

Exam.	New Batch (2066 & Later Batches)		
Level	BE	Full Marks	80
Programme	BCE, BEL, B.Agril.	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Project Engineering (CE701)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ All questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. a) Explain Work Breakdown Structure as a tool of project planning and state the importance of project planning.
- b) Draw the CPM network diagram (or Precedence diagram) from the following activity relationships: Compute total minimum project time of completion, critical activities and ES, EF, LS, LF, TF, FF, IntF and IndF.

Activity	A	B	C	D	E	F	G	H	I
Duration	3	5	5	6	2	3	4	2	6
Predecessor	-	A	A	A	B,C	C	D,E,F	D	G,H
Successor	B,C,D	E	E,F	G	G	G	I	I	-

Also mark the critical path in the network diagram.

2. a) Define project and explain its characteristics in brief. What are the major differences between project management and traditional management? Explain about the external environment of the project.
- b) Define project formulation and project appraisal. Write the procedure for developing a project proposal. What are the drawbacks of cost-benefit analysis of project formulation?
3. a) Why project planning is necessary to operate any project in dynamic environment? Linked bar chart is one of planning tool in project scheduling, justify this statement with suitable example. Is there limitations of this chart?
- b) Find out the expected time of each contractor to complete a given project having following details. Also, find out which contractor you prefer for operation and why?

Contractor	$t_o$	$t_f$	$t_p$
A	5	7	13
B	6	11	12
C	3	5	7

4. a) Discuss "monitoring, evaluation and control" is a must to succeed in a project. Explain project management information system and justify "the right information at the right time reduces the risk of wrong decision".
- b) Explain the term 'project finance' and describe features of sound capital structures. Write down and explain with example what are the factors to be considered to take capital structure decision.
5. a) Define risk management planning. Explain in details about internal and external risks in project. Justify giving suitable example how risk reduction is taken as risk response planning.
- b) A project has total capacity of \$1,000,000 which consists of 4,000 shares @ \$100; \$300,000 preference shares @ 18% interest; and remaining loan @15% interest. Earning before income and tax in a year is \$200,000. Compute the Earning per Share (EPS) and Book Value of Share, if Tax Rate is 20%.

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BEL, B.Agric.	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Project Engineering (CE701)**

- ✓ 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. Define Project. Elaborate Labor intensive, Capital Intensive, Joint Venture and Multilateral projects. Explain various elements of task environment. [2+4+4]
2. a) What is project appraisal? Explain marketing, management and environmental appraisal. [2+6]
- b) Define project proposal. Explain in brief about procedure for developing a project proposal. [2+6]
3. a) Draw the network diagram of the given project having following activities. Obtain project duration, critical path, TF, FF and interfering float. Prepare the resource aggregation chart and allocate the mason using early start schedule. [8+5]

Activity	Duration (days)	Mason (per day)
1-2	3	1
2-3	3	2
2-4	4	4
2-5	2	2
3-10	3	2
4-6	2	3
4-7	4	3
5-9	4	4
6-8	2	2
7-9	4	1
8-9	3	2
9-11	3	4
10-11	2	2
11-12	2	1

- b) Discuss on Work Breakdown Structure. [3]
4. a) Define Monitoring and Evaluation. Explain project control cycle. [2+4]
- b) Why cost control is important? A contractor agreed to build 50 doghouses in 90 days at a price of \$1000 per unit. 20 days later, the contractor has finished 10 doghouses with an actual cost of \$8500. What is the status of the project? [2+4]
- c) What is PERT? Discuss with example. [4]
5. Define Risk. Explain various sources of project risks. Describe important steps of risk management. [2+5+5]
6. a) What is capital structure planning? Discuss with examples. [5]
- b) What is capital budgeting decision? Explain its importance. Discuss Net present value used in capital budgeting decision. [5]

**OR**

What are the sources of financing large projects?

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Exam.	Regulation		
Level	BE	Full Marks	80
Programme	BCE, BEL, B.Agric.	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Project Engineering (CE701)**

- ✓ 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 labour intensive and capital intensive projects with example? Explain project Goal setting <sup>critical</sup> with an aid of suitable example. [3+5]
2. Define project formulation and project appraisal. Describe procedure for developing a project proposal. [2+2+8]
3. a) Explain Bar chart with its advantages and limitations. [8]  
 b) Define the term planning and explain the features of good project planning? Find all the components of CPM from the following information: [4+12]

S.N	Activity	Duration	Predecessor	Successor
1	A	3	-	D
2	B	6	-	E, G, I
3	C	2	-	F
4	D	2	A	G
5	E	1	B	H
6	F	3	C	I
7	G	7	B, D	-
8	H	3	E	-
9	I	4	B, F	-

4. a) Justify the statement "quality costs more, but lack of quality costs even more" giving examples of total quality cost included to achieve good quality. [6]  
 b) A construction company is planned to fix 100 units of precast window in 20 days with a budget of 25 lakhs. The progress status was reviewed on 10 days from date of start of fixing and only 40 units were fixed with the expenses of 9 lakhs. Find out all the parameters of earned value analysis and comment on its performance. [6]
5. Define risk and risk management. Explain about internal risk of any construction project that is facing by a Nepalese construction company. Explain with suitable example risk transfer. [2+8+2]
6. a) Define Capital Structure. XYZ company has total capital of Rs.10,00,000 which consists of 40% share and 60% loan issued @ 12% interest. It requires Rs.20,00,000 more to invest in a project and is considering for following three options. [1+6]
  - i) Rs.8,00,000 share and Rs.12,00,000 loan @14% interest
  - ii) Rs.5,00,000 share; Rs.7,00,000 preference share @15% interest and Rs.8,00,000 loan @14% interest and
  - iii) Rs.10,00,000 share and Rs.10,00,000 preference share @ 15% interest.
 Which is the best option based on Earning Per Share Calculation if the Earning before interest and tax in a year is Rs.5,00,000 and tax applicable is 30%
- b) Define Capital Budgeting decision. Explain ARR or return on Equity. Recommend appropriate measures that Government should take to attract private sector in Hydropower projects. [1+2+2]

Exam.	Old Back (2065 & Earlier Batch)		
Level	BE	Full Marks	80
Programme	BCE, BEI, BEJ, BCT, BME	Pass Marks	32
Year / Part	IV/1	Time	3 hrs

**Subject: - Project Engineering (EG706CE)**

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

1. a. Define Project. Write five characteristics of a Project and explain any two of them. [2+3+3]  
 b. What is plan? Why planning is important in project? Write systematic process of project planning. [2+3+3]
2. a. Draw a Gantt Chart of a project having at least 10 activities. Write its advantages. [6+2]  
 b. Define the terms Dummy activity, Total Float, Free Float and Independent float. [2+2+2+2]
3. a. Draw a CPM network. Find EST, EFT, LST, LFT, TF, FF. [4+6]

Activity	A	B	C	D	E	F	G	H	I
Predecessor	-	-	A	B	B	B, C	D	E	F, G, H
Duration	2	4	5	5	3	4	2	5	3

- b. Explain basic requirements of linear programming. [6]
4. a. Define Monitoring, Evaluating and Control. Explain Project Control Cycle. [4+4]  
 b. Why cost control is necessary in a project? What is earned value? Explain EVA approach of cost control. [2+2+4]
5. a. What are the sources of project finance? Explain any four determinants of capital structure planning. [2+6]  
 b. Why capital budgeting is important? Determine the feasibility of the following projects using any two methods. MARR is 15% [2+6]

Initial investment	Annual income	Annual O & M	Useful Life	Salvage Value
1,00,00,000	25,00,000	4,50,000	5 years	40,00,000

6. Write Short notes on (Any four) [4X4]
  - a. SMART objectives
  - b. Resource leveling
  - c. Feedback Control
  - d. Types of Budgets
  - e. EIA
  - f. WBS

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Year / Part	IV / I	Time	3 hrs.

**Subject: - Project Engineering (CE701)**

- ✓ 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 Bilateral, Multilateral and Joint Venture project with example? Discuss the external environment in which a project is operated. [4+6]

2. Define concept of project appraisal. Explain about contents of technical and financial proposal. Also explain input analysis of project formulation. [2+7+3]

3. a) Construct the CPM network for a project with following activities: [16]

Activities	A	B	C	D	E	F	G	H	I	J
Predecessor	-	-	A,B	B	A	C	E,F	D,F	G,H	I
Days	4	7	4	3	2	1	6	5	8	9

Find:

- i) Critical path
  - ii) Project completion time
  - iii) EST, EFT, LST, LFT, Total float, Free float ( $FF$ ), independent float ( $IF$ ) and Interfering float ( $IF$ )
- b) Define the terms resource histogram, resource levelling limited resource allocation and work break structure. [2+2+2+2]
4. a) Write the concept of Monitoring, Evaluation and Controlling and also explain project control cycle. [3+4]
- b) Why cost control is important in project? 15 houses were to be completed in three months with per unit cost of Rs 25,00,000/-. In one month 4 houses were completed with total expenditure of Rs 96,00,000/- use earn value analysis to find the status of the project. [3+4]
5. Define 'risk'. Explain various sources of project risk. Elaborate risk response planning. [1+5+4]
6. Define the term project financing. Explain features of capital structure planning. A project has total capital of Rs 5,00,000 which consists of 2000 shares @ Rs 100, 1,50,000 preference share 18% interest and remaining loan @ 14% interest. Earning before interest and tax in a year is Rs 1,00,000. Calculate EPS and book value of share if tax rate is 25%. [2+4+4]

2068 Baishakh

Exam. Level	Regular / Back		
	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT, BME	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Project Engineering**

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

1. a) Define a project and classify it? Name the characteristics of a project and describe what you mean by temporary team/organization in a project. [8]
- b) Name project life cycle and explain how you set goals in a project by giving example of one goal and verifying the same with the criteria of goal setting. [8]
2. For a project, following durations are given: [16]

SN	Activity	Durations	Precedence	Successor
1	A	5	-	E
2	B	6	-	F
3	C	7	-	G
4	D	8	-	H
5	E	9	A	I, J
6	F	7	B	I, J
7	G	5	C	I, J
8	H	3	D	I, J
9	I	4	E, F, G, H	-
10	J	5	E, F, G, H	-

Find EST, EFT, LST, LFT, TF, FF. Show critical path and find duration.

3. a) Define PERT and discuss its uses. Project A and B have  $t_o$ ,  $t_m$  and  $t_p$  as 5, 8, 12 and 6, 8, 11 respectively. Find Mean and Standard Deviation. Which project is better and more certain? [8]
- b) What are Gantt chart and discuss about resource allocation and smoothing. [8]
4. a) Differentiate Monitoring and Controlling by explaining Project Control Cycle. Explain the concept of Earned Value Analysis used for controlling cost. [8]
- b) Define Work Breakdown Structure? Write its importance and use. [8]
5. a) Explain the importances of Budgeting. Name different types of budgets and explain Capital Budgeting decision and Budgeting process. [8]
- b) Describe Socio Economic survey and also social and ordinary cost benefit analysis. [8]
6. Write short notes on: (any two) [8+8]
  - a) Environmental problems and type of impacts
  - b) Project Management Information System (PMIS)
  - c) Linear Programming
  - d) Goal setting in a project
7. Write short notes on: [4×4]
  - a) WBS and its uses
  - b) Feedback Control System
  - c) Manpower Levelling
  - d) Cashflowability and Capital Structure

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03 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**

2067 Ashadh

Exam. Level	Regular/Back		
	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT, BME	Pass Marks	32
Year / Part	IV / 1	Time	3 hrs.

**Subject: - Project Engineering**

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

1. a) Explain project family tree with suitable example. Explain also criteria of goal setting in any project. [4+4]
- b) List out different phases of project life cycle. Explain in details what are the activities to be done in implementation phase of project life cycle. [8]
2. Define forward and backward pass in the network analysis. Draw the network diagram and compute EST, EFT, LST, LFT, TF, FF, IF and interlacing floats for each activities of the project having precedence relationship as shown below. Also find out critical path. [4+12]

Activity	A	B	C	D	E	F	G	H	I	J	K	L
Duration (days)	10	9	7	9	8	5	13	6	9	12	10	8
Predecessors	---	---	A	A	B	S	D, E	C, G	H	G	G, F	K

3. a) Explain with examples closed system and open system of control. Justify the statement "Quality costs more, but lack of quality costs even more". [8]
- b) Define Project Management Information System (PMIS), stating objectives of PMIS. Explain the various choice of information channel in a project. [8]
4. a) Why project planning is necessary in any project? List out the planning tools used in project management. Write down the limitations of nonconventional bar chart showing suitable example of a bar chart. [4+4]
- b) Explain earned value analysis graphically showing favourable and unfavourable cases of variance. For a particular project, budgeted cost of work schedule was 9,50,000 and budgeted value of the work actually completed or earned value was 8,00,000 at a point of reporting date i.e. at 20 weeks from starting date. The completion time of project is 45 weeks. Based on above details, draw features of that project and comment on the schedule performance. [4+4]
5. a) List out various errors in drawing a network diagram. Find out the expected time of each engineer mentioned below. Which engineer you will choose and why? Who is more certain in completing the job? [4+4]

Types	$t_o$	$t_m$	$t_p$
NTC Engineer	5	9	12
NCell Engineer	4	5	9

- b) Describe environmental impact analysis. Explain in brief about shadow pricing, market externalities, market imperfection and social cost benefit analysis. [8]
6. a) Define budgeting? List out different types of budget. Explain the essential and purpose of budgeting for a new project. [8]
- b) Define capital structure planning. Explain in brief cash flow asility, leverage ratio, flexibility and marketability of the company. [8]
7. Write short notes on (any four) [4x4]
  - a) Environmental problems in Nepal
  - b) WBS with example specifying levels
  - c) Material scheduling
  - d) Linear programming
  - e) Resource allocation and smoothing
  - f) Budgetary control

Exam. Level	B.E.	Regular / Back	Full Marks	80
Programme	BCE, BEL, BEEX, BCT, BML	Pass Marks	32	
Year / Part	IV / I	Time	3 hrs.	

**Subject: - Project Engineering**

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

1. a) Define project. Explain the different characteristics of project. [8]
- b) Define project life cycle phases. Explain, with example, the typical life cycle phases of a project. [8]
2. A project has the following schedule, construct the network diagram and compute EST, EFT, LST, LFT, TF, FF, IF and interfering floats for each activities and find critical path. [16]

Activities	A	B	C	D	E	F	G	H	I	J	K	L
Predecessors	None	None	A	B	B	C, D	E	E	G, H	H	I, J	E, F
Time	8	2	1	9	4	5	6	3	3	5	2	3

3. a) What do you mean by project planning? Explain the importance of work-break down structure for project planning. [6]
- b) Define, monitoring, evaluation and control. Explain briefly quality control, cost control and schedule control in the project. [4+6]
4. a) What are the differences between CPM and PERT? Find the  $t_e$  (time estimates for x and y where  $t_o, t_m, t_p$  is 4, 6, 8 for x and 3, 5, 6 for y. Also find which is more certain by using S.D. and variance. [8]
- b) Define E.I.A. What are the environmental problems in Nepal and how do you improve them? [8]
5. a) Why capital structure planning is important for business firm? Explain in brief the determinants of capital structure planning. [2+6]
- b) Rank by using payback method, present worth, IRR and B/C ratio method. [8]

Item	Initial Investment	Annual Cash Flow	Life in years
1	Rs. 60000	12000	15
2	Rs. 88000	22000	22
3	Rs. 2150	1500	3
4	Rs. 20500	4500	10

6. a) Define Project Management Information System (PMIS). Why PMIS is important for effective coordination of project activities? [8]
- b) Define budget, sales budget, production budget, cash budget, fixed budget and flexible budget. [8]
7. Write short notes on any four: [4x4]
  - a) Resource allocation and smoothing
  - b) Earned value analysis
  - c) Steps in capital budgeting
  - d) SMART criteria
  - e) Socio-economic Analysis (Social Cost Benefit Analysis)



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Year / Part	IV / I	Time	3 hrs.

