

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

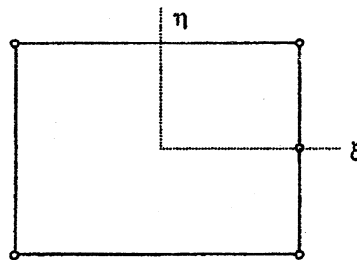
**Subject:** - Finite Element Method (EG785CE)(Elective II)

- ✓ 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.
- ✓ Assume suitable data if necessary.

1. Write down the basic steps for solving a structure using Direct Stiffness Method. Prepare the computer algorithmic steps for solving a plane truss using DSM with suitable example. Why it is said to be the most suitable method of computing, using computer algorithm, explain. [16]
2. The flexibility matrix [F] of the structure is given below; the displacement vector {Δ} due to external loads in the determinate primary structure is also given. Write the program algorithm for using Gauss Elimination Approach and find the value of the redundant forces using the approach. Hints: {Δ} = [F]{P} [16]

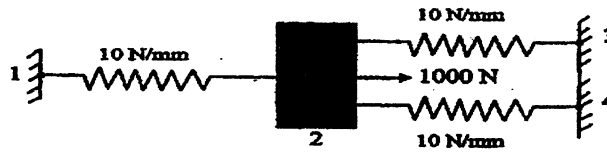
$$[F] = 1/EI * \begin{bmatrix} 125 & 62.5 & -25 \\ 62.5 & 333.33 & -37.5 \\ -25 & -37.5 & 10 \end{bmatrix}; \quad \{\Delta\} = 1/EI * \begin{Bmatrix} 221.67 \\ -1440 \\ 139 \end{Bmatrix}$$

3. a) A 5 node plane stress element has the following geometry. Sketch a suitable set of shape functions and write down the expression for the shape functions in terms of Natural coordinates. [6]



- b) A bar of length 3m is composed of two different sections. At the center of the bar, the bar has its x-section area of 3000mm<sup>2</sup> and its length is 1m, on either side of which the x-section area is 1500 mm<sup>2</sup> and the length are equal to 1m each. An axial load of 1200 kN is applied at the center of the bar. Determine the nodal displacement at the center of the bar. Take E = 78x10<sup>6</sup> kN/m<sup>2</sup>. [10]
4. a) Drive the expression for shape function of Constant strain triangular element, also draw the Shape function diagram. [8]
- b) Drive the expression for Strain-Displacement matrix for the constant strain triangle by using the Jacobian transformation matrix. [8]

5. Write down the main concept of minimum potential approach with suitable relations. For the given spring system, obtain the global stiffness matrix, displacements at each node and reaction at each supports, if external force at node 2 is 1000N and the Stiffness  $K_1=K_2=K_3=10\text{N/mm}$  are given. Use the minimum potential energy approach. [4+12]



6. Write short notes (Any Four) [4x4]
- Computing Perimeter of a Circle using FEM.
  - Rayleigh Ritz Method.
  - Application of FEM.
  - Shape function for a Beam Element.
  - Shape function for a three node bar element.

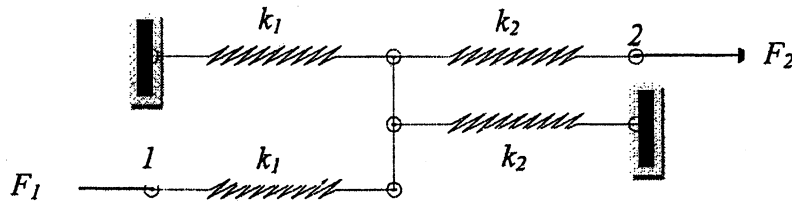
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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

**Subject: - Finite Element Method (Elective II)**

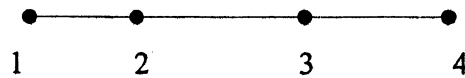
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any **Four** questions.
- ✓ **All** questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. a) Find out the nodal displacement at 1 and 2, where the corresponding forces  $F_1$ , and  $F_2$  are acting. Consider the horizontal forces  $F_1 = 20 \text{ kN}$  and  $F_2 = 10 \text{ kN}$ ; the stiffness  $k_1 = 2000 \text{ kN/m}$  and  $k_2 = 1500 \text{ kN/m}$ .

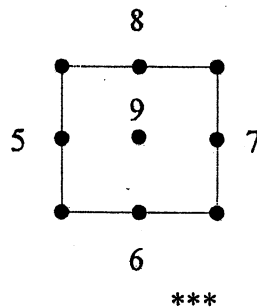


- b) A reinforced concrete cantilever beam having cross-sectional size  $250 \text{ mm} \times 400 \text{ mm}$  has its length  $2 \text{ m}$ . the beam is acted upon by uniformly distributed downward vertical load with the intensity of  $w = 40 \text{ kN/m}$ . Assume modulus of elasticity for concrete to be  $E = 2 \times 10^7 \text{ kN/m}^2$ . Find out the downward vertical displacement at its free end using method of PVP (Principle of Variational Process) approach.
2. a) Consider a simply supported beam having span length  $6 \text{ m}$ , which is acted upon by uniformly distributed downward vertical load with intensity  $w = 30 \text{ kN/m}$ . The beam is constructed of reinforced concrete section having rectangular size  $230 \text{ mm} \times 350 \text{ mm}$ . Assume modulus of elasticity for concrete to be  $E = 2 \times 10^7 \text{ kN/m}^2$ . Find out the displacement at the mid span using method of PMPE (Principle of Minimum Potential Energy) approach.
- b) Derive the shape function and stiffness matrix for an axi-symmetric two noded annular ring element with only one horizontal (radial direction) translational degree of freedom at each node. Consider inner and outer radius of the ring element be  $20 \text{ cm}$  and  $100 \text{ cm}$ .
3. a) Consider a bar of length  $5 \text{ m}$  is composed of two different sections. At the centre of the bar, the bar has its cross section  $3000 \text{ mm}^2$  and its length is  $1 \text{ m}$ ; on either side of the bar, the cross section is  $2000 \text{ mm}^2$  and the length of the bars are equal. At both the junction points between two bars, axial load of  $100 \text{ kN}$  is applied along the longitudinal  $x$ - direction. Determine the nodal displacement at these junction nodes. Consider the modulus of elasticity of the material  $2 \times 10^7 \text{ kN/m}^2$ .

- b) If a displacement field is described by  $u = 6x^3 + 4x^2y - 2xy^2 + 3y^3 + 1$  and  $v = 4x^2 + 4x^2y - x + y - 1$ , determine the strain values  $\epsilon_x$ ,  $\epsilon_y$  and  $\gamma_{xy}$  at  $x = 2$  and  $y = 1$ .
4. a) Derive the stiffness matrix of a two noded tapered straight bar element having only one degree of freedom along its longitudinal axis at each node, and span length  $L$ . Consider the element has area of cross section  $A_1$  at first node varies linearly, such that at the other end the area of cross section will be  $A_2$ .
- b) Determine the shape functions for nodes 1, 2, 3, and 4 in the following four noded straight bar element having only one dof at each node along its axial direction. The inner nodes 2 and 3 divide the element into three divisions in the ratios of 1.5:3.5:2.



5. a) Solve the differential equation  $y'' + 3y' - 2x^2y^2 = 10$  with initial value  $y(0)=1$  and  $y'(0)=0$  using weighted residual method.
- b) Consider a square shaped nine noded element as shown in figure. Determine the shape function for inner node 9. The interior nodes along the edges 5, 6, 7 and 8 divide the edge length into 1:2 ratios.



Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
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**Subject:** - Finite Element Method (*Elective 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**.
- ✓ Assume suitable data if necessary.

- Derive strain stress relation for a three dimensional problems of isotropic materials. Explain the different types of problems that can be analyzed in two dimensional stress analyses. Write modulus matrix for the cases. (8+4+4)
- A 4 m long 300 mm x 300 mm concrete member is vertically hanging. Investigate the state of deformation and stress in the member subjected to gravity using one quadratic bar element. Verify the results with the exact solution. (12+4)  
The exact solution can be verified by:  
Displacement:  $u(x) = \frac{\rho g}{E} \left[ Lx - \frac{x^2}{2} \right]$ , stress  $\sigma(x) = \rho g(L-x)$
- A single span beam is shown in Figure 1. Determine the member end forces and draw Bending Moment Diagram. Take  $E = 200$  GPa, and  $I = 10 \times 10^{-4} \text{ m}^4$ . Calculate displacement at 1m from the left end. (12+4)

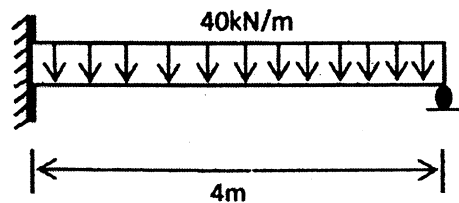


Figure 1

- The thickness of the steel flat strip is 0.25 inch and loaded as shown in Figure 2. Model the strip to check the strength of the plate in SAP2000. (16)

