100 kN with equal spacing of 4 m are moving from left to right along the central lines of the roadway having 200 kN as a leading load. Determine maximum bending moment at 40 m from left support. Also determine maximum tension in the cable. [6+4]
2. a) List the steps to follow and illustrate them in an example for determination of displacement in a structural system using virtual work (unit load) method. [4]
- b) A cantilever beam of length 4 m and having circular cross section of diameter 15 cm is subjected to a concentrated load of 10 kN and a twisting moment 5 kNm at its end. Calculate the strain energies due to bending, shear and torsion. $E = 200 \text{ kN/mm}^2$, $G = 80 \text{ kN/mm}^2$. [8]
3. a) State and prove theorems of movement area method. [4]
- b) Determine the vertical deflection of joint B. All the top chord members are subjected to temperature rise of 20°C and all the vertical members are 10 mm too long. Take coefficient of thermal expansion as $12 \times 10^{-6}/^\circ\text{C}$, Modulus of elasticity as 200 kN/mm^2 . Cross-sectional area of each member is 1500 mm^2 . [10]



4. a) Derive expression for calculation of structural quantities by using influence line diagram when the loads applied are concentrated force, uniform distributed load and couple. [6]
- b) A three hinged symmetrical circular arch has a span 50 m and a rise of 10 m. It is subjected to a rolling load of 50 kN/m of span 10 m moving from left to right. Determine maximum bending moment, radial shear and normal thrust at 15 m from left support with the help of influence line diagram. [10]

5. a) Determine slope and deflection at free end and 2 m from left support.

[12]



- b) Determine maximum bending moment at C and absolute maximum bending moment in the girder shown in figure below when four concentrated loads move from left to right.

[12]