**Subject: - Project Engineering**

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

1. a) Explain project, characteristics of a project. Explain goal setting (SMART). [8]
- b) Explain monitoring, evaluation and controlling and project life cycle. [8]
2. a) Explain CPM and PERT and their uses. [5]
- b) Draw the network. Find EST, EFT, LST, LFT, TF, EF and IF. [11]

SN	Activity	Duration	Predecessor	Successor
1	A	5	—	B, C, D
2	B	4	A	E
3	C	2	A	F, H
4	D	3	A	G
5	E	2	B	H
6	F	1	C	I
7	G	3	D	I
8	H	1	C, E	—
9	I	2	F, G	—

3. a) Describe the purpose of budget, project budget, operation budget, sales budget, cash budget and advantages of budget. [10]
- b) Explain budgetary control, objectives, advantages and essential conditions for applying a budget. [6]
4. a) Describe the elements of cost control, system of control and feed back control system. [8]
- b) Describe in detail the work-break-down structure. [8]
5. a) Explain capital budgeting, needs and importance steps and capital budgeting process. [8]
- b) Explain EIA. Describe different environmental problems and types of environmental impacts and method of identification and comparison by check list method. [8]
6. a) Draw Bar-chart and explain its advantages and disadvantages. Also find  $t_e$  and variance when  $t_o$ ,  $t_m$  and  $t_p$  are 6, 8, 12. [8]
- b) Explain earned value analysis. When 125 cub.m. of concrete is to be done in 10 days at the cost of Rs. 1,250,000 at the end of the third day managed to complete 40 cub.m. of concrete with expenses of Rs. 3,75,000. Find EVA and comment the performance. [8]
7. Write short notes on any four: [4×4]
  - a) Linear Programming
  - b) Socio-economic Survey and SCBA
  - c) Capital Structure Planning and Debt Equity Ratio
  - d) Resource Allocation and Smoothing
  - e) PMIS

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Design of RCC Structure (CE702)**

- ✓ 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.
- ✓ Use of IS: 456-2000; IS 1893 and SP16 are allowed. But, use of SP 16 is allowed only for column design.

1. a) State all the possible safety and requirements of limit state and define limit state of strength and serviceability. [4]
- b) Design a rectangle footing to carry a column load of 1150 kN and BM of 250 kN-m from 600×600 mm square column with the 20 mm diameter longitudinal steel. The bearing capacity of soil is 200 kN/m<sup>2</sup>. Consider depth of foundation as 1.5 m. Take unit weight of earth is 17 kN/m<sup>3</sup>. Use M20 concrete and Fe 415 steel. [16]
2. a) How do you consider earthquake loads while designing RCC structures? Explain briefly. [4]
- b) Design a slab for a room of size 3.6 m × 4.2 m prevented uplifting by walls (230 mm thick) loads for a intermediate storey of a residential building. Use M20 grade of concrete and Fe 415 grade of steel. Sketch the reinforcements. Carry out all necessary checks require in slab design. Take live load = 3kN/m<sup>2</sup>, floor finish = 1 kN/m<sup>2</sup>. [16]
3. a) Derive the formula  $L_d \leq \frac{M_1}{V} + L_0$ , where the symbols have their usual meanings. [4]
- b) Determine the longitudinal and transverse reinforcements in a short rectangular column subjected to a factored axial load of 2000 kN and factored moment  $M_{ux}$  about major axis of 190 kN-m and  $M_{uy}$  about minor axis of 95 kN-m. The size of the column is 300 mm×500mm and the unsupported length of 3 m. Adopt M30 concrete and Fe 500 grade steel. [16]
4. a) Explain with the help of sketches the requirements on reinforcement detailing in beams to ensure sufficient ductility. [6]
- b) A L-beam has a flange of effective width 900 mm and depth of 100 mm. The web below is 250 mm×500 mm. Determine the amount of reinforcement required for the cross-section if it has to carry a factored bending moment of 615 kN-m and SF of 50 kN. Adopt M20 concrete mix and Fe 500 grade steel. [14]

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**Subject: - Design of RCC Structure (CE702)**

- ✓ 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.
- ✓ Use of IS: 456-2000; IS 1893 and SP 16 are allowed. But, use of SP 16 is allowed only for column design.

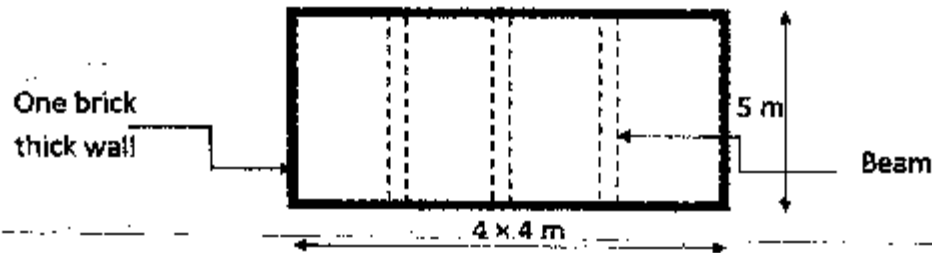
1. a) Using working stress method, design a rectangular section 300 mm width and 450 mm height carrying 30KN/m load in the effective span 3.6m. Use mild steel and M20 grade of concrete. [4]
- b) Enlist and make sketch of three kind of mechanical splices. [2]
- c) Design a short rectangular column of size 450mm×300mm and unsupported length 3 m subjected to an axial ultimate load of 1500KN and ultimate moments 150KNm and 80KNm a long major and minor axes respectively. Adopt M30 grade of concrete and Fe500 grade of steel. Sketch the final design. [14]
2. a) Write down the steps of design of a beam subjected to BM, SF and Torsion. [4]
- b) Design slab of a room of size 6.5m×4m for a live load of 4.5 KN/m<sup>2</sup> and floor finish of 1 KN/m<sup>2</sup> of slab are rigidly fixed with beam. Take width of beam 230 mm. Use M20 concrete and TMT bars. Draw top and bottom reinforcement detailing with sections. Carry out all checks required for slab design. [16]
3. a) Write provisions of ductile detailing of column with neat sketches. [6]
- b) Design an isolated footing to carry a column load of 1300 KN and BM of 100 KN-m from both axes of column. Column is 500 mm×500mm in size with 25 mm diameter longitudinal steel. The bearing capacity of soil is 220 KN/m<sup>2</sup>. Consider depth of foundation as 1.70 m. Take unit weight of soil as 18.5 KN/m<sup>3</sup>. Use M25 grade concrete and Fe415 steel. [14]
4. a) Discuss in detail the working stress method versus limit state method of design with their respective advantages and disadvantages. Compare balance, under reinforcement and over reinforced sections in limit state and working stress design methods. [8]
- b) A RC beam 300 mm× 500 mm is reinforced with 5-25 mm bars in tension and 5-12 mm bars in compression each at a clear cover of 25 mm. If effective span of the beam is 4.30 m. find the moment of resistance of the beam at ultimate state. Use M25 concrete and Fe 415 grade steel. [12]

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

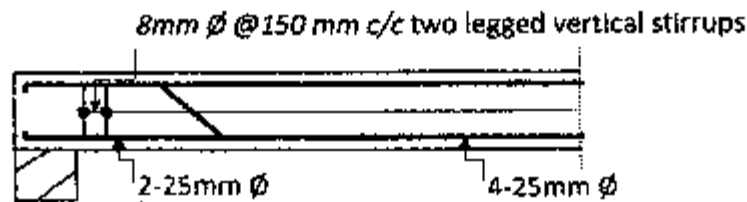
**Subject: - Design of RCC Structure (CE702)**

- ✓ 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**.
- ✓ Design codes IS 456, IS 1893, IS 13920 and SP 16 are allowed to use.
- ✓ Assume suitable data if necessary.

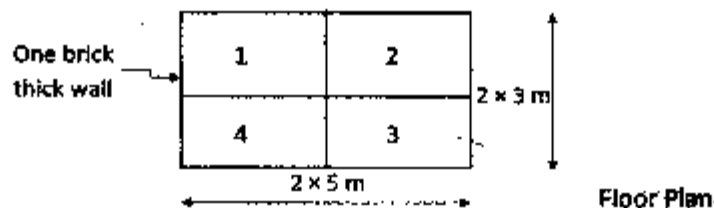
1. a) Explain different types of design methods used in Reinforced concrete structure design. [6]
- b) A column of 4 m length with both ends fixed and effectively held in position is subjected to a design axial load of 1000 KN and factored bending moment of 100 KN-m. Design the rectangular column with its longitudinal and transverse reinforcements. [14]
2. a) A floor consists of 125 mm thick RC slab, integrally connected with the beam as shown in figure below. Design an intermediate beam for BM and deflection if the floor is subjected to live load of  $4 \text{ KN/m}^2$  and floor finishes of  $0.7 \text{ KN/m}^2$ . [10]



- b) Find the shear resisting capacity of a rectangular beam of  $300 \text{ mm} \times 500 \text{ mm}$  at the section of bent up bar. Angle of inclination of bent up bar is  $45^\circ$ . Consider M20 and Fe415 grade of concrete and steel. [10]



3. a) Explain in details all design steps of R.C.C mat foundation design. [6]
- b) RC slab of the floor of a residential building is subjected to live load of  $3 \text{ KN/m}^2$  and floor finishes of  $1 \text{ KN/m}^2$ . Design the slab panel 2 for BM and SF. Draw neat sketches of slab showing top and bottom arrangements of reinforcing bars. [14]



4. a) Design the isolated footing of a column of  $350 \text{ mm} \times 500 \text{ mm}$ . Column is subjected to design axial load of 2000 KN and design BM of 80 KN-m. Allowable bearing capacity of soil is equal to  $175 \text{ KN/m}^2$ . [14]
- b) What are the ductility requirement for beam, column and joints of R.C.C structures? [6]

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

**Subject: - Design of Reinforced Concrete Structures**

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

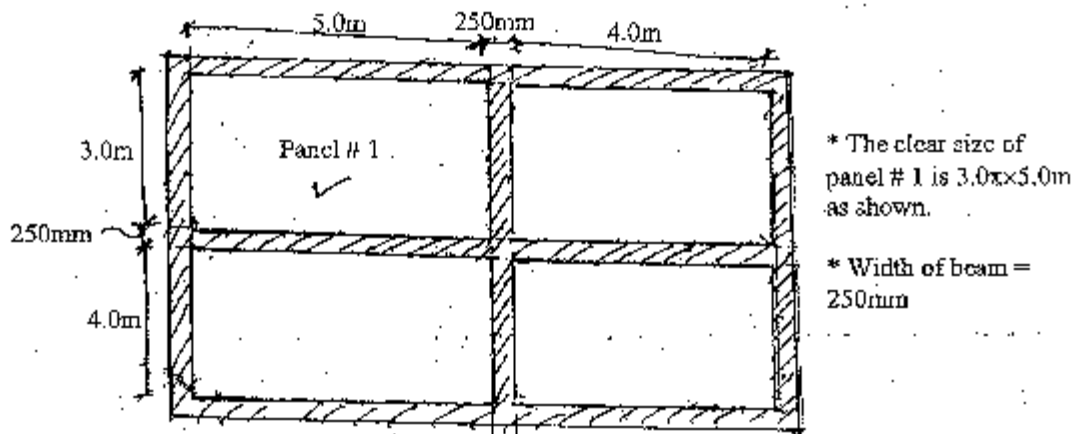
1. a) Prove that  $S_v = \frac{0.87 f_y A_{st} d}{V_s}$  or  $L_d = \frac{0.87 f_y \phi}{4 \tau_{bd}}$ . The symbols have their usual meanings. [5]
- b) A beam of 6m span is simply supported and carrying 24 kN/m live load and 3 kN/m dead loads excluding self weight. The beam is made of M20 concrete and Fe415 steel. Design the beam. Shear design is not required. [15]
2. a) Discuss briefly Limit State of Serviceability conditions. [5]
- b) Determine the reinforcement in a biaxially loaded column with the following parameters: [15]
  - Size of column = 400mm × 600mm
  - Factored load,  $P_u = 1500$  kN
  - Factored moment,  $M_{ux} = 300$  kNm
  - Factored moment,  $M_{uy} = 200$  kNm
  - Assume M25 concrete and Fe 415 steel.
3. a) Explain about detailing of reinforcement in staircases. [5]
- b) Design a reinforced concrete rectangular footing for a square column of size 450mm × 450mm, which is subjected to an axial load of 1650 kN and uni-axial moment of 240 kNm at service state. Consider allowable bearing capacity of soil as 120 kN/m<sup>2</sup>. Show design summary and reinforcement detailing with neat sketch. [15]
4. a) What do you understand by splicing of bars? Write down the primary conditions for the application of splicing in reinforced concrete structures. [5]
- b) Design a two-way slab resting on RCC beams on all sides for a room having clear dimensions of 4m × 6m. The slab is subjected to a super-imposed live load of 2.5 kN/m<sup>2</sup> and floor finishes (screeds and flooring) load of 2.75 kN/m<sup>2</sup>. Take M20 concrete grade and Fe415 steel grade. [15]
5. a) Draw idealized stress-strain curve for both steel and concrete and discuss on the design value of stresses. [5]
- b) A rectangular beam 180mm × 400mm is prestressed by a cable with an eccentricity of 75mm above the centroid at the supports and an eccentricity of 50mm below the centroid at the mid-span. Initial prestress is 900 N/mm<sup>2</sup> and area of the cable is 500mm<sup>2</sup>. Calculate the prestressing force at the other end of the beam if its span is 10m. Assume  $\mu = 0.50$  and  $K = 0.0016/m$ . [15]

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

**Subject:** - Design of Reinforced Concrete Structures

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any **Four** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Use of IS: 456, IS 1343 are allowed. IS 456 SP-16 is allowed to design column only.
- ✓ Assume suitable data if necessary.