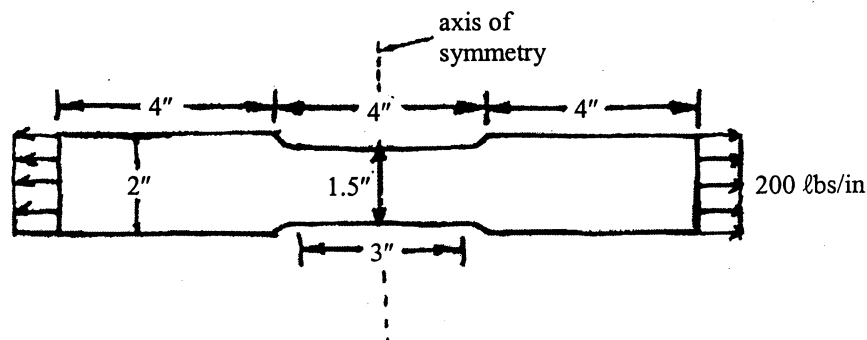


Figure 2

5. Draw the shape functions with equations for a rectangular element. For the plane stress condition,  $E = 200 \text{ GPa}$ ,  $\nu = 0.3$  and  $q = [0, 0, 0.05, 0.08, 0.15, 0.08, 0, 0]^T \text{ mm}$ , evaluate **stress** at the center of the element shown in Figure 3. (4+12)

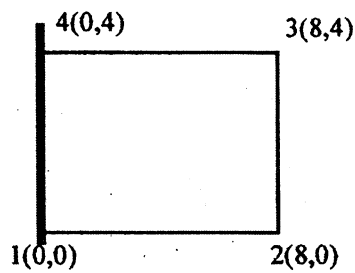


Figure 3.

6. Write short notes on (any two) (8+8)
- a) Basic steps in Finite Element Analysis
  - b) Geometrical Approximation and discretization
  - c) Stiffness Integration for a quadrilateral element

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

**Subject: - Finite Element Method (Elective)**

- ✓ 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. Calculate displacement at the mid point of larger section of structure shown in Figure 1. Also calculate fixed end forces. Take  $E = 200 \text{ GPa}$ ,  $A_1 = 300 \text{ mm}^2$ ,  $A_2 = 500 \text{ mm}^2$ ,  $\rho = 7850 \text{ kg/m}^3$ . (12+4)
2. Derive element stiffness matrix of a constant strain triangular element. (16)
3. Derive strain displacement relation of a four noded isoparametric element. (16)
4. A half symmetry model of a culvert is shown in Figure 2. The pavement load is uniformly distributed load of  $5 \text{ kN/m}^2$ . Prepare a finite element model of the structure. Discuss the solution process of the structure. (8+8)
5. Write down the equations of Hermite functions for a beam element and also draw the shape functions. Calculate vertical deflection and rotation at the quarter span of the fixed end span of the  $250 \text{ mm} \times 250 \text{ mm}$  concrete beam shown in Figure 3. Neglect self weight of the beam. (4+12)
6. Compute stresses at centroid of the steel plate shown in Figure 4. Take thickness of the plate,  $t = 10 \text{ mm}$ ,  $E = 200 \text{ GPa}$  and  $\nu = 0.3$ . (16)

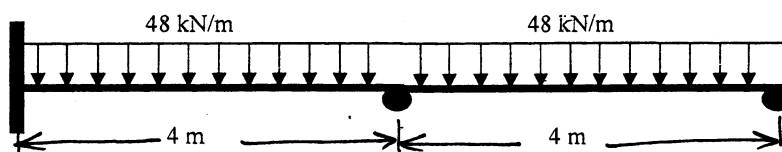


Figure 3

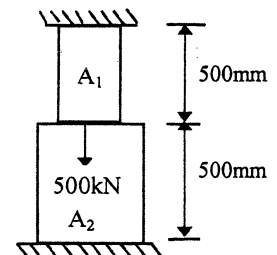


Figure 1.

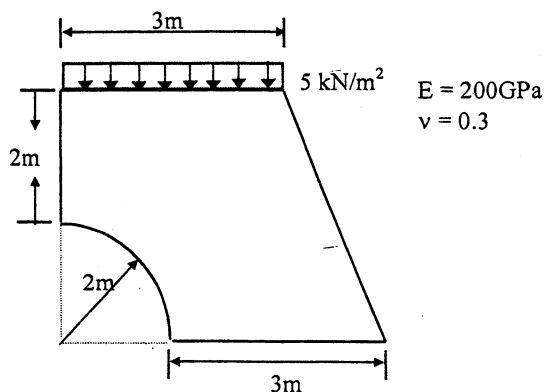


Figure 2.

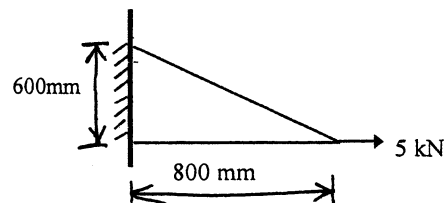


Figure 4.

03 TRIBHUVAN UNIVERSITY  
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**Examination Control Division**  
2072 Ashwin

Exam.	Regular		
Level	BE	Full Marks	40
Programme	All (Except B. Arch)	Pass Marks	16
Year / Part	IV / II	Time	1 ½ hrs.

**Subject: - Engineering Professional Practice (CE752)**

- ✓ 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. What is social change? What are the factors causing social change? Describe the role of technology in social change. [8]
2. What is profession? Describe the code of ethics for engineers. Explain tort and liability. [8]
3. What is contract? Explain tendering process and contract agreement. Describe essential elements of contract. [8]
4. "Engineering profession always emphasizes on safety first in engineering delivery" Describe with typical examples. [8]
5. Write short notes on: (any four) [4×2]
  - a) Impact of computers in society
  - b) Labour and business law
  - c) Professional institutions
  - d) Conflict and dispute management
  - e) Building codes and by laws

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Exam.	Regular / Back		
Level	BE	Full Marks	40
Programme	All (Except B.Arch.)	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

**Subject: - Engineering Professional Practice (CE752)**

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

1. a) Discuss on the impact of technology into the society. [4]  
b) Discuss about the engineering practice in Nepal. [4]
2. a) How does a moral dilemma occur? What are the bases to solve moral dilemma? [4]  
b) What are the codes of ethics for engineers according to Nepal Engineering Council? [4]
3. Sub-contractor Mr. A was severely beaten by his labors because he had not paid them for more than seven months. During investigation it was revealed that client did not pay to the contractor and contractor did not pay to the subcontractor. The client didn't pay because consultant did not submit the necessary bill report. The consultant says the work is defective and quality of the work is not as per specifications. While the contractor does not agree because it was not informed on site and blames that the consultant wants covert money. Discuss the case considering contract law, tort, liability and negligence whatsoever applicable. [8]
4. a) Describe briefly the elements of contract? [4]  
b) Define Tender, what are the essential informations to be given in the Tender Notice? [4]
5. a) Differentiate Patent right and Trademark right. Write down the characteristics of company business organization. What are the sources of business law in Nepal? [4]  
b) How the PPP model help in any development activities? What is its significance in a developing country like Nepal? [4]

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10/12 D

03 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2071 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	40
Programme	All (Except B.Arch.)	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

**Subject:** - Engineering Professional Practice (CE752)

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

1. a) Define society. What are the fundamental social needs to be addressed for the survival of every type of societies? [4]  
b) Define moral dilemma. What are fundamental laws of ethics to overcome moral dilemma? [4]
2. a) Define Profession. Illustrate the characteristics of a Profession. [4]  
b) What are the detail duties and responsibilities of Nepal Engineering Council (NEC)? How do you differentiate professional ethics with moral behavior? [4]
3. You are working as an Engineer from a Consulting Engineering Firm. Your contractor friend Er. Hari is working as a Project Engineer from contractor office in the same project. Mr. Hari invites you for dinner every Friday to celebrate "good Friday" and request you to share the guest house for your accommodation. What would you do in maintaining the code of ethics and friendship relation? [8]
4. a) Define contract document. What are the priorities of contract documents? Explain the rules of contract interpretation. [4]  
b) Why should you be aware of Labour Law? What will you do if a construction worker dies by falling from height in your site? [4]
5. Write short notes on: (any two) [4+4]
  - a) Copyrights, Patent and Trademarks
  - b) Public Private Partnership
  - c) Liability and Negligence

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10/12 D

03      TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2071 Magh

Exam.	OLD Back (2065 & Earlier Batch)		
Level	BE	Full Marks	40
Programme	BCE, BEL, BEX, BCT, BME	Pass Marks	16
Year / Part	IV / II	Time	1 ½ hrs.

**Subject:** - Engineering Professional Practice (EG766CE)

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

1. a. Define society. Differentiate between society and community.  
b. Explain the role of Engineers in developing the Nation. Be specific to your study area.
2. a. Define Ethics. Justify the statement 'Engineering is a Profession'  
b. Define Moral, Ethics and Code of Conduct. Why code of conduct is necessary for Engineers?
3. a. What are the Objectives of Nepal Engineers Association? Give your opinion on how NEA can establish itself as leading professional association in Nepal  
b. Define tender. Differentiate between bid security and performance security.
4. a. Define negligence, vicarious liability and liability of partners in Tort.  
b. If you want to establish a consulting firm immediately after graduation?
5. a. Define copy right, patent right and trade mark. Explain the important features of Trade mark in Nepal.  
b. An industry was using a chemical in making a product. The storage tank of the chemical waste, which was hazardous to health and environment, had a leakage. During inspection Er. X came to know leakage that had already taken place that might cause adverse impact on health and hygiene of the surrounding. You informed your boss about the event. Considering the possible social objection he requests you to be silent on the issue and also hints you that you may have to be out of the job if the case would go into the hands of social reformers. If you were Er. X what you would do?.

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03 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2070 Bhadra

Exam.	Regular		
Level	BE	Full Marks	40
Programme	All (Except B.Arch.)	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

**Subject: - Engineering Professional Practice (CE752)**

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

1. a) Why is society necessary for engineers? What are the roles that an engineer can play in the society? [5]  
b) What are the job description of a fresh engineer that can be appointed in a public organization. [5]
2. a) What do you understand by ethics? Why are code of conducts required for professionals? [5]  
b) What are the detailed duties of an engineer in the profession? [5]
3. a) Define tender. Explain the purpose of tender. List the essential informations to be contained in the tender notice. [5]  
b) What kind of liability that engineers most suffer from? Explain. [5]
4. Globalization has been an eye open opportunity for developing country. It helps transfer technology and development process but also a culture that loosens confidence on nationality. How can people work for development within their own culture with others as guide? Explain. [10]

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03 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2070 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	40
Programme	All (Except B.Arch)	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

**Subject:** - Engineering Professional Practice (CE752)

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

1. a) Why the conflict exists between an individual's freedom and the social goal? [5]  
b) How can building codes help the people to be safe? Explain [5]
2. a) What is a profession? What are liability and negligence? Write down the code of conduct to be followed by Engineerings? [5]  
b) How do you mean by moral dilemma? Explain various ways to overcome dilemmas. [5]
3. a) What is contract? What are the essential elements of contract? [5]  
b) Describe the health and safety provision of labour law? [5]
4. a) What is conflict? Discuss the dispute resolution process? [5]  
b) Explain the Intellectual property and also explain the procedure of registration of copy right. [5]

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

2069 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	40
Programme	BCE, BEL, BEX, BCT, BME	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

**Subject: - Engineering Professional Practice (EG766CE)**

- ✓ 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) What are the differences between community and society? Briefly describe the theories of social change. [2+3]  
b) What are the impacts of technology and its changes on society in this 21<sup>st</sup> century? [5]
2. a) How do you describe engineering profession? Explain the significant features of profession. [2+3]  
b) What are Factors affecting the morale of a professional engineer? Describe in brief to justify and satisfy yourself in the context of Nepal, to have and maintain the professional and moral ethics. [2+3]
3. a) Recently Nepal Engineer's Association (NEA) celebrated its golden jubilee years 2069. In this regard, are you satisfied with role played by NEA in enhancing and upgrading engineering profession and welfare of the engineering till date or not? Justify your thoughts. [5]  
b) Elaborate the differences between void and voidable contract. Explain briefly about general conditions of contract and its essential contents. [2+3]
4. a) Explain tort. What are the reasons behind introducing tort law in the society? How do you distinguish copyright with patent right? [1+1+3]  
b) Differentiate between public limited company and private limited company. [5]
5. Write short notes on: [2.5×4]
  - a) Impact of engineering profession
  - b) Nepal Engineering Council
  - c) Benefits of prequalification
  - d) Trade mark

**OR**

Recently Samsung Korea was asked to pay compensation of billions of dollar to Apple Inc. by an American court. What do you know about this case? Are you satisfied with the verdict? Express your opinion clearly.

[10]

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

2068 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	40
Programme	BCE, BEL, BEX, BCT, BME	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

***Subject: - Engineering Professional Practice***

- ✓ 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) Write five most important rules of conduct for a professional engineer considering code of ethics prevalent in Nepal. [4]  
b) In a telecommunication project, you are the engineer from client's side. The contractor requests you for preparing his final bill of works done, assuring you to pay a handsome amount for your effort, as his engineer recently quit the job. How should you respond? Explain your arguments. [6]
2. a) After being an engineer, what type of business concern should you establish if your team comprising of five engineers wish to be a design/supervision consultant in Nepal and why? Write disadvantages of public limited company. [5]  
b) Number of severe cracks appeared in a building designed by an engineer and also approved by the Municipality within one year of its construction. The house owner approached you for your suggestion about the course of action he should take to get remedy. Explain your suggestion in view of liability and negligence. [5]
3. a) Assume yourself as a recently appointed engineer-in-charge of a newly established brick factory. How do you regulate working hours and overtime hours? What facilities should you provide to the laborers considering the requirements of prevailing labor law on Nepal? [5]  
b) What is negligence? Explain vicarious liability. [5]
4. What is copyright and patent right? Discuss their importance. Explain major features of copyright Act in Nepal. [2+4+4]
5. Write short notes on any two. [2×5]
  - a) Theories of social change
  - b) Role of engineers in social development
  - c) Nepal Engineering Council
  - d) IT specific crimes in the society

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03 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
Examination Control Division

2067 Mangsir

Exam.	Regular / Back		
Level	BE	Full Marks	40
Programme	BCE, BEL, BEX, BCT, BME	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

**Subject:** - Engineering Professional Practice

- ✓ 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.
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1. a) Define society. Describe how engineers can contribute in the development of the rural society. [1+4]  
b) Differentiate between copy right and patent right. [5]
2. a) Define profession. Describe the characteristics of profession. [1+4]  
b) How do you judge the ethical standard of engineers in Nepal? Describe the role of Nepal Engineering Council in maintaining ethical standard of Nepalese Engineers. [2+3]
3. a) Define contract. Describe any four importance elements of contract. [1+4]  
b) Explain the detailed duties and liabilities of Designers/Professionals. [2+3]
4. During quality control visit in a remote village, it has been found that a building is being constructed on the bank of a river, and it will be damaged due to flood. Approximately 20% of the construction was completed. The survey was done by your friend with the consent of the local people. However, the quality of construction was as per specification. Your job is limited to control the quality of the building only. Discuss the case and recommend your views on whether to continue the construction or not. [10]
5. Write short notes on: (any four) [2.5×4]
  - a) Conflict theory of social change
  - b) Code of conduct
  - c) Objectives of Nepal Engineers Association
  - d) Welfare provisions in labor law
  - e) Characteristics of Private Ltd. Company
  - f) Trademark

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03 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
Examination Control Division

2066 Magh

Exams		Regular/Back	
Level	BE	Full Marks	40
Programme	BOE-BEL, BEX-BCT, BME	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

**Subject: - Engineering Professional Practice**

- ✓ 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. Er. Narendra Sah was working with the contractor in a construction project (say construction of housing complex in Kathmandu). He was given the responsibilities to control quality of work in the site. Incidentally, material supplier (Ramchandra) in the construction is a friend of Narendra. Owing to the road blockade and other strikes, Ramchandra was facing difficulty in supplying sand and aggregates as per the given specification. Sand and aggregates materials was available in the close proximity of the site, but it is slightly sub-standard. Ramchandra requested Narendra to allow this material to be used for construction. Ramchandra convinced Narendra that the strength of concrete shall be produced as per specification even with the use of sub standard materials. Ramchandra also offered to share 50% of the cost saved during this process. How do you judge the conduct of Narendra and Ramchandra on an ethical ground? [6+4]
2. a) What do you understand by society, social structure and community? Write down the elements of community. [3+2]
- b) How would you relate technology with social change? Describe briefly the factors causing social change. [2+3]
3. a) Define profession and professionalism. Describe briefly the features of profession. What are the factors affecting morale of profession? Describe briefly the fundamental ethical values for code of ethics. [1+1+1+2]
- b) What do you mean by professional association? Describe briefly the principal objectives of a professional body. State the provision of Engineering Professional Practice in Nepal. [1+2+2]
4. a) Describe intellectual property right? Elaborate what do you understand by the terms patent, design and trade mark. [2+3]
- b) Explain the different provision in the Nepalese legal system related to the practice of Engineering Profession in Nepal. [5]
5. Write short notes on: (any two) [2×5]
  - a) Valid, void and voidable contract
  - b) Occupational health and safety provisions in labor law 2048 BS
  - c) Negligence, liability and tort
  - d) Computer crimes and computer virus

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05 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2065 Baishakh

Exam.	Back		
Level	BE	Full Marks	40
Programme	All	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