1. a) What is the difference between working stress method and limit state method? Explain with stress and strain diagrams. [5]
- b) Design a simply supported rectangular beam with the effective span of 7m. The size of beam is required to be limited to 300mm × 700mm. Design shear reinforcement also. Take a live load of 70 kN/m. Use M20 concrete and Fe415 grade steel. [15]
2. The floor slab system of a two-storeyed building is shown in figure. The slab system is supported on 250mm wide beam as shown. Assuming a floor finish load of 1 kN/m<sup>2</sup> and a live load of 4 kN/m<sup>2</sup>, design and detail the slab panel # 1 as indicated in the floor plan. Also check whether the section satisfies the deflection criteria. (Check for shear and development length not required). The torsional reinforcement should be designed. Use Fe415 steel. Assume mild exposure conditions. [12+4+4]



3. a) Explain the concept of design of a staircase. Show the detailing of reinforcement of straight flight in plan and section. [5]
- b) Determine the reinforcement equal in all sides of a biaxially loaded column with the following parameters. [15]
  - Size of column = 400mm × 500mm
  - Factored load,  $P_c = 1200$  kN,
  - Factored moment  $M_{ux} = 120$  kNm,
  - Factored moment  $M_{uy} = 100$  kNm.
  - M20 concrete and Fe 415 steel.
  - $d/D = 0.15$  for both axes.
4. a) Explain how an RC structural member subjected to torsion, shear force and bending moment is designed by IS code method. [6]

Exam.	Regular/Back		
	Level	BE	Full Marks
Programme	BCE	Pass Marks	32
Year / Part	IV / 1	Time	3 hrs.

**Subject: - Design of Reinforced Concrete Structure**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any Four questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Use of IS: 456, IS 1343 are allowed. IS 456 SP-16 is allowed to design column only.
- ✓ Assume suitable data if necessary.

1. a) What is the difference between the limit state method fro working stress method of design. [7]
- b) A RC beam has an effective depth of 45cm and breadth of 30cm. It contains 5-20mm dia mild steel bars, out of which 2-20mm dia bars are curtailed at a section where shear force at service load is 100KN. Design the shear reinforcement if the concrete is M20. [13]
2. a) How the deflection can be controlled in a beam, explain it in brief. [7]
- b) A beam is simply supported on two walls of width 250mm with a clear span of 6m. If the beam have to support 150mm deep slab and live load of intensity 3 KN/m<sup>2</sup>, design a T-beam. The beam is spaced at 4 m c/c. Take M20 concrete and Fe415 steel. Design for shear is not required. [13]
3. a) How the bent-up bars contribute in shear strength of beam, explain it. [4]
- b) Design a roof slab for a room 6m×3.5m restrained on all four sides by beams. It has to support super imposed load of 4 KN/m<sup>2</sup>. Take M20 concrete and Fe250 steel. [16]
4. a) Describe the steps for design of a rectangular RC footing. Why shear reinforcement is not provided in footing? [7]
- b) Design a rectangular column supporting an axial load of 1200KN along with a bending moment of 150 KN-m at working loads. Use M25 concrete mix, Fe415 steel and the section reinforced equally distributed on two sides only. [13]
5. a) What are the differences between load balancing approach and homogeneous beam concept? Explain it. [4]
- b) Compute the net initial and final concrete stresses in the extreme top and bottom fibres at the mid span of a beam, which are 25cm wide and 30cm deep on a span of 8m. The beam is to support a dead load of 8 KN/m and live load of 6 KN/m. The beam is prestressed with a final force of 700 KN at an eccentricity of 7.5cm. Loss may be assumed as 15%. [16]

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

**Subject: - Design of Reinforced Concrete Structures**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any **Four** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ IS 456, IS 1343 and SP16 are allowed to use.
- ✓ Notations given are of usual meaning.
- ✓ Assume suitable data if necessary.

1. a) Write the characteristics of steel reinforcing bars used in the reinforced concrete structures. [5]
- b) Design a simply supported reinforced concrete beam of rectangular section at limit state of collapse in flexure and shear. The beam is subjected to a design load of 45 KN/m (including self weight). Clear span of the beam is 6m. Take M20 grade of concrete and Fe415 steel as the materials of beam. [15]
2. a) Show that  $L_d \leq 1.3 M_1 / V_u + l_d$  [10]
 

Where,  $L_d$  - Required development of reinforcement  
 $M_1$  - Moment resisting capacity of flexure member  
 $V_u$  - Design shear force  
 $l_d$  - Additional anchorage length of reinforcing bar
- b) A reinforced concrete column of size 600mm×400mm with  $A_{st} = 8-28$ mm diameter is subjected to  $M_{ux} = 350$  KN-m,  $M_{uy} = 50$  KN-m and  $P_u = 2000$ KN. Check whether the column is safe for above combination of load and bending moments. Take M20 and Fe415 grades of concrete and steel respectively and the effective cover to reinforcing bar 60mm. [10]
3. a) What is the principle of sufficient stiffness method to control deflection? How the deflection of RC flexure member is controlled by this method. [6]
- b) Design a simply supported RC slab of 4m×6m at limit state of collapse in flexure. Arrange the designed reinforcing bars and draw a neat sketch of slab showing arrangement of top and bottom reinforcements. [14]
 

Take, Live load = 4 KN/m<sup>2</sup>      Floor finish = 1 KN/m<sup>2</sup>  
 Grade of concrete = M20      Grade of steel reinforcement = Fe500
4. a) Design a RC concrete spread footing of a RC wall having 4m length and 300mm width. Total load on wall is equal to 1000KN at service state. Take M20 and Fe415 grades of concrete and steel respectively, and safe bearing capacity of soil = 150KN/m<sup>2</sup>. [12]
- b) Explain how a RC structural member subjected to torsion, shear force and bending moment is designed by IS code method. [8]
5. a) A rectangular beam of 200mm wide and 375mm deep has an effective span 9m. The prestressing cable has a triangular profile with zero eccentricity at ends and 75mm at mid span. The effective prestressing force is 800KN after all loss. Determine maximum value of concentrated load that the beam can support at mid span. [10]
- b) Write down design steps for the design of RL long column of unbraced frame. [10]



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

**Subject: - Design of Reinforced Concrete Structures**

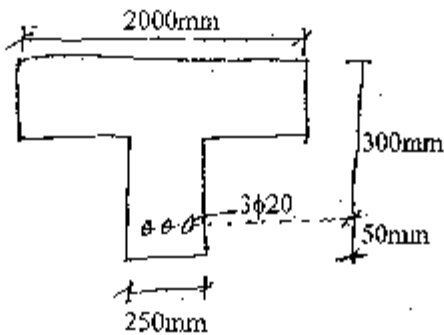
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any Four questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume missing data if necessary possibly complying to IS: 456-2000.
- ✓ Use of IS: 456-2000, IS: 1343 and SP 16 are allowed. But, use of SP-16 is allowed only for column design.

1. a) A reinforced concrete column of a moment resisting frame has its cross section  $400\text{mm} \times 600\text{mm}$  and effective height 3.6m. The column has to carry loading combination of dead load, live load and moment due to wind load. The computed dead load and live load on column are 250 kN, and 100 kN respectively, whereas the induced horizontal load on column due to wind load is 5 kN/m. Calculate loading values for all possible loading combinations as per IS 456. [8]
- b) The moment of resistance of a rectangular reinforced concrete beam section having width  $b$  mm and overall depth  $D$  mm is  $0.85bd^2$ . The stresses in the extreme fiber of the concrete; and in the steel are not to exceed  $7 \text{ N/mm}^2$  and  $140 \text{ N/mm}^2$  respectively and the modular ratio equals to 18.33. Determine the ratio between the depth of neutral axis from the compression fiber and the effective depth of the beam. The beam is reinforced for tension side only. [12]
2. a) State all the possible safety and serviceability limit states to be considered in the design by Limit State Method. [5]
- b) Design an isolated square footing foundation of uniform thickness for a  $400\text{mm} \times 400\text{mm}$  column subjected to an axial load of 600 kN and a moment of 50 kNm at service state. Consider bearing capacity of soil as  $150 \text{ kN/m}^2$  and concrete grade M20 and steel grade Fe415. [10]
- c) Draw idealized stress-strain curve for both steel and concrete and discuss on the design values of stresses. [5]
3. a) Write down the procedure for design of shear reinforcement. Also explain how the isolated footings are designed under punching shear? [8]
- b) Design the reinforcement required for a simple rectangular beam having effective span length of 6m. The beam is carrying 8 kN/m load from 120mm thick slab. Consider the width of beam 250mm and overall depth of beam to be 450mm. For loading calculation, consider live load on floor: 5 kN/m, floor finish: 3 kN/m, partition wall: 10 kN/m. M20 concrete and Fe415 steel are used. [12]
4. a) A concrete beam of 20m span, 200mm wide and 500mm deep is pre-stressed using a cable with cross sectional area of  $250\text{mm}^2$ . The cable profile is parabolic with an eccentricity of 100mm above the centroid of the section at the end supports and 100mm below at the mid span. If the cable is tensioned from one end only, estimate the percentage loss of pre-stress in the cable due to the effects of friction. Consider  $m = 0.35$  and  $k = 0.0015/\text{m}$ . Use the parabolic profile of the curve as  $y = \frac{4e}{l^2} x(l-x)$ . [12]

- b) What do you understand by curtailment of tension steel in simple beams? Show by illustrating a neat sketch. [8]
5. a) Compare the factor of safety used in Working Stress Method and Partial Safety Factor used in Limit State Method for concrete and steel. [4]
- b) Differentiate among the balanced, under reinforced and over reinforced section in a rectangular reinforced concrete section in limit state method with corresponding strain diagram. [8]

OR

Determine the moment of resistance of the section shown in figure below. Take  $\sigma_{cbc} = 7 \text{ N/mm}^2$  and  $\sigma_{st} = 140 \text{ N/mm}^2$ . [8]



- c) Design a square shaped reinforced concrete column that has to carry ultimate factored load of 800 kN inclusive of live load, at an eccentricity of 80mm in both X and Y directions. Use concrete grade M20 and steel grade Fe415. [8]

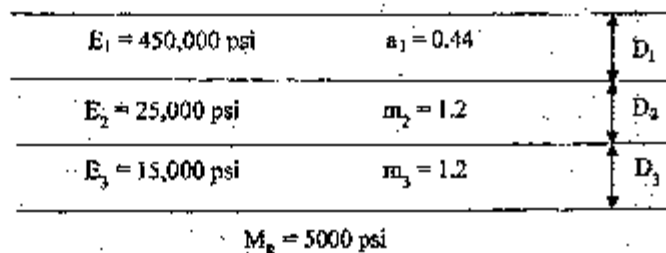
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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Transportation Engineering II (CE703)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ All questions carry equal marks.
- ✓ Normal graph paper should be provided.
- ✓ Necessary figures are attached herewith.
- ✓ Assume suitable data if necessary.

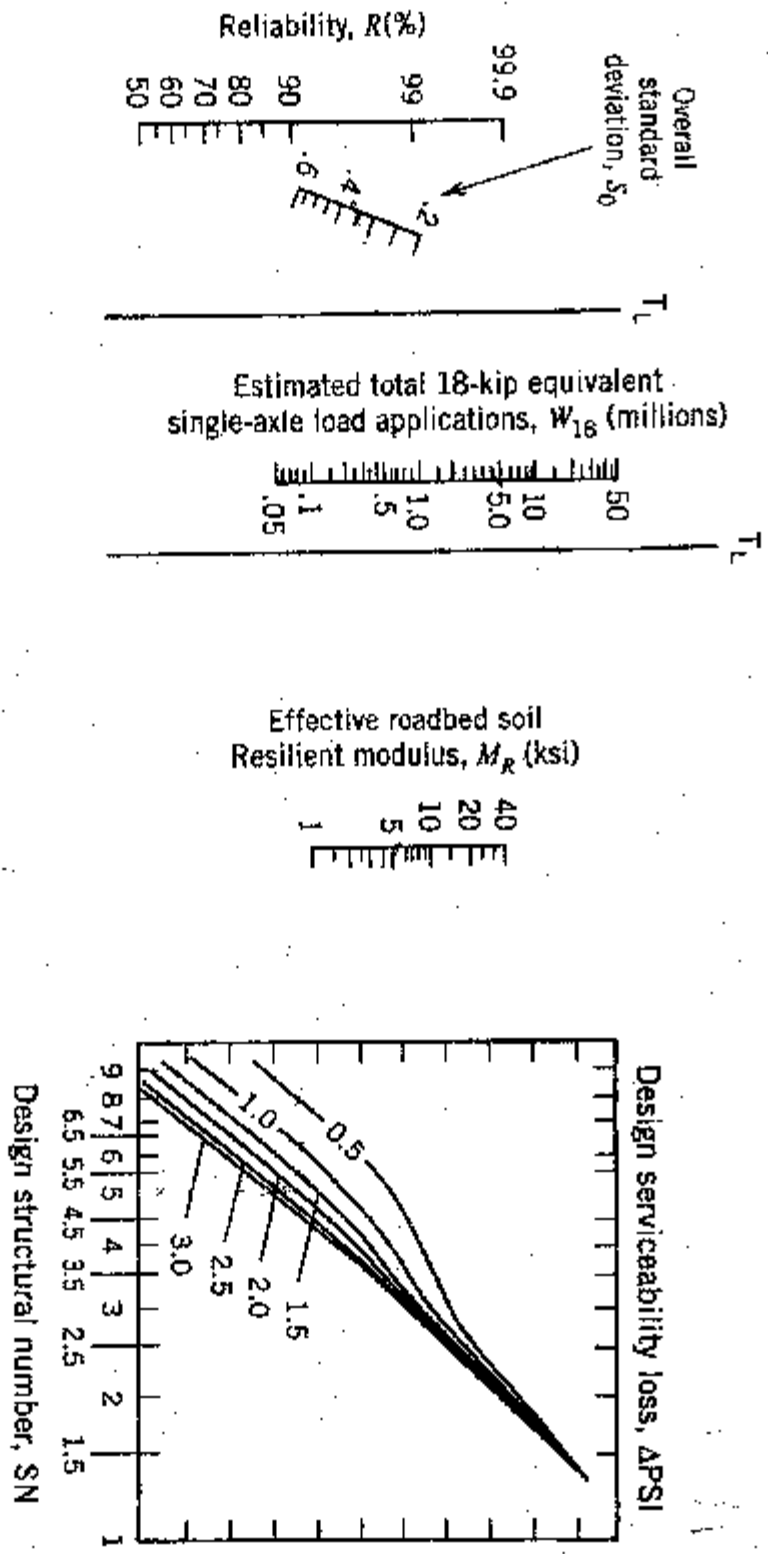
1. Define traffic engineering. Describe road users and vehicular characteristics.
2. What are the uses of origin and destination study? Briefly explain the methods of conducting this study.
3. Average trip time for office is 30 minutes with standard deviation of 5 min. Assuming normal distribution of trip time, calculate the followings:
  - a) Probability of trip time being at least 35 minutes
  - b) If the working hour starts at 10:00 AM and trip starts at 9:40 AM what is the probability of being late?
4. An isolated signal with pedestrians indication is to be installed on a right angled intersection with road A 15 m wide and road B 12 m wide. The heaviest volume per hour for each lane of road A and road B are 300 and 250 respectively. The amber times for roads A and B are 3 and 2 seconds respectively. Design the timings of traffic and pedestrian signal.
5. What do you understand by legal axle load and standard axle load? Describe the stresses induced in the rigid pavement slab. How spacing between contraction joints is calculated in jointed plain concrete pavement?
6. In the figure below, a pavement system with the resilient moduli, layer coefficient of surface course and drainage coefficients are shown. If predicted ESAL =  $15 \times 10^6$ , R = 90%,  $S_o = 0.4$  present serviceability index = 4.2 and terminal serviceability index = 2.7, select the thickness of  $D_1$ ,  $D_2$  and  $D_3$ .