**Subject: - Engineering Professional Practice**

- ✓ 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) Define social change and its theories. Discuss on the various roles to be played by the Engineers in the transformation of Nepalese society towards 'New Nepal'. [1+4]  
b) What do you mean by intellectual property right? Differentiate between 'Copyright' and 'Patent right'. [2+3]
2. a) What is profession? Do you agree with the statement 'Engineers are professional'? Give reasons. [1+4]  
b) Define ethics. Describe 'Utilitarianism' theory and 'Distributive Justice' theory in making right decision. [1+4]
3. a) What do you mean by professional association? How do you evaluate the role of Nepal Engineers' Association as a professional association of Nepalese Engineers? Discuss. [2+3]  
b) Define and discuss on various conditions regarding 'Offer and Acceptance' which is an essential element of contract. Name other essential aspects of contract. [3+2]
4. a) List the information which should customarily appear in an advertisement for tenders. [5]  
b) Define 'Employees' and 'Workers' as per labor act in Nepal. Discuss "health and safety" of labors covered by Labor Act. [1+4]
5. You are appointed as a consulting engineer in a project where your best friend is supplying material. The community people knew the fact and asked you to quit the job because you cannot control the quality of the material. How do you cope with this situation? Discuss ethical aspects related to this situation. [10]

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

2064 Poush

Exam.	Regular/Back		
Level	BE	Full Marks	40
Programme	BCE, BEL, BEX, BCT, BME	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

**Subject: - Engineering Professional Practice**

- ✓ 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) What do you understand by society and community? Illustrate the characteristics of society. Write briefly the theories of origin of society. [5]  
b) What do you understand by Technology and Social change? Write down the factors governing social change? [5]
2. a) Define Contract. Discuss essential elements of contract? [5]  
b) Define Tender, tender notice earnest money and performance bond. Write down the contents of tender notice. [5]
3. a) What do you mean by Professional association? Discuss briefly on the principal objectives of professional body. Introduce Nepal Engineers' Association and Nepal Engineering Council. [5]  
b) What do you mean by moral and ethics? Write down the code of conduct to be follow by Engineers. [5]
4. A trial-bridge (suspension bridge) over the Bheri River at Shubhaghat near Mehalkuna bazaar of Surkhet district collapsed on 25<sup>th</sup> December, 2007. The collapse of the bridge claimed some 18 people's life and it is speculated that about 70 persons are missing in the Bheri river. The mishap happened while a large crowd of people (some eye witnesses claims 500 to 600 persons) were crossing the bridge to participate in a local fair on the other side of the bank. The bridge is located at about 10km northeast from the Chhinchu bazaar. The span of the bridge was 187 meters and was completed construction in the fiscal year 2063/064 (July 2006 / June 07). This was constructed by DDC-Surkhet, supervised by DTO-Surkhet and the consultant was FACE Consultant Kathmandu. The contractor was the DC Nirman Sewa, Nepalgunj. The fabricator of all the elements of the bridge was Hulas Steel Industries, Simara. Nepal Government has announced to conduct detail investigation of the incident. Initially, it was assumed that the bridge failed due to overload. Prior to the incident, the DTO technician had allegedly instructed the contractor to tighten the nuts of the bulldog grips of the main cables. The Chairperson of the Fair Management Committee has been quoted to say that the contractor has not tightened the nuts as was required. Preliminary investigations by the SBD Engineers seem to indicate that the bridge failed due to faulty bulldog grips. How would you judge the incident on the ground of professional ethics? [10]
5. Write short notes on: [10]
  - a) Health and safety provision of Labor Law 2048 B.S.
  - b) Tort, Negligence, Liability and Vicarious Liability
  - c) Computer Crimes

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8205

04 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2072 Ashwin

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

**Subject: - Technology, Environment and Society (CE753)**

- ✓ 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.

*luxury.*

1. What do you mean by technology? Write down benefits of technology in education sector.
2. Describe the LEP Approach for the development of Nepal? Explain community empowerment process of LEP Approach.
3. What are the primary reasons for human interventions in the ecosystem? How natural resources of ecosystem is converted into wealth?
4. What are the factors contributing to global warming? Outline their sources, impacts and mitigation measures of global warming.
5. Discuss the major environmental issues of Nepal? What are the causes of acid rain?

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Exam.	Regular / Back		
Level	BE	Full Marks	40
Programme	BCE	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

**Subject:** - Technology, Environment and Society (CE753)

- ✓ 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 technology and its impact on societies. Define appropriate technology and its relevancy to LDC. [8]
2. ✓ Write down in detail causes, effects and mitigation measures of air pollution. [8]
3. ✓ a) Discuss LEP approach in infrastructure development. [4]  
b) Discuss the role of Engineer in Community Management. [4]
4. ✓ What is climate change? Write down its probable impacts and problems mitigation measures that Nepal can adopt. [6]
5. ✓ Differentiate between renewable and non-renewable energy. [5]
6. Discuss intellectual revival of Europe in 13 to 15 century. [5]

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Exam.	Regular		
Level	BE	Full Marks	40
Programme	BCE	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

**Subject: - Technology Environment and Society (CE753)**

- ✓ 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 is "Agricultural Age", "Industrial Age" and "Information Age"? Explain. Write the positive as well as negative impact of technology on society. [4+4]
2. Describe briefly the impact of early part of industrial revolution. Describe the impact of World War I and II in our society. [3+5]
3. How participatory approach encourage to empowerment community in development activity? Write some key features of infrastructure development policies of Nepal. [2+6]
4. Define ecosystem and ecology. How increasing population disturbs to natural ecosystem and how to minimize this disturbance? List out the major environmental issues of Nepal. [2+3+3]

**OR**

What are the sources of Air and Water Pollution? Write some mitigation measures of water and air pollution? [4+4]

5. What is climate change? Describe its impacts and potential mitigation measures. Also describe international efforts made to address this problem. [1+4+3]

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04 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2070 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	40
Programme	BCE	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

**Subject:** - Technology Environment and Society (CE753)

- ✓ 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 is meant by industrial and information society? Discuss the impacts of computer and cybernetics in creating information society that makes the whole world as a global village. [8]
2. State the different ages of human development. Write the key developments on technology during first and Second World War and their positive and negative impact on population. [3+5]
3. What are the different key features of infrastructure development policies of Nepal? Do participatory approaches empower community, justify your answer. [3+5]
4. Define environment and ecosystem. Describe how the disposal of sludge and industrial waste results in pollution of river, lakes and canals? Recommended appropriate mitigation measures to minimize the impacts. [8]
5. What do you mean by climate change? Write major symptoms of climate changes in Nepal. State some national and international efforts for mitigation and adaption of climate induced problems. [1+4+3]

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05 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2069 Bhadra

Exam.	Regular / Back		
Level.	BE	Full Marks	40
Programme	BCE	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

**Subject:** - Technology, Environment and Society (EG767CE)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
  - ✓ Attempt any **Five** questions.
  - ✓ **All** questions carry equal marks.
  - ✓ Assume suitable data if necessary.
1. Define industrial revolution, industrial society and information society. Also discuss about the transformation from industrial to information society.
  2. Describe about the industrial wastewater and its treatment methods. And, list out the major causes of polluting Bagmati River in Kathmandu.
  3. "Technology can control price" Do you agree with this statement. Support your views with examples.
  4. How Nepalese society is impacted by technology in course of time? What is the major environmental problem of Nepal?
  5. What is climate change? Describe its impacts and potential mitigation measures. Also describe international efforts made to address this problem
  6. Write short notes on: (any two)
    - a) Ecology, ecosystem and its characteristics
    - b) Technology and shift in employment
    - c) Air pollution, pollutant, its impacts and control measures
    - d) Acid rain, its impacts and control measures

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05 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2068 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	40
Programme	BCE	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

***Subject: - Technology, Environment and Society***

- ✓ 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 briefly the characteristics of information society. Justify how the information can play a major role as a source of knowledge and power in the modern era?
  2. Describe briefly the difference in impact of early industrial revolution of 1660 - 1815 AD and revolution of 1815 - 1918 AD.
  3. What are the factors contributing to the global climate change? Explain briefly the international efforts towards mitigation of climate change impact.
  4. Describe how the disposal of sludge and industrial waste results in pollution of river, lakes and canals? Recommend appropriate mitigation measures to minimize the impacts.
  5. Discuss the characteristics of technology. Describe how the technological innovations can unmask old social problems.
  6. Note down all the important environmental issues pertaining to Nepal. Describe briefly the corrective interventions required.

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05 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2066 Magh

Exam.	Regular/Back		
Level	BE	Full Marks	40
Programme	BCE	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

***Subject: - Technology, Environment and Society***

- ✓ Candidates are required to give their answers in their own words as far as practicable.
  - ✓ Attempt any Five questions.
  - ✓ All questions carry equal marks.
  - ✓ Assume suitable data if necessary.
1. Do you agree that "Technology can control price"? Support your views with examples.
  2. Describe the impact of technology on employment. Justify the educational needs to accommodate new type of employment.
  3. Describe about the industrial waste and its management. Why this type of waste needs special treatment as compared to other wastes. Explain.
  4. What is climate change? Describe the possible intervention to reduce its impacts.
  5. Describe about the technological development from Stone Age to modern era and its impact on environment and society in the respective periods.
  6. Write short notes on: (any two)
    - a) Status of water pollution in Nepal
    - b) Pros and cons of technology
    - c) Appropriate technology

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Exam.	Regular/Back		
Level	BE	Full Marks	40
Programme	BCE	Pass Marks	16
Year / Part	IV/II	Time	1½ hrs.