7. Draw a neat sketch of typical pavement structures. Explain in detail the construction methodology of Otta Seal.
8. Explain with a neat diagram the characteristics of mass haul diagram, including free haul, over haul, economic haul, shrinkage and swelling factor.
9. Define road maintenance. Describe the failures of the flexible pavement.
10. What are the methods of providing tunnel ventilation? Explain the major factors controlling the selection of bridge sites.

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# AAHSTO Flexible Pavement Nomograph



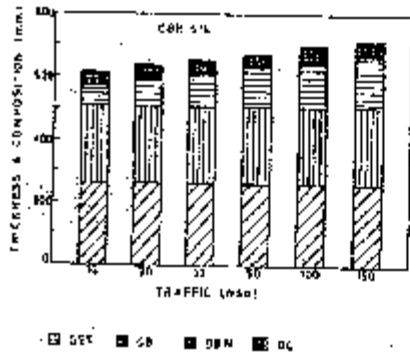
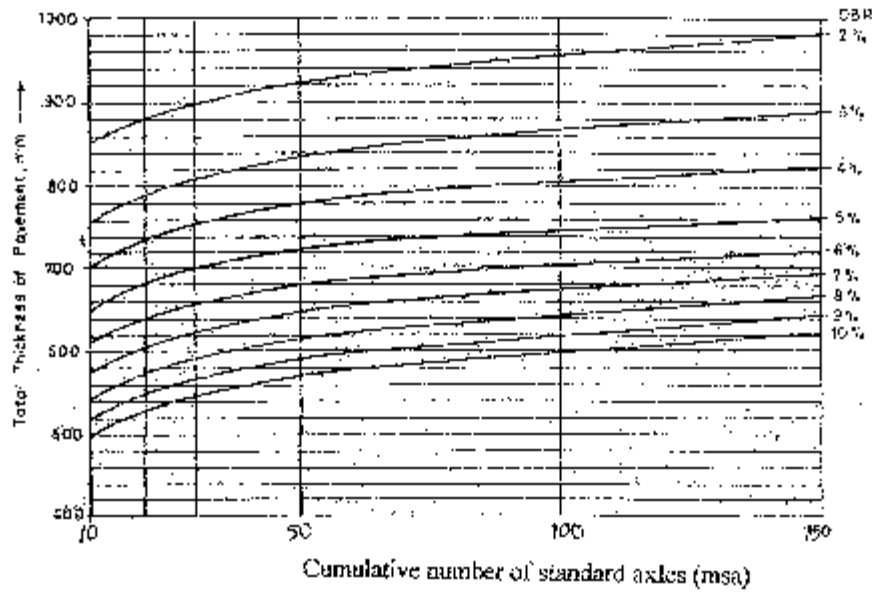
**Subject: - Transportation Engineering II (CE703)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
  - ✓ Attempt All questions.
  - ✓ All questions carry equal marks.
  - ✓ Necessary figures are attached herewith.
  - ✓ Assume suitable data if necessary.
1. List the objectives of accident study. Explain briefly causes and preventive measures of accident.
  2. Describe channelized intersections with their advantages and disadvantages.
  3. The data collected after speed and delay studies by floating car method on a stretch of road 3.2 km long are given below. Determine the average values of volume, journey speed and running speed of the traffic stream along either direction.

Trip	Direction of trip	Journey time (min)	Total stopped delay (min)	No. of vehicles		
				Overtaking	Overtaken	From opposite direction
1	C - D	6.50	1.58	4	7	270
2	D - C	7.48	1.72	5	4	250
3	C - D	6.92	1.62	5	4	300
4	D - C	7.82	1.82	3	3	275
5	C - D	6.33	1.40	3	2	295
6	D - C	8.13	2.10	2	1	280
7	C - D	6.71	1.73	4	4	300
8	D - C	7.40	1.85	3	3	230
9	C - D	6.23	1.60	4	2	275
10	D - C	6.98	1.78	2	1	242

4. An isolated signal with pedestrians indication is to be installed on a right angled intersection with road H of 12 m wide and road F of 9.6 m wide. The heaviest volume per hour for each lane of H and F are 475 and 325 respectively. The approach speeds are 60 and 45 kmph for road H and road F respectively. Design the timings of traffic and pedestrian signals. Assume amber times for road H and road F as 5 and 4 secs respectively.
5. Explain how design traffic is calculated from the data obtained from traffic surveys. Give at least three different examples in various design methods.
6. Design the pavement for an existing two lane single carriageway road with the following details.
  - a. Initial traffic in both direction in the year of completion of construction = 5640 CVPD
  - b. Design life = 10 years
  - c. Design CBR value = 6%
  - d. Axle load using the road (CV) = 118 KN
7. Define road construction technology. Describe the various activities to be performed for the road construction.
8. Describe the construction procedure of bituminous concrete road and check needed for quality control.
9. Define road maintenance. Explain different measure to be taken for gully control works.
10. What are the factors to be considered in tunnel lighting? What are the different methods of river bank protection work?

Chart for question no. 6



cumulative traffic (msa)	Total pavement thickness (mm)	pavement composition		
		bituminous surfacing		Granular base and sub-base (mm)
		BC (mm)	DBM (mm)	
10	515	40	65	base = 250 subbase = 260
20	640	40	90	
30	655	40	105	
50	675	40	125	
100	700	50	180	
150	720	50	160	

Exam.	Old Back (2065 & Earlier Batch)		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

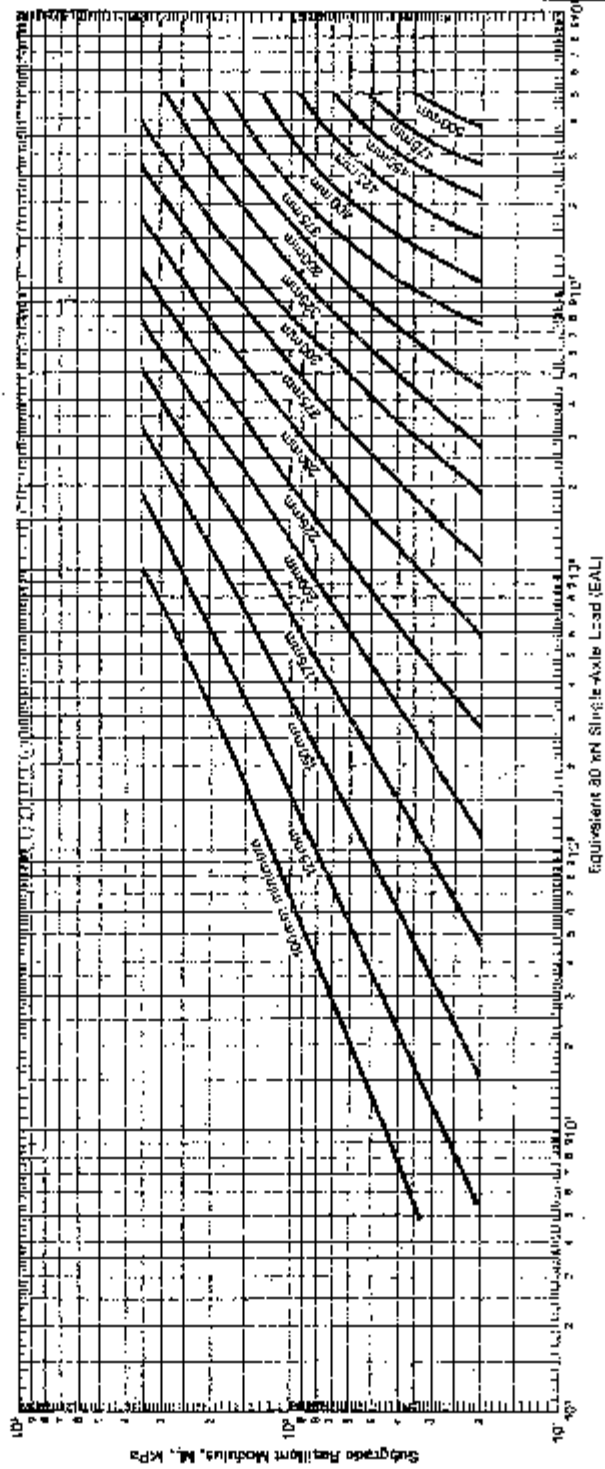
**Subject: - Transportation Engineering II (EG723CE)**

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

1. a) What do you mean by Origin and Destination Study? Explain the various applications of Origin and Destination studies. (8)
- b) What do you mean by Traffic Control Device? Explain in short about the types of Traffic Signs. (8)
2. a) Compare on-street and off-street parking. Draw neat sketches showing parallel and angle kerb (on-street) parking geometry. (6)
- b) An isolated signal with pedestrian indicators to be installed on a right angled intersection with road A of 15 m and road B of 7 m respectively. The heaviest volume per hour for each lane of road A and road B are 350 and 250 respectively. The approaching speeds for road A and road B are 60 kmph and 45 kmph. Design the traffic and pedestrian signal timings. (Take amber period for yellow light signal as 2 to 4 secs and pedestrian walking speed of 1.0 m/sec) (10)
3. a) Explain the various types of stresses needed to be considered in the design of rigid pavement. (8)
- b) An existing single lane road has to be upgraded by bituminous pavement for a certain length by the following considerations. (8)
  - i) Base traffic of 80 kN equivalent single axle load (ESAL) =  $5.11 \times 10^4$  ESAL per year
  - ii) Design period = 12 years
  - iii) Construction period = 1 year
  - iv) Traffic growth rate = 6%
  - v) 87.5<sup>th</sup> percentile CBR value of sub-grade soil from 7 sample locations = 4%
  - vi) Elastic modulus of asphalt concrete for surface course,  $E_{sc}$  = 2900 MPa
  - vii) Elastic modulus of emulsified stabilized base,  $E_b$  = 1600 Mpa
  - viii) Elastic modulus of granular sub-base,  $E_{sb}$  = 125 Mpa

You are required to design the pavement from Asphalt Institute Method. Draw the cross section of final pavement layers considering the thickness of asphalt concrete on surface course is not less than 50 mm. (Full depth AC curve attached herewith)
4. a) What is Mass Haul Diagram? Explain its importance in road construction with diagram. (10)
- b) Discuss the construction procedure of premix bituminous carpet in brief. (6)
5. a) What are the causes that result the failure of cement concrete pavement. Explain briefly. (8)
- b) Explain pavement evaluation. (8)
6. Write short notes on any four of the following: (4x4)
  - a) Components of a bridge
  - b) Importance of ventilation in tunneling
  - c) Importance of road lighting
  - d) Thirtieth highest hourly traffic volume
  - e) Construction procedure of gravel road

### Full-Depth Asphalt Concrete



Design Chart V-1.



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

**Subject: - Transportation Engineering II**

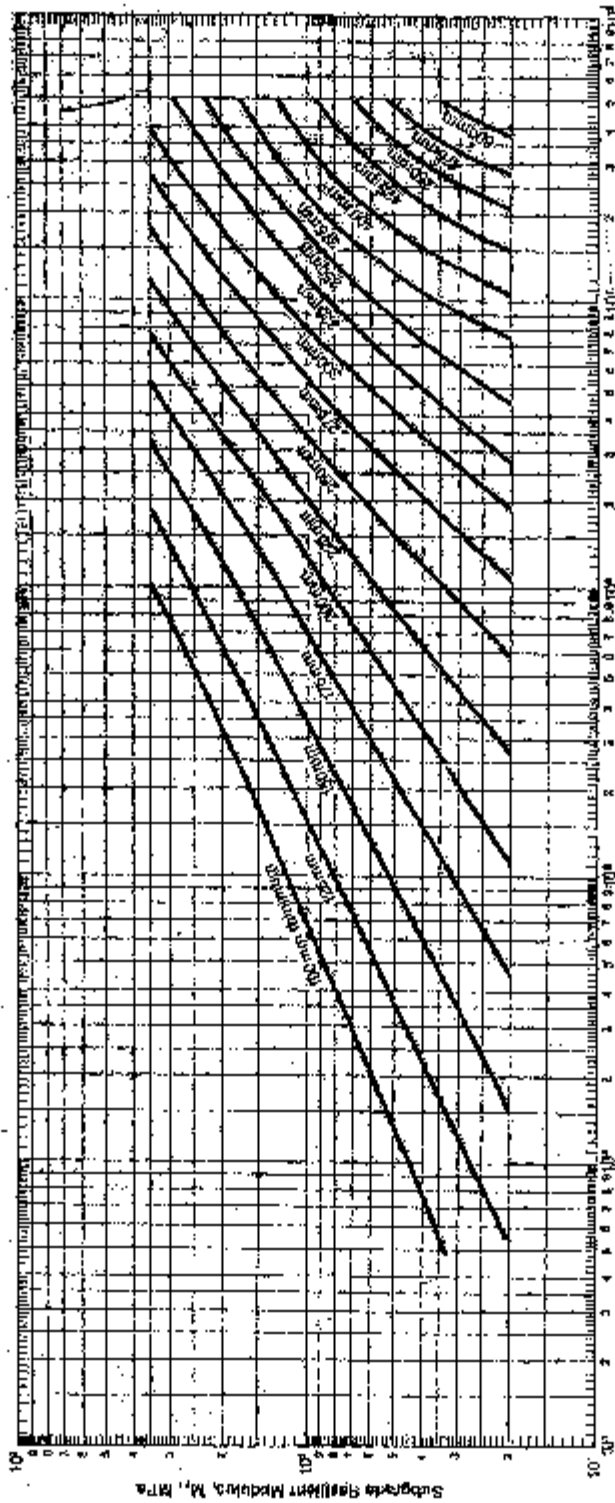
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any Five questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Necessary design chart is attached herewith.
- ✓ Assume suitable data if necessary.