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***Subject: - Technology, Environment and Society***

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

1. What is meant by information society? Discuss how information age can affect social life.
2. List out the development strategies and discuss their relevancy in the development process of Nepal.
3. Discuss how the technological innovations reveal social problems. Also mention the pros and cons of technological development.
4. Describe about the regional and global environmental issues. Explain, which one is the most burning issues in the present context and why?
5. Describe how the industrial wastewater and emission degrade the quality of aquatic and terrestrial ecosystems. Also recommend the preventive measures to minimize their impacts.
6. What are the key national environmental issues of Nepal? Recommend potential preventive measures to minimize the impact of solid waste in urban area of Nepal.

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03

TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

**Examination Control Division**

2065 Baishakh

Exam.	Back		
Level	BE	Full Marks	40
Programme	BCE	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

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***Subject: - Technology, Environment and Society***

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

1. What is Industrial Revolution? Describe the major changes it brought to human civilization.
2. What can be the feasible solutions to control human disturbances to ecosystem? Give your options.
3. Present your arguments in favor of the statement that "Technology is a curse".
4. Discuss the importance of technology in controlling prices.
5. Discuss about the challenges on controlling acid rain.
6. Discuss about the impact of technology in Nepalese society.

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02 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2072 Ashwin

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

**Subject: - Construction Management (CE754)**

- ✓ 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. Write the various phases of project life cycle. Discuss the relation between Client, Consultant and Contractor in a construction project.
2. Explain the importances and steps of construction planning and scheduling. Write the application of value engineering in the procurement of construction materials.
3. Write the factors to be considered in the selection of appropriate construction equipment. Explain equipment for excavation and equipment for compaction.
4. a) Define Tender Notice and write the essential information that should be included in a Tender Notice.  
b) Explain the concept of time cost trade off in determining duration of contract.
5. Explain the points to be dealt in financial management and cash flow management by a manager in a construction project. Explain how a manager takes decision in controlling project with "earned value analysis"?
6. Write the responsibilities of 'site engineer' while supervising the work of a contractor. Justify the statement 'prevention maintenance is better than corrective maintenance'. Explain the importance of communication in construction project.
7. a) State the purpose of specification and write the techniques of specification writing.  
b) Write various methods of valuation of properties and elaborate concept of depreciations.
8. Write short notes on: (any two)
  - i) Material handling system
  - ii) Leadership styles
  - iii) Measurement book
  - iv) Material productivity control

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

***Subject: - Construction Management (CE754)***

- ✓ 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 characteristics of Construction Project? Explain. [4]
2. Explain time cost trade off with example. [6]
3. What is material wastage standard? Describe the application of value engineering in procurement of material. [6]

**OR**

Define economic order quantity. Calculate EOQ and reorder point if rebar required is 1000 tonnes; Ordering Cost is Rs. 10,000; Carrying Cost is 15%, rebar rate is Rs. 90,000 per tonne; Safety Stock is 50 tonnes; lead time is 4 day and consumption per day is 50 tonnes.

4. a) Discuss the methods of tunnel excavation. [6]  
b) Discuss Batching and Mixing plant. [6]
5. Classify contract based on payment. Explain lump sum contract and cost plus contract. [2+2+4]
6. Prepare a typical job layout of a Building Project. [4]
7. Define work scope control. Discuss earned value analysis with example. [2+4]
8. Explain procedure to prepare Bills. [4]
9. Describe the types of maintenance in project. [4]
10. Define leadership. What are the characteristics of good leader? Which style is better? [1+3+2]
11. What are the causes of accidents in construction project? How it can be minimized? [2+2]
12. Explain the importance of specification. Write a detailed specification of brick work in cement sand mortar. [3+5]
13. Calculate the value of a building built 10 years ago having a plinth area of 450 sqm, constructed in the land of 1000 sqm. Current market value of land is Rs. 15,000 per sqm and rate of building is Rs. 30,000 per sqm. Assume suitable data if necessary. [8]

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

**Subject: - Construction Management (CE754)**

- ✓ 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 Consultant. Explain the role of Consultant in maintaining the quality of Construction works. [1+3]
2. Why do you prefer Bar Chart as planning tool? Explain pretender Stage Planning by contractor in Detail. [2+4]

OR

Calculate Minimum Cost and Minimum Duration Schedule using time cost Trade-off analysis of the project with following detail. Indirect cost is Rs. 1000 per day. [6]

Activity	Predecessor	Normal Duration	Crash Duration	Normal Cost	Crash Cost
A	-	5	2	5000	6200
B	A	4	3	6000	7000
C	A	3	2	5000	6500
D	A	6	4	4000	4400
E	B	5	3	15000	18000
F	D	4	2	3000	4800
G	C,E, F	6	3	8000	10400

3. Define A, B and C category of materials. Calculate Economic Order Quantity of Cement with following details; Total Quantity = 12000 bags;  $C_i=15\%$ ,  $C_o=10000$ ;  $P = 750$  Rs. per bag. [3+3]
4. What are the disadvantages of using equipment in Construction sites? List out construction equipment used in hydropower and explain any two of them with sketches. [2+3+5]
5. What is BOOT Contract? Explain its importance in Developing Countries like Nepal [2+4]
6. Why cash flow management is necessary for a contractor. Draw a typical cash flow estimate of a contractor showing the most critical stage. [2+3]
7. What are the reasons of excessive material wastage during usage? Explain its preventive measures. [3+3]

or

Perform earned value analysis of a project with five activities as given below. Progress was evaluated at the end of 5th day. [6]

Activity	Cost	1	2	3	4	5	6	7	8
A	6,000								
B	15,000								
C	10,000								
D	4,000								

At the end of 5 <sup>th</sup> day	% Complete	Actual Cost
A	100%	7000
B	55%	7500
C	40%	3600
D	0%	x

Also comment on the performances.

8. What are the responsibilities of site Engineer in construction site? Explain procedures to prepare bills. [3+3]
9. "Prevention is better than cure" Elaborate it with reference to preventive and corrective maintenance [4]
10. Explain various types of leadership and their suitability in construction projects in Nepal. [6]
11. Why insurance is necessary during construction? Explain. [4]
12. Differentiate between general and detailed specification. Write detailed specification for brick work in 1:4 cement sand mortar. [2+7]
13. Define valuation. What are the purposes of valuation? Explain the factors affecting value of the property [2+3+3]

Or

Workout the value of a Cinema hall from the following data.

[8]

- i) Cost of Land = Rs 5 crore
- ii) Gross income = Rs. 2 crore
- iii) Operating Cost = 40% of Gross income
- iv) Repair and Maintenance of machineries = 5% of Capital Cost where capital cost is Rs. 40 lakh
- v) Repair of Hall = 5% of Gross income
- vi) Sinking fund for machineries whose life is estimated 25 years @ 4% after allowing 10% scrap value.
- vii) Insurance premium = Rs 50000 per year
- viii) Assume year's purchase for 60 years at 8% and redemption of capital at 10%.

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

**Subject: - Construction Management (CE754)**

- ✓ 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. Write short notes on (Any Three only) [3×4]
  - (a) Tower Cranes
  - (b) Tunnel excavation by Blasting
  - (c) Concrete Batching Plants
  - (d) Road pavers
2. Write short notes on (Any Four only) [4×3]
  - (a) Responsibilities of Site Engineer
  - (b) Measurement Book
  - (c) Safety Requirements
  - (d) Building Codes
  - (e) Diagnostic Maintenance
  - (f) Importance of Maintenance
3. (a) Explain the importance of Specifications in Construction Works [4]  
 (b) Write a note on the art and science of writing Specifications covering following aspects [6]
  - (i) Necessity of specification
  - (ii) Procedure of drafting
  - (iii) What to write and what to avoid in writing.
4. (a) Explain the situation where the following method of valuation will be used [3]
  - (i) Cost based method
  - (ii) Plinth area method
  - (iii) Development method
 (b) Work out the valuation of a Cinema hall with the following data [5]
  - (i) Cost of land = Rs. 15,00,000
  - (ii) Gross income = Rs. 90,00,000
  - (iii) Expenses undergone per year to run the Cinema including Staff salary, electricity charges, municipal taxes stationery and printing etc. 30 % of gross income.
  - (iv) Repair and maintenance of machinery, plant and equipment at 5 % of their capital cost which is Rs. 55,00,000
  - (v) Sinking fund for machinery, plant and equipment whose life is estimated as 25 years at 5 % after allowing 10 % Scrap value.
  - (vi) Insurance premium is Rs. 60,000 per annum.

Assume year's purchase for 60 years at 8 % and redemption of capital at 4 % and repair of hall at 2 % of gross income.
5. (a) Discuss on scope of construction management and Project life cycle phases. [5]  
 (b) Discuss on Time cost Trade-off with examples and steps in planning. [5]
6. Write short notes on (Any ~~Three~~ <sup>Four</sup> only) [4×4]
  - (a) ABC Classification of materials.
  - (b) Material inventory.
  - (c) Types of contract
  - (d) Financial management
  - (e) Prequalification of contractor
7. Write short notes on (Any three only) [3×4]
  - (a) Performance control using EVA
  - (b) Labor productivity control
  - (c) Leadership styles
  - (d) Motivating and directing

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

**Subject:** - Management of Construction and Maintenance (EG776CE)

- ✓ 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 the importance of specification in construction work. Write down the main techniques that you follow for writing specification.. [4+4]
- b) Write detailed specification of: [4+4]
  - i) RCC with M20 concrete in column
  - ii) Brick work in 1: 6 cement sand mortar
2. a) What are the responsibilities of site engineer in construction work? Explain the relationship between owner, contractor and consultants. [4+4]
- b) Explain about the process for evaluation of tender and selection of contractor. [8]
3. a) Discuss about the different equipments for tunnel construction. [8]
- b) Enlist the equipment for highway construction and explain any two of them with sketches. [2+6]
4. a) What is job layout? Discuss various factors to be considered in construction site planning. [2+6]
- b) "Preventive maintenance is better than the corrective maintenance". Do you agree with this statement? Explain with suitable example. [8]
5. a) For the activities lying on the critical path of a network, the normal duration and the crash duration along with their respective direct cost are given in the table. [8]

Activity	Normal duration	Normal cost (Rs)	Crash duration	Crash costs (Rs)
1-2	2 days	50	1 day	75
2-3	4 days	160	3 days	225
3-5	9 days	270	6 days	350
5-6	5 days	100	4 days	250

The overhead indirect cost is Rs.30/- per day. Crashing is possible for 1 day for each of the activities 1-2, 2-3, and 5-6 and 3 days for activity 3-5. Find the lowest cost schedule by crashing step by step assuming no fresh critical path is developed on crashing a project.

- b) Among CPM, PERT and bar chart which planning tool do you prefer for building construction? Explain. [8]
6. Write short notes on: (any four) [4×4]
  - a) Process of material procurement
  - b) Purchase or lease of equipment
  - c) Fayol's principles of management
  - d) Maslow's theory of motivation
  - e) Importance of record keeping
  - f) Balance sheet

**Examination Control Division.**  
**2069 Bhadra**

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

**Subject:** - Management of Construction and Maintenance (EG776CE)

- ✓ 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 the importance of specification in construction work. Write down the main techniques that you follow for writing specification.. [4+4]  
b) Write detailed specification of: [4+4]
  - i) RCC with M20 concrete in column
  - ii) Brick work in 1: 6 cement sand mortar
2. a) What are the responsibilities of site engineer in construction work? Explain the relationship between owner, contractor and consultants. [4+4]  
b) Explain about the process for evaluation of tender and selection of contractor. [8]
3. a) Discuss about the different equipments for tunnel construction. [8]  
b) Enlist the equipment for highway construction and explain any two of them with sketches. [2+6]
4. a) What is job layout? Discuss various factors to be considered in construction site planning. [2+6]  
b) "Preventive maintenance is better than the corrective maintenance". Do you agree with this statement? Explain with suitable example. [8]
5. a) For the activities lying on the critical path of a network, the normal duration and the crash duration along with their respective direct cost are given in the table. [8]

Activity	Normal duration	Normal cost (Rs)	Crash duration	Crash costs (Rs)
1-2	2 days	50	1 day	75
2-3	4 days	160	3 days	225
3-5	9 days	270	6 days	350
5-6	5 days	100	4 days	250

The overhead indirect cost is Rs.30/- per day. Crashing is possible for 1 day for each of the activities 1-2, 2-3, and 5-6 and 3 days for activity 3-5. Find the lowest cost schedule by crashing step by step assuming no fresh critical path is developed on crashing a project.

- b) Among CPM, PERT and bar chart which planning tool do you prefer for building construction? Explain. [8]
6. Write short notes on: (any four) [4×4]
  - a) Process of material procurement
  - b) Purchase or lease of equipment
  - c) Fayol's principles of management
  - d) Maslow's theory of motivation
  - e) Importance of record keeping
  - f) Balance sheet

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

Subject: - Management of Construction and Maintenance

- ✓ 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. Write down the detailed specifications for brick work in (1:4) cement sand mortar in superstructure [16]
2. a) Explain the procedures followed after opening and evaluation of a tender in government projects. [8]  
b) What is prequalification? Mention various steps to be followed in prequalification and what are the differences between prequalification and post qualification. [8]
3. Describe in detail the operation and application of the following types of excavating equipments with line diagram showing the basic parts. (i) Power shovel (ii) Back hoe (excavator) (iii) steel roller (3 wheeled) [16]
4. a) Explain the main considerations necessary in the storing and stacking of civil engineering materials. *pile up* [8]  
b) Explain the importance of preventive maintenance in roads and buildings and also mention various types of maintenance. [8]
5. a) ~~What~~ are the principles of management and compare administrative principle and management principle. [8]  
b) Describe balance sheet and profit and loss account and their functions. [8]
6. Write short notes on: (any four) [4×4]
  - a) Tunnel boring machines
  - b) Batching and mixing in concrete construction
  - c) Centralization and decentralization
  - d) Barriers of communication
  - e) Building code
  - f) Cost control *very much*

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04 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2068 Bhadra

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

**Subject: - Management of Construction and Maintenance**

- ✓ 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) Discuss the importance of specifications in construction work. Write down detailed specification for cement sand mortar (1:4) [8]
- b) What is contractor's prequalification and why it is necessary? What are the advantages and disadvantages of prequalification? [8]
2. a) How does corrective maintenance differs from preventive maintenance? Describe the importance of maintenance on highways. [3+5]
- b) Explain the procedures for opening and evaluation of bid in construction project. [8]
3. a) The following information are available about various activities of the network. Determine least cost schedule. Project overhead cost are Rs 2000 per.week. [10]

Activity	Normal Duration	Normal cost	Crash Duration	Crash cost
1-2(A)	4	4000	3	7000
1-3(B)	8	5000	7	8000
2-3(C)	5	3000	3	1000

- b) Elaborate the factors to be considered to reduce accident while working with machine. [6]
4. a) What is motivation? Why it is necessary in construction sites? Explain Herzberg's theory of motivation. (Pg. 175704) [8]
- b) Explain steps of procurement procedure for materials in Government offices. [8]
5. a) Discuss any two types of excavating and earth moving equipment in detail. [8]
- b) List different types of tunneling and rock drilling equipments. Explain briefly. [8]
6. Write short notes on: (any four) [4×4]
  - a) Scientific theory management
  - b) Compacting machines
  - c) Equipment for lifting
  - d) Trade unions and relation with management
  - e) Importance of record keeping for construction
  - f) Building code
  - g) Safety regulation

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

***Subject: - Management of Construction and Maintenance***

- ✓ 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. Write down the detailed specifications for brick work in (1:4) cement sand mortar in superstructure [16]
2. a) Explain the procedures followed after opening and evaluation of a tender in government projects. [8]  
b) What is prequalification? Mention various steps to be followed in prequalification and what are the differences between prequalification and post qualification. [8]
3. Describe in detail the operation and application of the following types of excavating equipments with line diagram showing the basic parts. (i) Power shovel (ii) Back hoe (excavator) (iii) steel roller (3 wheeled) [16]
4. a) Explain the main considerations necessary in the storing and stacking of civil engineering materials. [8]  
b) Explain the importance of preventive maintenance in roads and buildings and also mention various types of maintenance. [8]
5. a) What are the principles of management and compare administrative principle and management principle. [8]  
b) Describe balance sheet and profit and loss account and their functions. [8]
6. Write short notes on: (any four) [4×4]
  - a) Tunnel boring machines
  - b) Batching and mixing in concrete construction
  - c) Centralization and decentralization
  - d) Barriers of communication
  - e) Building code
  - f) Cost control

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02 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2066 Magh

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

**Subject: - Management of Construction and Maintenance**

- ✓ 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. What are Bid bond and Performance bond? Explain the procedures to be followed in pre-qualifying contractors for bidding for the construction of a commercial complex of Rs. 500 million estimated cost. [16]
2. Describe the different equipments used for road-construction. Explain the functions and sequence of operation of paver and bitumen sprayer. [16]
3. a) Describe in detail the relationship among Owner, Contractor and Engineer in any construction project. [8]  
b) Explain the concept of 'time cost trade off' with illustrations. What do you mean by crashing of a project activity? Your boss is asking you to reduce the time schedule of a project considerably, what do you suggest? [8]
4. a) Interview is considered as an important step in selecting people for the job, what abilities of a candidate are viewed during an interview? Explain. [8]  
b) What is material handling? Explain. What factors would you consider in material handling? [8]
5. a) Explain maintenance needs and types of maintenance. Describe balance sheet and profit and loss account and their functions. [8]  
b) What is motivation? Explain the concept of motivation using Maslow's need hierarchy and Herzberg's two factor theories. [8]
6. Write short notes on: (any four) [4×4]
  - a) Barriers of communication
  - b) Centralization and decentralization
  - c) Advantages and disadvantages of trade union
  - d) Tunnel boring machines
  - e) Batching and mixing in concrete construction

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04 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2065 Baishakh

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

**Subject:** - Management of Construction and Maintenance

- ✓ Candidates are required to give their answers in their own words as far as practicable.
  - ✓ Attempt any Six questions.
  - ✓ All questions carry equal marks.
  - ✓ Assume suitable data if necessary.
1. a) How do you differentiate between the general specification and detailed specification for a particular work?  
b) Explain various important points which should be considered while preparing detailed specifications.
  2. a) Write the names of different types of contracts used in Civil Engineering. Which type of contract is used for Government works? Why?  
b) How are tenders scrutinised and compared before the selection of the tender is made? How is a tender to be chosen?
  3. Discuss any two types of excavating and earth moving equipment in detail. Give sketches.