1. a) Define traffic capacity. Describe the factors affecting capacity and level of service. [6]
- b) Design the timing of traffic and pedestrian signals of an isolated signal to be installed at a right angle intersection when road P and Q cross. The data available are: [10]

	Road P	Road Q
i) Width	14.00	10.50
ii) Peak hour traffic volume, Vehicle/hour/lane	210	120
iii) Approach speed, Km/h	50	35

2. a) Define rotary intersection. What are the advantages and disadvantages of rotary intersection? [8]
- b) A vehicle skids through a distance of 40m before colliding with another parked vehicle, the weight of which is 75 percent of the former. After collision both the vehicles skid through 14m before stopping. Compute the initial speed of moving vehicle. Assume coefficient of friction of 0.62. [8]
3. a) An existing two lane single carriageway gravel road has to be upgraded by bituminous pavement, to cater the growing traffic demand. Present traffic in terms of ESA is  $0.8 \times 10^3$  per day. The regional traffic growth rate is taken as 6.5% per annum. Data required for pavement design are as given below. [8]
- i) Design period = 10 years
  - ii) Construction period = 1 year
  - iii) 87.5 percentile CBR value of sub grade soil from 7 sample locations = 5%
  - iv) Elastic modulus of asphalt concrete for surface course  $E_{ac} = 2000\text{MPa}$
  - v) Elastic modulus of crushed stone base  $E_{base} = 350\text{MPa}$
  - vi) Elastic modulus of granular sub-base  $E_{sub-base} = 250\text{MPa}$
- You are required to design the pavement by Asphalt Institute Method. Draw the cross section of final pavement layers considering the minimum thickness of asphalt concrete on surface course equal to 50mm.
- b) What are the factors affecting pavement design? Write down the steps of IRC design guidelines for rigid pavement. [8]
4. a) What is Mass Haul Diagram? What are the equipments and plants needed for the accomplishment of various activities of road construction? [2+6]
- b) Distinguish between prime coat and tack coat. Explain construction method of surface dressing. [2+6]
5. a) Explain the importance of road maintenance. Describe the maintenance of bituminous pavement. [2+6]
- b) Classify the bridges according to types of super structure and span length. Make a sketch of a bridge section (longitudinal and cross) and plan indicating its elements. [8]
6. Write short note on: (any four) [4x4]
- a) Fixed delay and operational delay
  - b) Spacing and head way
  - c) Typical failures of the rigid pavement
  - d) Gravel road construction
  - e) Radius of relative stiffness

# Full-Depth Asphalt Concrete



Equivalent 80 MN Single-Axis Load (ESAL)

100

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

**Subject: - Transportation Engineering II**

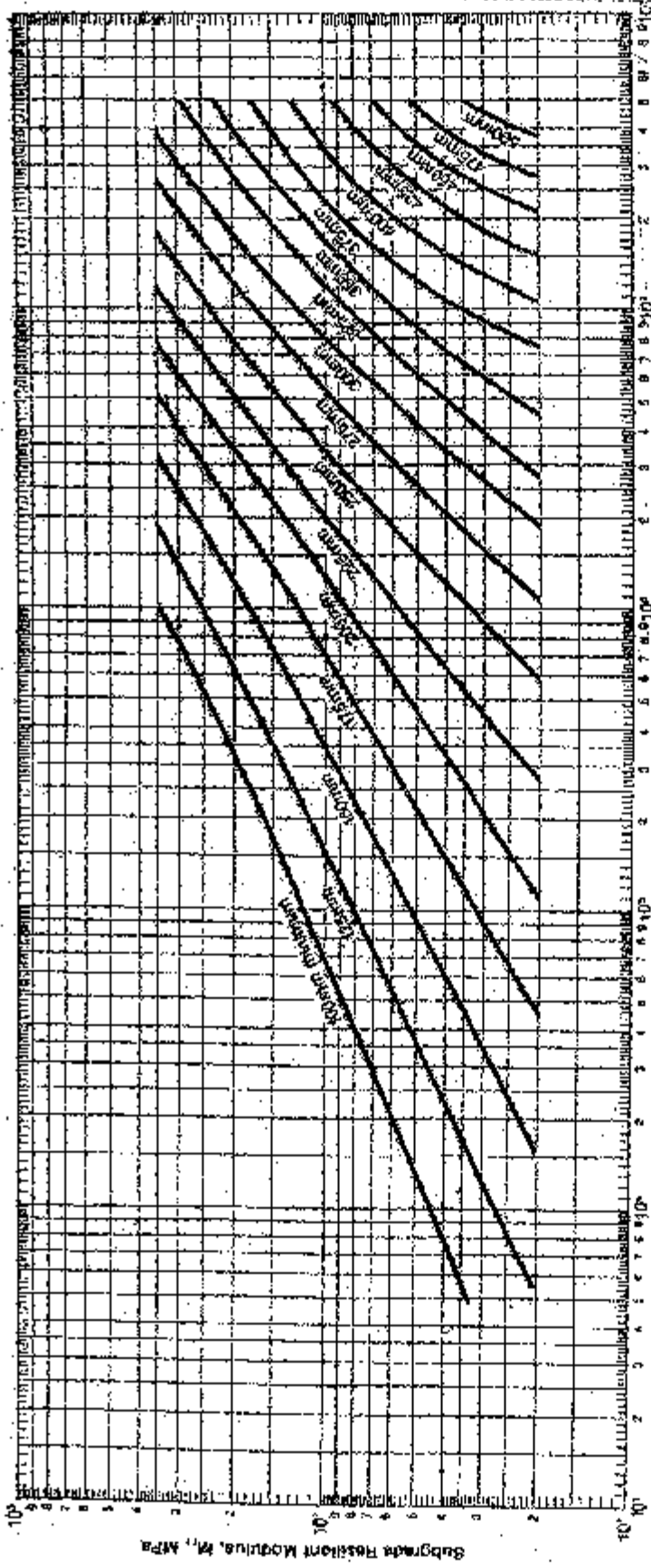
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any **Five** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Necessary charts are attached herewith.
- ✓ Assume suitable data if necessary.

1. a) Describe the road user characteristics. Explain their importance in traffic engineering. [4+2]  
b) The following speed data were collected during a two-minute segment of a spot speed study (speed in Km/h). [3+3+4]  
45, 55, 48, 52, 60, 48, 60, 42, 52, 65, 64, 63, 58, 56, 68, 54, 68, 64, 66, 70  
Calculate: (i) The time mean speed; (ii) The space mean speed.  
What will be the average density of the above traffic stream if the mean headway is 4.5 sec?
2. a) What is grade separation? Mention their types with sketches. Draw a right angle four legged intersection of two roads and show their various types of conflict points if (i) both roads are with two way movements; (ii) one road is with one-way and another is with two way movements. [1+3+4]  
b) What are different methods of traffic control at an intersection? The average normal flow of traffic on cross roads A and B during design period are 400 and 300 PCU per hour; the saturation flow values on these roads are estimated as 1450 and 1150 PCU per hour respectively. The all-red time required for pedestrian crossing is 12 sec. Design two phase traffic signal by Webster's method. [2+6]
3. a) Classify pavement and explain the functions of different layers of flexible pavement. [6]  
b) An existing single lane gravel road has to be upgraded by bituminous pavement for a specified length as it is the demand for catering the increment in volume of heavy traffic. In order to estimate the base traffic, traffic survey was carried out at two points on the existing roads. The pavement design is based on the following assumptions. [10]  
i) Base traffic of 82 kN equivalent single axle load (ESAL) =  $1.888 \times 10^3$  ESAL per day  
ii) Design period = 10 years  
iii) Construction period = 18 months  
iv) Growth rate = 6%  
v) 87.5 percentile CBR value of sub-grade soil from 7 sample locations = 5%  
vi) Elastic modulus of asphalt concrete for surface course  $E_{ac} = 2000$  MPa  
vii) Elastic modulus of crushed stone base  $E_{base} = 250$  MPa  
viii) Elastic modulus of granular sub-base  $E_{subbase} = 125$  MPa  
You are asked to design the pavement by Asphalt Institute Method. Draw the cross section of final pavement layers considering the minimum thickness of asphalt concrete on surface course where is equal to 50mm. Chart is provided.

4. a) Explain the features of mass-haul diagram with neat sketches. Describe free haul, over-haul and economic-haul. [8]
- b) Write down the explanatory note on bituminous constructions types: interface treatment; surface dressing; premixed carpet; asphalt concrete. [2x4]
5. a) Write down the methods of structural evaluation of pavement. A number of deflection readings were taken on a pavement. The mean and standard deviation were 1.5 and 0.2 respectively. The allowable deflection is 1.0mm. Determine overlay thickness. [2+6]
- b) Classify the bridges according to their structure, material and loading. Draw a sketch of the bridge with all its components. [4+4]
6. Write short note on (any four): [4x4]
- a) Traffic flow parameters
  - b) Maintenance in bituminous road
  - c) Construction procedure of WBM road
  - d) Importance of lighting in tunnel
  - e) Reverse or tidal flow operation

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Full-Depth Asphalt Concrete



Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / 1	Time	3 hrs.

**Subject: - Estimating and costing (CE705)**

- ✓ 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.

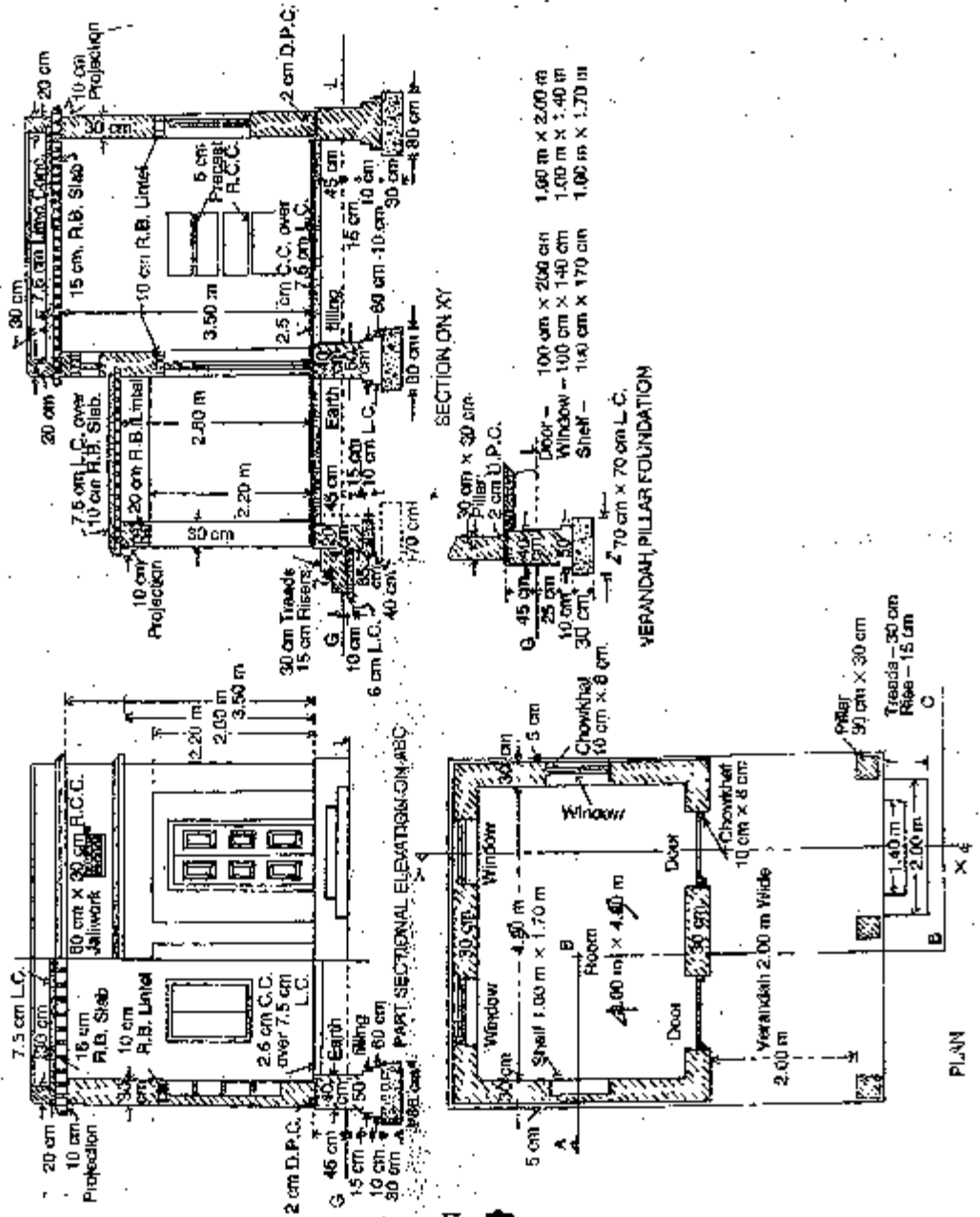
1. Explain with example process of preparation of a preliminary estimate of a office building. [5]
2. a) Explain with neat sketches to workout quantity of semi-circular arch (span, thickness and rise of arch given). [4]
  - b) Prepare tables of quantify sheet and abstract cost for a residential building. [3]
  - c) What is Bill of quantities? State its importance. [3]
3. List most common units of measurement and payment for civil works and sanitary works (at least five from each). [5]
4. a) Prepare materials required for an items of brickwork in cement mortar (1:4). Size of brick is 230mm×110mm×55mm, with mortar joint 10mm. [6]
  - b) Prepare rate analysis for 20mm thick cement sand plaster (1:4) in wall per 100m<sup>2</sup>. [6]
  - c) Explain various factors which affects the rate analysis. [6]
5. Define project. Discuss estimate of irrigation project. [5]
6. a) Estimate detailed quantities for the following items form attached building drawing:
  - i) Earth work in excavation in foundation [4]
  - ii) Brick work in cement sand (1:6) mortar up to plinth [4]
  - iii) 40 mm thick sal work wood paneled door shutter [4]
  - iv) 12 mm thick inside cement plaster (1:6) [4]
- b) Calculate the quantities of earthwork of a portion of hill road from the following data: [12]
 

Formulation width = 8m, side slope in cutting and filling = (1:1) and (2:1)

Distance	Depth of cut	Depth of fill	Cross slope of ground
0 m	0.30	-	10:1
30 m	0.20	-	15:1
60 m	-	0.50	12:1
90 m	-	0.70	8:1

- c) Workout the quantity of well foundation of a bridge. The well is to be circular of 4.5 meter internal diameter with 800 mm wall in 1:6 cement and sand mortar. The well to be founded on strata 15 meter below bed of river which is dry during the hot weather. Bottom of the well to be plugged with 1.0 meter thick cement concrete 1:4:8 and the top to be sealed with 0.75 meter thick cement concrete 1:4:8 and central portion is to be sand filled. [9]

# SINGLE ROOM BUILDING WITH FRONT VERANDA



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

**Subject: - Estimating and Costing (CE705)**

- ✓ 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. a) What are the purposes of Estimating and Costing? Explain the data required for Estimating. [3+5]
- b) Explain in short the various methods of taking quantities in building works. [4]
2. a) What do you understand by approximate estimate? When do you need revised estimate? And Why? Explain. [4+4]
- b) What are the purposes of Rate Analysis? Prepare Rate analysis of the following: [4+4+4]
  - i) 1<sup>st</sup> class brick work is 1:6 C.S mortar per m<sup>3</sup>
  - ii) 25 mm thick premix carpeting per m<sup>2</sup> W.C. commode low level cistern per no.
3. a) What are the works that an estimator has to take account in project estimate? Explain. [6]
- b) Find out the quantities of the following items of work of a T-beam seeking of a bridge with 6 m span and 45 cm bearing at ends. [5+3]
  - i) RCC work (1:2:4) excluding steel
  - ii) Cement concrete (1:2:4) in wearing coat
4. Prepare a detailed estimate of the following items of work of a building (drawing attached here with) [5+4+5]
  - i) Earth work in excavation
  - ii) RCC (1:3:6) in foundation
  - iii) Brick work is 1:6 c.s mortar in foundation and plinth
5. Estimate the quantities of earthwork for a portion of a hilly road from following data: [10]
 

Formation width = 10 m  
Side slopes in cutting = 1:1 and in Banking = 2:1 (H.V) length of chain = 30 m

Chainage:	12	13	14	15
Depth of cut:	0.4	0.2	-	-
Ht. of Banking:	-	-	0.3	0.5
Transverse slope of ground:	1:10	1:12	1:10	1:8
6. Calculate the quantity of earth work for a portion of channel with the following data: [10]
  - Bed width = 3 m
  - Free Board = 0.44 m
  - Side slope for digging = 1:1
  - Side slope for Banking = 1: 1½ (V:H)
  - Fully supply depth = 1 m
  - Top width of bank = 1.5 m

Chainage:	0	30	60	90	120	150
RL of GL:	225.24	224.8	224.43	224.12	224.5	224.98
Proposed level:	224.00	223.94	223.88	223.82	223.76	223.7

Also draw a typical X-section.