**OR**

What are different types of tunneling and rock drilling equipment? Explain briefly.

4. Write short notes on (any three)
  - a) Tower Cranes
  - b) Concrete Mixers
  - c) Use of CPM and Bar Charts
  - d) Safety Regulations
  - e) Cash Flows
5. a) Mention the various factors effecting the selection of construction equipment.  
b) Explain how "Preventive maintenance is better than corrective maintenance".

**OR**

Explain the steps involved in diagnosing the problem affecting a structure for which rehabilitation is to be done.

6. a) Explain the characteristics of supervisory and leadership style.  
b) Describe briefly the characteristics of training and selection method.
7. Write short notes on (any four)
  - a) Site order book
  - b) Material handling system
  - c) Time-cost trade off
  - d) Balance sheet
  - e) Building codes
  - f) Communication
  - g) Importance of quality control

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04 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2065 Baishakh

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

**Subject: - Management of Construction and Maintenance**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
  - ✓ Attempt any Six questions.
  - ✓ All questions carry equal marks.
  - ✓ Assume suitable data if necessary.
1. a) How do you differentiate between the general specification and detailed specification for a particular work?  
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  2. a) Write the names of different types of contracts used in Civil Engineering. Which type of contract is used for Government works? Why?  
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**OR**

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  - a) Site order book
  - b) Material handling system
  - c) Time-cost trade off
  - d) Balance sheet
  - e) Building codes
  - f) Communication
  - g) Importance of quality control

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04 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2064 Poush

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

**Subject:** - Management of Construction and Maintenance

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

1. What is performance bond? Prepare a tender notice for selecting contractor for the construction of a commercial complex of Rs. 100 mln cost. Assume necessary data as you require.
2. Name and discuss the equipment used for earthwork in excavation and pavement construction.

**OR**

List different types of cranes and discuss in brief with sketches.

3. a) What is cash flow? Explain the procedure how you prepare cash flow for a construction project.  
b) How you fix duration of a construction project. What is time cost trade off? Explain.
4. a) Write steps you follow in procurement of 10000 bags of cement for a commercial complex.  
b) In the selection of personnel for a project, what would you consider in the interview? Explain.
5. a) Explain maintenance needs and all types of maintenance. Prepare chart with figures, the balance sheet and profit and loss account and explain the functions.  
b) Explain the need of communication, flow, barriers and breakdown of communication. And also explain decision making levels and stages.
6. Write short notes on (any three):
  - a) 14 principles of administration management by Fayol
  - b) Advantages and disadvantages of trade union
  - c) Centralization and decentralization
  - d) Supervisory style and types of leadership
  - e) Equipment for tunnel boring
  - f) Concrete mixers

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

**Subject: - Time Series Analysis (Elective III) (CE 78505)**

- ✓ 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 deterministic and random process. [3]
2. What is trend in time series? Discuss two methods for the detection of trend. [1+4]
3. (a) Discuss the methods for the selection of proper probability distribution. [6]  
 (b) The probability density function of a random variable is given by  
 $f(x) = 5x(1-x)$  for  $0 < x < 1$   
 $= 0$  elsewhere [6]  
 Find the probability that  $x$  will take on a value within 2 times standard deviations of the mean and compare it with the lower bound provided by Chebyshev's inequality.
4. (a) Define autocorrelation with relevant equations? How is it useful for the investigation of independent process? [3+5]  
 (b) The first serial correlation coefficient of MA(1) process is 0.27. Compute the parameter and variance of the process. Take the variance of random variable = 1.5. [2+2]
5. (a) Starting from Yule-Walker equation for AR(m) model, obtain the parameters of AR(1) and AR(2) model. Also explain the nature of autocorrelation function of AR(1) model with sketches. [2+2+3]  
 (b) Classify the following process as AR, MA or ARMA and compute first four serial correlation coefficients. [1+8]  

$$(X_t - \mu) = 0.7(X_{t-1} - \mu) + e_t - 0.5e_{t-1}$$
6. (a) Explain the Thomas-Fiering model for generating seasonal flows. [8]  
 (b) The mean, standard deviation, first and second serial correlation coefficients of observed annual flows of a stream are estimated as 450 Mm<sup>3</sup>, 130 Mm<sup>3</sup>, 0.7 and 0.45 respectively. Generate a sequence of 5 annual flows assuming that the flows are normally distributed and taking the chain of 5 standard normal random numbers as 1.235, 0.596, -0.813, 0.819, -0.056. Use AR(2) model. [10]
7. (a) Explain the central limit theorem method for the generation of normally distributed random numbers. [6]  
 (b) Using the sequence of uniform random numbers in pairs given below, obtain the sequence of normal random numbers using Box-Muller method. [8]

$u_1$	$u_2$
0.576	0.249
0.588	0.322
0.470	0.670
0.157	0.350

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

**Subject: - Time Series Analysis (Elective III) (CE78505)**

- ✓ 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 the applications of time series modelling in water resources engineering. [3]
2. What is stationarity? Discuss the approach for testing stationarity of time series. [1+4]
3. a) Explain the methods for the determination of parameters of probability distributions. [5]
  - b) The annual rainfall at a place is found to have a mean 740 mm and standard deviation 400 mm. Find the ranges within which the rainfall will lie with a probability of at least 0.5. Use Chebyshev's inequality. [7]
4. a) What are different types of periodic series? Describe each of them in brief. [4]
  - b) For MA (2) process, following data are given:  $r_1 = 0.36$ ,  $r_2 = -0.2$ . Compute parameters  $\beta_1$  and  $\beta_2$ . [6]
5. a) Discuss the nature of autocorrelation function of AR(1) and AR(2) model with sketches. [3+4]
  - b) Classify the following process as AR, MA or ARMA and compute first four serial correlation coefficients. [1+8]
 
$$(X_t - \mu) = 1.3(X_{t-1} - \mu) - 0.5(X_{t-2} - \mu) + e_t$$
6. a) What is spectral analysis? How is it done? Explain with relevant equations. [2+6]
  - b) The  $\bar{X}$ ,  $s_x$ ,  $r_1$ ,  $r_2$  of the observed annual flows of a stream are estimated as 875 Mm<sup>3</sup>, 262 Mm<sup>3</sup>, 0.8 and 0.46 respectively. Generate a sequence of 3 annual flows assuming that the flows are normally distributed and taking the chain of three uniform random number as 0.3781, 0.63702, 0.98343. Use AR(2) model. [11]
7. Obtain 2 normal random numbers from the sequence of following uniform random numbers using central limit theorem method. [6]
 

0.637, 0.301, 0.386, 0.988, 0.855, 0.023, 0.351, 0.949, 0.665, 0.705, 0.376, 0.435
8. Explain the following: [9]
 

Method of maximum likelihood for estimation of parameters, test of assumptions of AR models and Parsimony of parameters.