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

**Subject: - Estimating and Valuation**

- ✓ 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. a) How are the following items of work measured? What are their units of measurement and payment? (i) Pointing work (ii) Steel reinforcement [3]
- b) Explain what do you understand by: (i) Bill of quantities (ii) Contingency [3]
- c) Explain why approximate estimate of any structure is done before the detailed estimate and final cost is worked out? [4]
2. Describe how will you prepare a detailed cost estimate of a building. [4]
3. a) What do you mean by analysis of rates? What are the requirements of rate analysis? [2]
- b) Calculate the quantities of materials required for the following items of work: [2×3]
  - i) 105m<sup>3</sup> of PCC (1:4:8) in foundation
  - ii) 725m<sup>2</sup> of 20mm thick cement plaster (1:4) in wall.
- c) Prepare an analysis of rate of brick masonry in (1:5) cement mortar in super structure. Assume size of brick 240 × 130 × 65mm and thickness of mortar joint is 12mm. [4]

**OR**

Prepare an analysis of rate for 40mm thick asphalt concrete wearing coat per 10m<sup>2</sup>.

- d) Prepare an analysis of rate for W.C. commode with low level cistern. [4]
  4. a) What are the factors which should be kept in mind while evaluating fair and reasonable value of the property? [4]
  - b) Discuss the various methods of valuation of the property. [4]
  - c) Workout the valuation of a cold storage with the following data: [8]
    - i) Cost of land = Rs. 20,00,000.00
    - ii) Gross income per year = Rs. 95, 00, 000.00  
Expenses incurred per year are as follows:
      - iii) Staff salary, electricity charges at the rate of 25% of gross income.
      - iv) Repair and maintenance of machinery, plants, equipments etc at the rate of 5% of their capital cost, which is Rs. 15,00,000.00.
      - v) Sinking fund for machinery, plants etc with 25 yrs life at the rate of 4% after allowing 10% scrap value.
      - vi) Insurance premium per year is Rs. 15,000.00
- Assume year's purchase for 60 yrs at the rate of 8% and redemption of capital at the rate of 4%.

5. a) Estimate the quantity of Earthwork of a portion of road from the following data: [8]

Formation width of the road = 10m

Side slope in banking = 2:1 (H:V.) Side slope in cutting = 1:1

Downward grade 1 in 120 from distance 0 to 30m while it remains in level from distance 30m to 90m and have again upward grade 1 in 90 from distance 90 to 120m.

The formation level at distance 60m = 1197.50m.

The ground levels of the centre line of road are as under:

R.L. of ground	1198.65	1196.40	1199.30	1200.40	1198.10
Distance in m.	0	30	60	90	120

- b) Work out the quantity of Earth work in cutting and filling of a portion of a hill road as per data given below: [10]

Cross slope = 1 in 5

Formation width = 8m

Side slope in cutting = 1:1

Side slope in filling = 2:1

R.L. of formation	699.20	702.20	704.20
R.L. of ground	698.80	700.00	706.20
Distance(m)	0	30	60

6. Estimate the quantity of the following items of work from the accompanying building drawings: [3+5+4+4]

- i) PCC (1:3:6) in foundation
- ii) Brick work in (1:6) cement mortar in foundation and plinth.
- iii) Salwood work for doors and windows frame
- iv) PCC M20 for R.C.C. slab

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

**Subject: - Estimating and Valuation**

- ✓ 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. a) What is an estimate? What is meant by <sup>quantity</sup> quality survey? Distinguish between estimated cost and actual cost. [3]
- b) What is meant by analysis of rate? What are the factors which affect the rate analysis? [3]
2. a) Prepare a preliminary estimate of two storied health post building to get administrative approval of Ministry. Data are given as below. [6]  
30% built up area is occupied by circulation space.  
10% built up area is occupied by walls.  
Plinth area rate is Rs. 18000.00/sq.m.  
Extra cost for interior design 1% of building cost.  
Extra cost for electrical installation 8% of building cost.  
Extra cost for other service 5% of building cost.  
Contingency = 5%  
Supervision charge = 3%
- b) How are the following items of work measured? [4]
  - i) Plaster work
  - ii) Cornice work
- c) Write short notes on: (any three) [3×2]
  - i) Overhead charge
  - ii) Task or out turn of work
  - iii) Salvage value and scrap value
  - iv) Sinking fund
3. a) Prepare an analysis of rate for M20 (1:1½:3) for RCC work per 10m<sup>3</sup>. [6]
- b) Calculate the quantities of materials required for following works: [2×4]
  - i) 10m<sup>3</sup> brick masonry in 1:6 cement mortar
  - ii) 10m<sup>3</sup> PCC (1:3:6) in foundation
4. a) Why valuation of property is required? Differentiate between obsolescence and depreciation. [5]
- b) Mention the various data you will need to collect as a valuator for land valuation. [4]

- c) A town planning authority has to acquire an area of  $4,50,000\text{m}^2$  for the development of a new colony. After developing the area it is proposed to be sold at a rate of Rs. 40.00 per  $\text{m}^2$ . Work out the maximum compensation which shall be given to the land owners, whose land is to be acquired, assuming:

[7]

- i) The town planning authority's establishment charges @ 15% on the sale price.
- ii) 35% area is to be provided for roads, parks and other public amenities.
- iii) Colony improvement expenditure @ Rs. 6.00 per  $\text{m}^2$ .
- iv) Engineer's and Architect's fee for surveying and planning the colony @ 4% on the sale of plots.

5. a) Estimate the quantity of earthwork in cutting and filling from the following data for a portion of road.

[7]

Formation width = 10m

Side slope in banking = 2:1

Side slope in ~~banking~~ <sup>cutting</sup> = 1:1

Chainage	Depth of cutting (m)	Height of filling (m)	Cross slope of ground
0	0.60	—	10:1
20	0.30	—	8:1
40	0.50	—	12:1
60	—	0.35	10:1
80	—	0.70	12:1

- b) Find out the quantity of earthwork of a portion of road to be constructed with the following data:

[7]

Formation width of the road throughout = 10m

Side slope in banking (2:1) and side slope in cutting (1:1)

Downward grade 1 in 120 from distance 90m to 120m. While it remains in level from distance 120m to 180m and have again upward grade 1 in 90 from distance 180m to 210m.

The formation level at distance 180m = 1197.50m.

The ground levels are as under

R.L. of ground	1198.65	1196.40	1199.30	1200.40	1198.10
Distance (m)	90	120	150	180	210

6. Estimate the quantities of the following items of work from the accompanying drawing.

[14]

- a) Earthwork in excavation
- b) Cement concrete
- c) 1<sup>st</sup> class brick work
- d) RCC work

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

**Subject: - Estimating and Valuation**

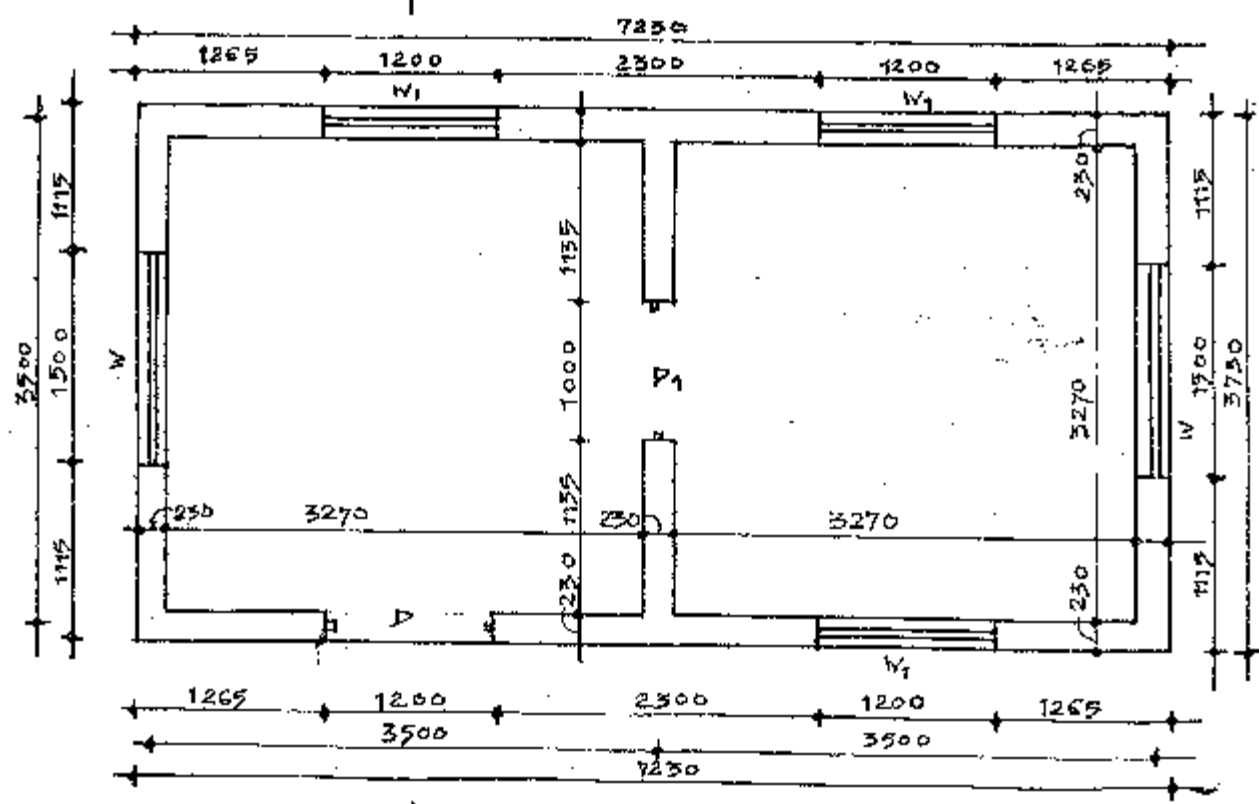
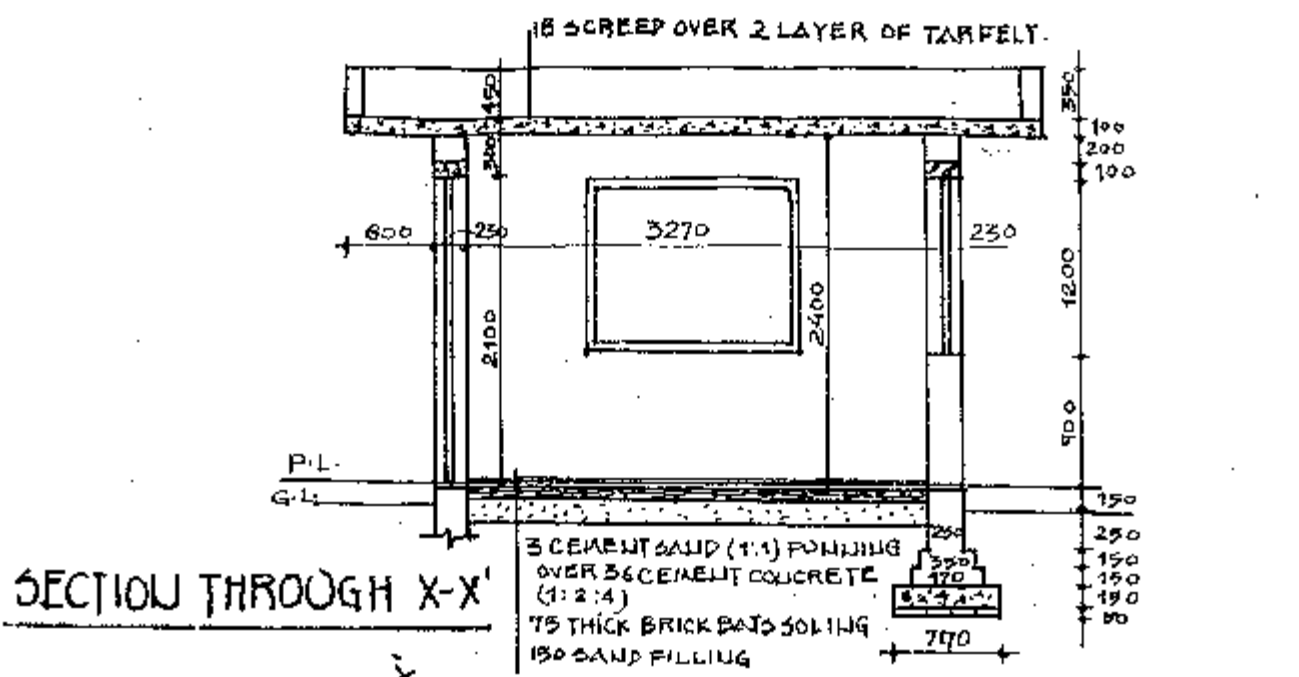
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ **Necessary figures are attached herewith.**
- ✓ Assume suitable data if necessary.

1. a) Describe how will you prepare a preliminary estimate of a government office building for administrative approval of government including external services. The external services should be specified [5]
- b) How are the following items measured? [5]
  - i) Plaster work
  - ii) Cornice work
2. a) Prepare an analysis of rate for p.c.c (1:3:6) pr  $m^3$ . [6]
- b) Calculate the quantities of materials required for the following works: [10]
  - i)  $150m^3$  of brick work in (1:4) cement mortar in super structure
  - ii)  $120m^2$  of 20mm thick cement sand plaster(1:4)
3. a) Distinguish clearly between: [6]
  - i) Value and cost
  - ii) Salvage value and scrap value
  - iii) Cost based method of valuation and development method of valuation
- b) A building is situated in a town on a land measuring  $600m^2$ . The area of the built up portion is  $20m \times 15m$ . The building is provided with water supply, sanitary and electrical fittings and is of very sound construction and the life of which may be assumed as 100 yrs. Work out the valuation of the property, if the age of the building is 30 yrs. The prevailing built area rate is Rs 15000.00 per  $m^2$  and value of land is Rs 500.00 per  $m^2$  *plinth* [10]
4. a) Find out the quantity of earth work of a portion of road to be constructed with the following data: [10]
 

Formation width of the road = 10m  
 Side slopes in banking and cutting = (2:1) and (1:1)  
 Downward grade 1 in 120 from distance 90 to 120m while it remains in level from distance 120 to 180m and again upward grade in 1 in 90 from distance 180 to 210m.  
 The formation level at distance 150m = 1197.50

R.L. of ground	1198.65	1196.40	1199.30	1200.40	1198.10
Distance (m)	90	120	150	190	210
- b) Calculate the quantity of earthwork in cutting and filling in a portion of a hill road from km 8.50 to km 9.00 having cross slope (transverse slope) of ground in 5 with the following data. [10]
 

Formation width of road = 8m  
 Side slope in cutting = (1:1)  
 Side slope in filling = (2:1)  
 Depth of cut at centre line at km 8.50 = 40cm  
 Depth of cut at centre line at km 9.00 = 80cm
5. Estimate the quantities of the following items of work from the accompanying drawing: [18]
  - a) Earth work in excavation in foundation
  - b) Brick work in foundation and plinth
  - c) Inside wall and ceiling cement plaster
  - d) Brick work in superstructure



PLAN.

DOORS AND WINDOWS SCHEDULE

- D - 1200 x 2100
- D1 - 1000 x 2100
- W - 1800 x 1200
- W1 - 1200 x 1200

Exam. Level	Regular / Back		
	BE	Full Marks	80
Programme	BCF	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Estimating and Valuation**

- ✓ 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. a) What are the purposes of estimating? 'An estimate is never the actual cost of the work', justify your answer. [5]
- b) What are the different types of estimates? How do they differ from each other? [5]
2. a) Prepare a preliminary estimate of a 4 storied office building having total carpet area of 2000m<sup>2</sup> for obtaining the administrative approval of the ministry. Given the following data. 30% built up area will be taken up by corridors, verandah, toilets, staircase etc and 10% of the built up area will be occupied by walls. [7]
 

Plinth area rate is Rs. 15000/sqm  
 Extra for special architecture treatment 1.5% of building cost  
 Extra for electrical installation 8% of building cost  
 Extra for other services 5% of building cost  
 Contingencies 5% of building cost  
 Supervision charge 5% of building cost
- b) Write short notes on (any three): [6]
  - i) Approximate estimate
  - ii) Revised estimate
  - iii) Centre line method
  - iv) Capitalized value
3. a) Prepare an analysis of rates for supplying and laying premix asphalt concrete per m<sup>2</sup>. [7]
- b) Calculate the quantities of material required for following works. [10]
  - i) 100m<sup>2</sup> cement sand plaster 12mm thick in (1:6)
  - ii) 100m<sup>3</sup> P.C.C. (1:2:4)
4. a) You have been asked to prepare a valuation report of land for a security of loan. Describe various data which you will collect as a valuation. [5]
- b) A 4 storey building has just completed at a cost of Rs. 40,00,000. The building is constructed on a plot of 19 aana purchased for Rs. 25,00,000 in 2060. The prevailing rate of plots in the locality is Rs. 32,00,000 per ropani. Work out the standard rent per floor per month assuming the following outgoings. [10]
  - i) Municipal tax 25% of ratable value
  - ii) Collection and management charge @ 3% of gross rent
  - iii) Repairs at 1% on 9/10<sup>th</sup> cost of construction
  - iv) Sinking fund @ 5% for 65 years on 90% cost of construction
  - v) Miscellaneous expenses @ Rs. 500 per month



5. a) Estimate the quantity of earth work for a portion of road, when formation width is 10m. Side slope in cutting and filling are 1:1 and 2:1 respectively. [5]

				Distance
0m	30m	60m	90m	

				R.L.G
100m	110m	111m	112m	

				R.L.F
100m	upward grad (1:100)			

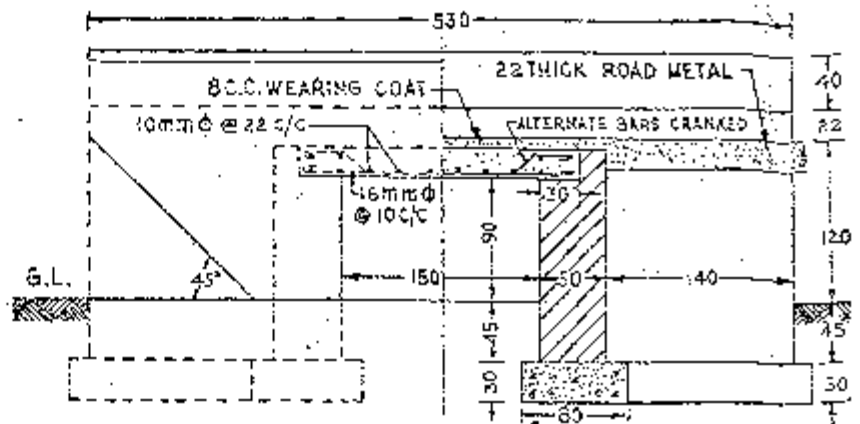
- b) Find out the quantity of a hilly road when the following data are given: formation width is 10m. Side slope in cutting and filling are (1:1 and 2:1) respectively. [6]

Chainage	Depth of cutting at centre line	Cross slope of ground
0	0.5m	10:1
30	0.30m	12:1
60	1.00m	10:1

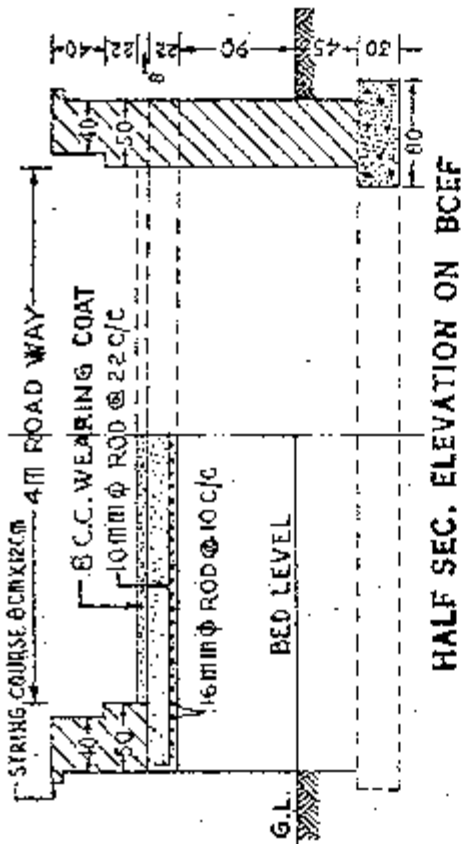
Draw cross section at each point.

6. Estimate the quantities of the following items of work from the accompanying drawing. [14]
- Earthwork in excavation
  - Cement concrete in foundation
  - Brick work
  - RCC work

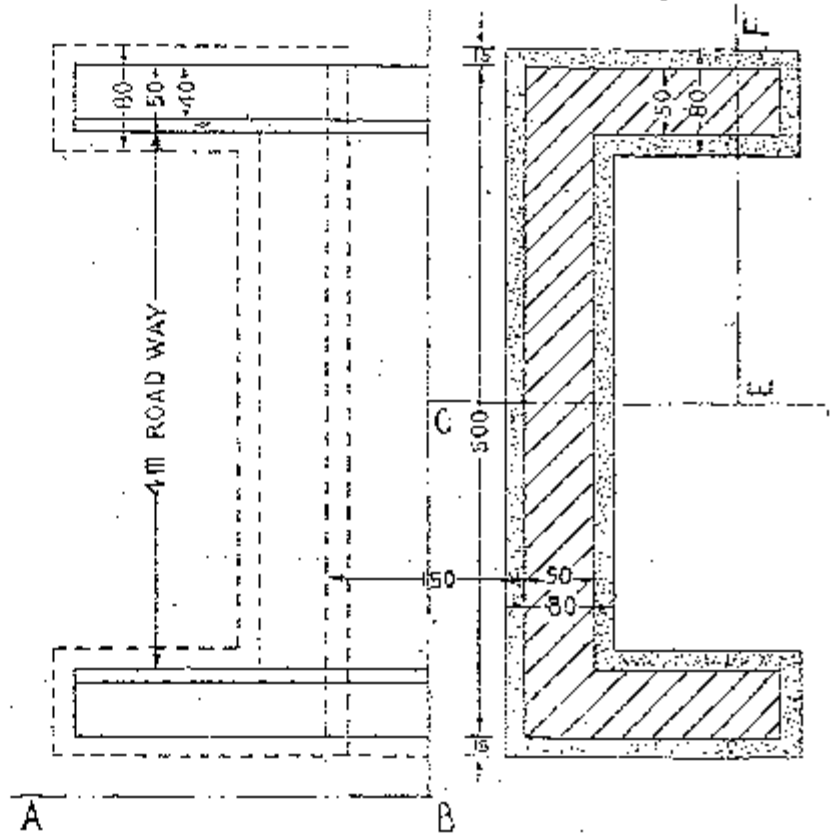
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HALF SEC. ELEVATION ON ABCD



HALF SEC. ELEVATION ON BCEF



HALF SECTIONAL PLAN

All dimensions in centimetre

*CSG Bhadra*  
*Checking & redaction*

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

**Subject: - Estimating and Valuation**

- ✓ 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 figure is attached herewith.
- ✓ Assume suitable data if necessary.

1. a) What is an estimate, why it should be prepared before construction work? What are the requirements of estimating? [5]
- b) Under what circumstances different types of estimate is prepared? Describe each of them with conditional examples. [5]
2. a) Prepare a preliminary estimate of a two storied VDC's office building to get administrative approval of district development committee having carpet area 500m<sup>2</sup>. 30% of the built up area is occupies by circulation element and 10% of built up area is occupies by walls. Plinth area rate for civil work is Rs. 10,000 per m<sup>2</sup> cost of water supply, sanitary and electrification is 15% of civil cost. Cost of other services is 10% of civil cost. Departmental charge 8% of total cost. [7]
- b) Write short notes on (any three) [3×2]
  - i) Contingency
  - ii) Bill of quantities
  - iii) Distress value
  - iv) Depreciation
3. a) Prepare an analysis of rates for doors and window frame per m<sup>3</sup>. [7]

**OR**

Prepare an analysis of rates for supplying and laying W.C. commode with low level cistern.

b) Calculate the quantities of materials required for [2x5]

- i)  $10\text{m}^3$  Brick masonry in 1:4 cement mortar
- ii)  $100\text{m}^3$  PCC 1:3:6 in foundation.

4. a) Mention various method of valuation and under what circumstances each one is prepared? [5]

b) A 4 story building having a cubic content of  $400\text{m}^3$  was constructed 25 yrs ago on a freehold land measuring  $500\text{m}^2$ . The building fetches a rent of Rs. 25,000.00 per month. What amount will you recommend for advancing a loan to the owner against mortgage if the rate of land in that area is Rs. 2000.00 per  $\text{m}^2$ . Assume the following outgoing: [10]

- i) Municipal and property taxes @ 30% of gross rent.
- ii) Collection and management charges @ 3% of the gross rent.
- iii) Repairs and maintenance @ 8% of gross rent. Assume the future life to be 65 yrs. Rate of interest as 8% and for redemption of capital 4%.

5. Estimate the quantity of earthwork in cutting and filling from the following data for a portion of road 80m length. [10]

Formation width – 10m  
Side slopes in banking 2:1  
Side slopes in cutting 1:1

Change	Depth of cutting at centre line	Height of banking	Cross slope of ground
0m	0.60	—	10:1
20m	0.70	—	12:1
40m	0.50	—	15:1
60m		0.30	12:1
80m		0.70	10:1

6. Estimate the quantities of the following items of work from the accompanying drawing. (Aqueduct) [15]

- a) Earthwork in excavation
- b) Cement concrete in foundation
- c) Brick work
- d) RCC work

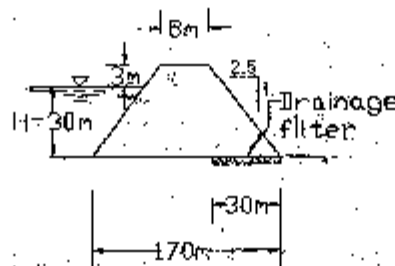
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Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Hydropower Engineering (CE704)**

- ✓ 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. Discuss about the advantages and disadvantages of hydropower projects comparing to other sources of energies. [6]
2. What are the different stages of hydropower development? Explain the working principle of peaking run off river plant and show general arrangements of components with neat sketches. [2+3+3]
3. a) What do you mean by sediment yield and life of a reservoir? Explain various remedial measures that help to reduce the reservoir sedimentation. [1+3]
  - b) A hydropower plant receives design discharge of  $25 \text{ m}^3/\text{s}$  from  $150 \text{ m}$  height. The annual output of the plant is  $220 \text{ GWh}$ . If the peak load demand is  $30 \text{ MW}$ , determine (i) annual load factor (ii) Capacity factor and (iii) Utilization factor. Assume overall efficiency of the plant equals to  $85\%$  and neglect head loss in the penstock. [2+2+2]
4. a) Following Figure shows the cross-section of an earthen dam having coefficient of permeability  $1 \times 10^{-6} \text{ m/s}$ . Calculate the seepage discharge through the body of the dam with the help of phreatic line. [8]



- b) Write the purpose of use of filter material in earthen dam. Explain its design principle. [4]
- c) What are the factors to be considered in the dam site evaluation? Describe the different failure modes of a gravity dam? [4+4]
5. a) Find the dimensions of a settling basin for a high head project of Himalayan River which utilizes a discharge of  $60 \text{ m}^3/\text{s}$  and a gross head of  $100\text{m}$ . The sediment size to be removed is up to  $0.15 \text{ mm}$ . Consider the turbulence effect also. Draw the plan and section. [5+2]
  - b) What are the requirements of good intake? Explain different types of intake used in hydropower projects in Nepal with neat sketches. [2+3]

6. a) Describe advantages and disadvantages of different tunnel shapes based on geometry with neat sketches. [4]
- b) In a hydropower project, the headrace tunnel of 4.5 m diameter and 2,500 m length carries  $25 \text{ m}^3/\text{s}$  discharges to the surge tank of 10 m diameter. The penstock from surge tank to power house has 3.5 m diameter and 1000 m length. Considering the case of instantaneous closure, find the maximum height of surge tank required and time period of oscillation of wave. Assume friction factor = 0.02. [8]
7. a) Determine the size and setting height of the Francis turbine for a site having net head of 150 m, discharge is  $160 \text{ m}^3/\text{s}$  and efficiency of 85%. [4]
- b) Water is being supplied to a pelton wheel under a head of 300 m through a 100 mm diameter pipes. If the quantity of water supplied to the wheel is  $1.50 \text{ m}^3/\text{s}$ , find the number of jets in the wheel. Assume coefficient of velocity is 0.96. [4]
8. What are the different types of power houses used in hydropower? Explain their relative suitability considering the field conditions. [4]

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

**Subject: - Hydropower Engineering (CE704)**

- ✓ 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. Discuss the advantages and disadvantages of hydropower over other sources of energy. [3+3]
2. Differentiate between pre-feasibility and feasibility studies of a hydropower project with explaining the site specific hydrological and topographical investigations. [8]
3. a) A hydropower project is planned to develop in a Nepalese River having net head of 150 m, turbine efficiency of 90% and generator efficiency of 95% with the monthly hydrograph as shown below: [3+2+3]

Months	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Q (m <sup>3</sup> /sec)	100	80	60	50	40	30	40	50	70	110	150	120

As an environmental flow, a minimum flow of 10% of each month is mandatory.

If the storage project is designed with full regulation of annual hydrograph find out: the capacity of the reservoir, installed capacity of the power plant, and annual energy generation.

4. a) Design an elementary profile of a gravity dam made of stone masonry using following data: [8]
  - R.L of base of dam = 198 m
  - HFL = 228 m
  - Sp. gravity of masonry = 2.4
  - Safe compressive stress in masonry = 1200 KN/m<sup>2</sup>
  - tan  $\phi$  = 0.70
  - Seepage coefficient = 1
- b) Show with neat sketch, various seepage control measures in embankment dam. [6]
- c) Discuss with sketch the arrangement and suitability of 3 different types of spillways used in a headworks. [2+3]
5. a) Differentiate between pressurized and non-pressurized intakes in RoR system. [3]
- b) Design the settling basin from the particle size and concentration approach and calculate the trap efficiency from the following data. (Refer figure 3 & 4) [8]
  - Design discharge = 80 m<sup>3</sup>/s
  - Number of basin = 2
  - Installed capacity of the plant = 110 MW
  - Water temperature = 12°C
  - Particle size to be removed = 0.2 mm
  - Manning's constant (n) = 0.01
  - Flushing discharge = 1 m<sup>3</sup>/s
  - (If flushing system is continuous)

Assume other necessary data if needed. If the flushing system is changed to intermittent with single basin what are the changes, describe with suitable reason.
- c) What are minimum performance standards of the sound headworks. [3]

6. a) Design a forebay using following data sets: [4]
- $Q = 15 \text{ m}^3/\text{s}$
  - Storage requirements = 4 minutes
  - Length of penstock = 500 m
  - Diameter of penstock = 2 m
- b) Discuss various tunneling methods used in Hydropower projects. What is the purpose of shotcreting? Discuss the procedure. [4+2+2]
7. Design a pelton wheel turbine for a hydropower plant having net head of 310 m and discharge of  $5 \text{ m}^3/\text{s}$ . Take the efficiency of the turbine as 90%. What will be the specific speed of such turbine? [7+1]
8. Describe with sketch different types of power house and their general arrangement. [4]

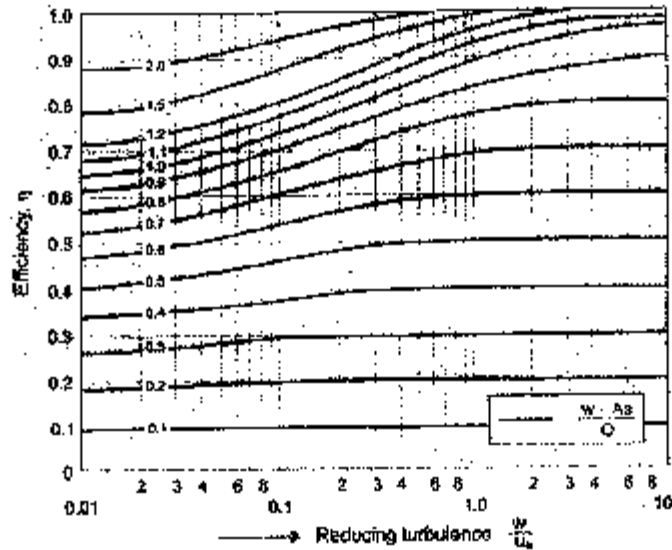


Figure 3: Camps Diagram

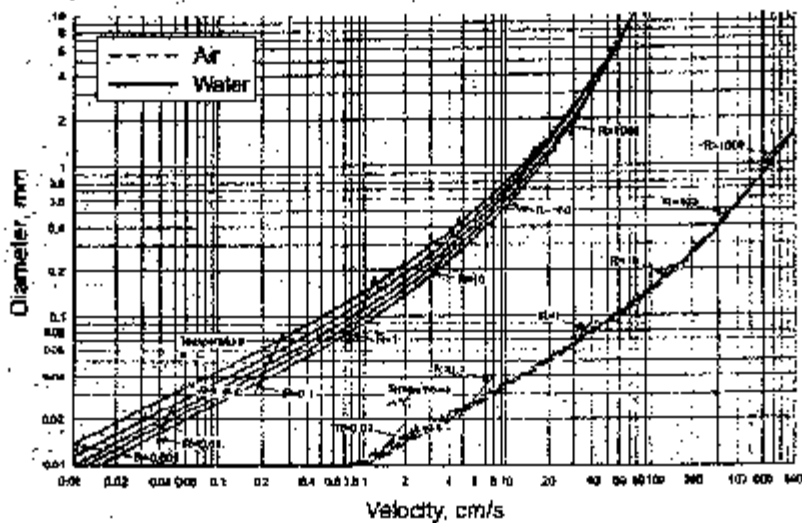


Figure 4: Fall velocity of quartz spheres in water and air after Rouse



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

**Subject: - Hydropower Engineering (CE704)**

- ✓ 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. a) "Most of the political parties of Nepal are determined to avoid Load Shedding during 5 years in their manifesto" Do you agree with their commitment during this period? What approach need to be taken for hydropower development in Nepal to meet the demand rate up to 2020. [2+3]
- b) Explain site specific hydrological, geological and topographical investigations to be carried out during the pre feasibility study level of a hydropower project. [5]
2. Hydropower project is planned to develop in a river having net head of 100 m and overall efficiency of 85% with the monthly hydrograph as shown below.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Discharge	180	120	140	300	320	1800	2000	2500	2100	900	500	300

- i) Calculate installed capacity, annual spill energy and firm energy if RoR project is designed based on the 40% probability of exceedence flow. [2+2+2]
- ii) If the storage project is developed with full regulation of annual hydrograph (design discharge is equal to average monthly flow), Calculate the storage requirements. [2]
- iii) Calculate the installed capacity and annual energy generation from the storage project as mentioned in above case. [2+2]
3. a) Show that the resultant force in a concrete gravity dam should pass within the middle third of the base width in order to avoid tension in the heel. [6]
- b) Design a hydraulic jump stilling basin at the toe of the spillway with the following data; [9]
  - Discharge = 80 m<sup>3</sup>/s
  - Width of the spillway = 8m
  - Spillway crest level = 96.00m
  - River bed level = 65.00m
  - Tail water level = 71.00 m
  - Coefficient of discharge = 0.7
  - Downstream bed slope (i) = 1.500 and Manning's roughness coefficient = 0.016 and ratio of length of stilling basin and sequent depth = 5.1
- c) Explain very briefly three types of gates and its working mechanism with sketches widely practiced in hydropower projects in Nepal. [1+3]
- d) Determine the seepage discharge for the earthen dam having 33 m total height with 3m width impervious central core. Fake top width of the dam is 7m and freeboard 3m. The coefficient of permeability of dam material is  $4 \times 10^{-6}$  m/sec and that of impervious core is  $4 \times 10^{-9}$  m/sec. The upstream and downstream slope of the dam is 3:1 and 2.5:1 respectively. [5]

4. a) Find out the dimension of a continuous flushing settling basin for a high head project in Himalayan River which utilizes a discharge of  $60 \text{ m}^3/\text{s}$  and head of  $300 \text{ m}$  the sediment particles larger than  $0.15 \text{ mm}$  have to be trapped efficiency  $95\%$  in the basin. Consider the effect of the turbulence and check the length of basin using Valikanov's relation of the density of the silty water of  $1.105 \text{ ton/m}^3$ . Draw plan and section of the basin showing major components. [6+3]
- b) Explain the general requirements of a functional ROR headworks. [3]
5. a) What do you mean by hydraulic design of tunnel? Explain the selection criteria of tunnel alignment. [2+2]
- b) What are the design considerations of Forebay? Design a Forebay with turbine discharge  $12 \text{ m}^3/\text{sec}$ , water is conveyed from Forebay to powerhouse by two number of penstock of  $2 \text{ m}$  diameter each. Take retention time  $3 \text{ minute}$  and limiting velocity  $0.2 \text{ m/sec}$ . [2+4]
- c) Why restricted orifice type is more efficient than simple cylindrical type. [2]
6. a) Design specific speed, turbine diameter and setting of the Francis turbine in a hydropower project having net head of  $150 \text{ m}$  and design discharge of  $25 \text{ m}^3/\text{sec}$ . Take turbine efficiency  $81\%$ . [2+2+2]
- b) What are the conditions Francis turbines are preferable than Pelton turbine? [4]

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Exam.	New Batch (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Hydropower Engineering (CE704)**

- ✓ 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. List out the major features of Hydropower Development policy 2001. Is the policy able to attract private sector? Write your comments. [6]
2. a) Drawing neat sketch (plan and section with all components), discuss the principal characteristics of diversion type storage hydropower plant. [4]
- b) Highlight the major studies and investigations carried out during reconnaissance, prefeasibility and feasibility studies. [4]
3. The mean monthly flow of a typical Nepalese river is as follows: [2+4+2]

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Q (m <sup>3</sup> /s)	80	74	83	100	130	222	600	800	590	240	120	100

- i) Calculate the installed capacity of a plant based on minimum flow of the river without pondage (if the plant is designed for pure run of river plant) with net head of 200 m and overall efficiency of a plant is 85%.
- ii) The plant has three sets of units (turbine and generator) such that one unit with full capacity is operated during off peak hour. If the plant is designed for a peaking plant with 4 hour peaking (morning 2 hour and evening 2 hour), what will be the installed capacity of a plant?
- iii) What will be the increase in benefit from peaking if peak hour energy rate is Rs 12/kWh and off peak energy rate is Rs 6/kWh during minimum flow month?
4. a) A concrete gravity dam on the rocky foundation is acted by the upstream horizontal hydrostatic force of 4.50 million KN and by the downstream the same of 0.50 million KN. Determine the volume of concrete works ( $\rho_{\text{concrete}} = 24 \text{ KN/m}^3$ ), neglecting bond stress and up lift force and taking a factor of safety on the horizontal thrust of 2.5 and a friction coefficient between the concrete and rock of 0.65. [8]
- b) Write with necessary sketch and their hydraulics, any three types of spillways used in a head works of a hydropower plant. [6]
- c) Explain causes of failure of earthen dam. What criteria do you adopt for safe design of earthen dam? [2+4]
5. a) Discuss the requirements of a functional R/R headworks. Drawing a typical plan of such headworks, discuss how these requirements are fulfilled. [2+3]
- b) Find out the dimension of a settling basin with turbulent flow for a high head hydropower plant, which utilizes a discharge of 40 m<sup>3</sup>/s. The sediment particles coarser than 0.15 mm ( $w = 1.5 \text{ cm/s}$ ) have to be trapped in the basin. Draw plan and sections (cross and longitudinal) showing major components and flushing arrangement. [3+3]
- c) If you have allocated about 10% volume for sediment storage and overall trapping efficiency of settling basin is 40%, find out the frequency of flushing of settling basin, when the sediment concentration is 2000 ppm. [3]

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6. a) The design discharge through the tunnel of a hydropower project is  $60 \text{ m}^3/\text{s}$  is conveyed by three number of penstock to the turbine of 2 m diameter each. Take the length of tunnel is 7 km, diameter of tunnel is 10 m, friction factor of tunnel is 0.016, friction factor of penstock = 0.04 and velocity of wave in penstock = 1800 m/sec. If the surge tank of 30 m diameter has been provided at the end of the tunnel, find the following: (i) maximum up-surge and down-surge in the tank (ii) water hammer pressure (iii) Time of oscillation of wave. [4+2+2]
- b) Discuss with sketch, types of tunnel supports and their necessity? [3+1]
7. What do you mean by setting of turbine? The pipe line 1200 meter supplies water to 3 single jet pelton wheels. The head above the nozzle is 360 m. The velocity coefficient for the nozzle is 0.98 and the coefficient of the friction for the pipe line is 0.02. The turbine efficiency is 0.85. The specific speed of turbine is 15.3 rpm and loss head is 18 meter in pipeline due to friction. If the operating speed of each turbine is 560 rpm, determine (i) Total power developed (ii) Discharge (iii) Diameter of each jet and diameter of pipe line. [2+6]
8. Drawing a section of vertical axis Francis turbine in a powerhouse, show the different parts of powerhouse structure. [4]

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

**Subject: - Hydropower Engineering (CE704)**

- ✓ 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 objectives of Hydropower Development Policy 2001? Explain five main features provisioned in Hydropower Development Policy 2001 for the development of hydropower in Nepal. [3+3]
2. a) Prepare a three alternative layouts plan and sectional drawings of the ROR Hydropower plants. [6]  
 b) What are the stages of hydropower development cycle? [2]
3. The stream flow record for a hydropower development site is given below. Draw a flow duration curve and determine firm and secondary energy if the available head is 60 m design discharge capacity is  $45\text{m}^3/\text{s}$  and overall efficiency is 82%. [8]

Months	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Q( $\text{m}^3/\text{s}$ )	30	38	28	22	16	32	56	72	54	46	38	36

4. a) Draw uplift pressure diagram (i) for dam holding 50 m water depth at upstream vertical face with top and bottom width 10 m and 30 m respectively. Uplift may be considered to be acting an 60% of the area of section. Tail water depth is 5 m. (ii) for the same dam there is a drainage gallery at 6 m from face. [3+2]  
 b) The u/s and d/s slope of a homogeneous earthen dam with 12m toe drain are 2:1 and 3:1 (H:V) respectively. The water depth at u/s of dam is 50m. The dam has a crest width of 20m and free board is of 5m. The coefficient of permeability of dam material is 2.5 cm/hr calculate (i) Specific discharge through the body of dam (ii) co-ordinate of phreatic line. [10]  
 c) With appropriate drawings illustrate the general arrangement of intake for storage plants. [5]
5. a) How are the control of bed load and floating debris in ROR intake done? Explain with appropriate plan and sectional drawings of the system. [6]  
 b) Compute the dimension of periodic type settling basin considering and without considering the turbulence effect for a hydropower plant through settling theory. Take,  
 Settling velocity = 6 cm/sec  
 Discharge =  $5\text{m}^3/\text{sec}$   
 Particle size to be removed = 0.2 mm  
 Depth of basin = 2.4 m [8]
6. a) A power station is fed by a 4000m long concrete lined tunnel of 5.0 m dia and 600 m long pressure shaft of 4.0 m dia operating under a gross head of 250 m. If the design discharge of the plant is  $60\text{m}^3/\text{sec}$  and the friction factors in tunnel and pressure shaft are 0.014 and 0.012 respectively.  
 i) Compute the sectional area required for mass oscillation in a surge tank [3]  
 ii) Maximum upsurge and downsurge levels [3]  
 iii) If the headwater level is 1048 m, find out the invert level of the headrace tunnel at surge tank [3]  
 b) Explain the importance of tunnel lining. [3]
7. Discuss the various types of reaction and impulse turbines used in a hydropower plant. Discuss their suitability and major performance characteristics. [8]
8. Discuss the arrangement in a typical surface powerhouse. How do you compute the basic dimensions of such building? [2+2]