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

**Subject: - Ground Water Engineering (Elective II) (CE76509)**

- ✓ 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 confined and unconfined aquifer. [4]
2. (a) What is Darcy's law for groundwater flow? Derive it and discuss the validity of this law. [2+4+2]
 

(b) It takes 4hour for water in an aquifer to travel from point A to point B, 30m apart. The difference in water surface elevation between A and B is 0.6m. If the porosity of the material is 15%, determine the permeability of the aquifer, seepage velocity and Reynolds number. Take average grain size of material = 1mm and kinematic viscosity of water = 0.009 stoke. [3+3+2]
3. (a) Derive an expression for the equation of phreatic line for steady 1D flow into horizontal galleries dug to the impervious soil layer in unconfined aquifer. [8]
 

(b) Determine the flow into a horizontal gallery 220m long resting on an impervious strata (unconfined) 11m below ground surface (bgl). The ground water table in the area is 4m bgl and drops at the face of the gallery to 9m bgl in a length of 450m. Permeability of the strata is 40m/day. Also deduce the equation of the phreatic surface. [4+4]
4. (a) Show that the discharge (Q) for steady radial flow into a well in unconfined aquifer is given by
 
$$Q = \frac{2\pi T(S_1 - S_2)}{\ln(r_2/r_1)}$$
 where T = transmissivity,  $S_1$  and  $S_2$  = drawdowns located at  $r_1$  and  $r_2$  distance away from the main well. [8]
 

(b) A well penetrates into a confined aquifer of 28m deep. Pumping is done at the rate of 1500 lpm. Hydraulic conductivity of the aquifer is 20 m/day. Calculate the drawdown of the well at 80m away from it after a lapse of 12hour of pumping. Take storage coefficient as 0.003. [8]
5. (a) Explain Theis solution for the determination of storage coefficient and transmissivity of aquifer. [6]
 

(b) From a preliminary test, it is expected that a tubewell can yield 1800lpm under a drawdown of 4.3m from a confined aquifer of 12m thick, struck at a depth of 27m below ground level. The static water level is 11m below ground level. Determine the diameter and length of strainer. Take permeability of aquifer material = 0.1cm/s. [4+4]
6. (a) Explain seismic refraction method for the exploration of groundwater. [5]
 

(b) Explain the working principle, advantages and limitations of the jet pump used for lifting groundwater. [5]

(c) Discuss about the aquifer system of the Terai region of Nepal. [4]

10/15 D.

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**Examination Control Division**  
2071 Magh

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

**Subject:** - Environmental Impact Assessment (*Elective III*) (CE78504)

- ✓ 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) The term climate change and sustainable development is burning issues these days. Explain how EIA has come forward as an effective tool to tackle these issues. [8]
   
b) Differentiate between IEE and EIA. What are the major environment screening criteria in Nepal? [3+5]
2. a) Give proper linkage of EIA and project cycle. List out the different aims of environmental scoping. [5+3]
   
b) What is the objectives of scoping in EIA process. How do you prepare TOR for EIA process briefly describe with an example. [8]
3. a) What is the purpose of baseline studies? Describe about environmental setting for baseline studies. [4+4]
   
b) A cement factory burns 5 tonnes of coal per hour and discharge the combustion products through a stack having a physical height of 75 m. Predict the impact of SO<sub>2</sub> emission on environment at 1000 m downwind and at a lateral distance of 400 m on either side of plume from chimney. Note that sulfur content on coal is 4%. Wind speed at top of the chimney is 6 m/sec. Atmospheric pressure is 1000 mb. Inside diameter of chimney is 0.9 m. Stack gas exit velocity 12 m/sec. Stack gas exit temperature and air temperature are 140°C and 25°C respectively. Take  $\sigma_y = 120$  m and  $\sigma_z = 85$  m. [8]
4. a) Discuss the impact evaluation technique. A largely poorly controlled brick factory has a stack 75 m high, it is currently emitting 127 g/s of SO<sub>2</sub>. Estimate the ground level concentration of SO<sub>2</sub> from this sources at a distance 3 KM directly downwind when the wind speed is 6 m/s at top of stack and the stability class is C (Take horizontal dispersion and vertical dispersion coefficient is 280 m and 170 m respectively). [8]
   
b) What is EMP? Highlight the objective of environmental monitoring. What are the different types of monitoring carried out in EIA? [2+2+4]
5. a) Explain different types of environment protection measures (EPMs). [8]
   
b) It is said that 'The beauty of EIA is public participation'. Explain the statement. Who are stakeholders involved in EIA process? [4+4]
6. Write short notes on: [4×4]
  - a) Method of impact evaluation techniques
  - b) Environmental Auditing
  - c) EIA Review
  - d) Project Cycle of EIA

05D TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2071 Bhadra

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

**Subject: - Hill Irrigation Engineering (Elective II) (CE76508)**

- ✓ 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) Point out the need, scope, limitations and advantages of micro irrigation methods in the hills of Nepal. [10]  
b) Determine the storage volume of a gravel trap having a discharge of 625 lps with maximum sediment concentration of  $2.1 \text{ kg/m}^3$ . Assume that the gravel is trapped at a rate of  $1.6 \text{ kg/m}^3$  of flow having bulk density of  $1900 \text{ kg/m}^3$ . Assume that the gravel trap should be cleaned in every 30 days. [6]
2. a) Compute irrigation interval and irrigation hours per day for a 16 mm drip line 3 lit/hr dripper, if lateral spacing of drip line is 90 cm and dripper spacing is 70 cm. Available water for the given soil is 0.28 fraction. Take crop water requirement equal to 4 mm/day. The crop rooting depth is 90 cm. [8]  
b) Describe the flow assessment techniques in Nepal with their data requirements and reliability. [8]
3. a) Design a settling basin for HIS having good intake site. Design flow =  $0.4 \text{ m}^3/\text{s}$ ; size of silt to be trapped = 0.5mm. Take  $Q/A_s = 0.02$  and critical bottom velocity = 0.25 m/s. Assume scour velocity for flushing = 1.8 m/s. Provide a neat sketch showing designed dimensions. [10]  
b) Calculate 80% reliable April flow for an ungauged catchment A using the data of Hydrologically Similar Catchment B. A has mean April flow equal to  $4 \text{ m}^3/\text{s}$  from 4 years of measurement. B has mean April flow for the same period equal to  $5.0 \text{ m}^3/\text{sec}$ . The long term mean April flow and standard deviation for B are equal to  $5.5 \text{ m}^3/\text{sec}$  and 1.25 respectively. [6]
4. a) Determine half monthly values from monthly ETo data (mm/day) for 12 months. [8]  

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.58	2.32	3.76	4.52	4.85	5.28	5.28	4.27	3.47	3.15	2.46	1.86
- b) Design a cascade drop to lower the water level in the canal by 3.5 m. The canal is carrying a discharge of 350 lps, having bed width 0.45 m. The existing ground slope at the drop is 1:1. Provide a neat sketch. [8]
5. a) What type of intakes are suitable for hill irrigation? Describe your answer with neat sketches. [8]  
b) Describe with neat sketches, the layout patterns of distribution systems appropriate to hill irrigation canals. [8]
6. Write short notes on any four of the following: [4\*4]
  - a) Design issues for head works of HIS ✓
  - b) Appropriate drainage crossings for HIS ✓
  - c) Vegetative measures against surface erosion and land slides
  - d) Difference between sprinkler and drip irrigation methods ✓
  - e) Suitable escape structures for HIS with sketch ✓
  - f) Appropriate and cost effective methods of sediment control in HIS

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

**Subject: - Computational Techniques in Civil Engineering (CE751)**

- ✓ 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.
- ✓ Candidates should use separate answer book for each group.
- ✓ Assume suitable data if necessary.

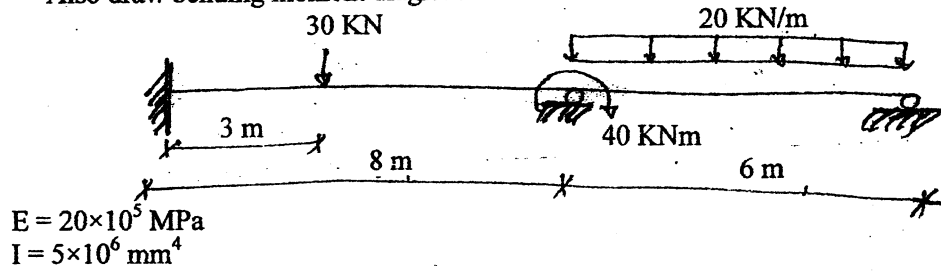
**Group A**  
**(Water Part)**

1. a) Derive the expression for second order accurate explicit finite equation for dynamic wave model. [6]
- b) A channel with a width of 40 m, bed slope 2% and Mannings  $n=0.03$  carries a discharge of  $100 \text{ m}^3/\text{s}$  through a section. If  $\Delta x$  is taken as 1500 meters, recommended the maximum time step for stable solution of kinematic wave routing in this condition. Assume hydraulic radius equal to flow depth. [6]
2. a) Write an algorithm for simulation of water hammer process using method of characteristics. [4]
- b) If the MOC is applied for  $t_1 = 1 \text{ sec}$  and  $t_2 = 2 \text{ sec}$ , time levels for a pipe with diameter 30 cm carrying water. If  $Q_A = 0.7 \text{ m}^3/\text{s}$ ,  $Q_B = 0.76 \text{ m}^3/\text{s}$  and  $Q_C = 0.74 \text{ m}^3/\text{s}$ ,  $H_A = 20 \text{ m}$ ,  $H_B = 20.6 \text{ m}$  and  $H_C = 20.4 \text{ m}$  are the values at grid points. Find the values of  $Q$  and  $H$  at  $t_1 = 1 \text{ sec}$  that will be required for finding  $Q$  and  $H$  at  $P$  when characteristics do not lie on diagonal. Here,  $\Delta x = 1000 \text{ m}$ ,  $\Delta t = 1 \text{ sec}$ ,  $f = 0.02$  and  $c = 800 \text{ m/s}$  [4]
3. Derive expression for finite difference scheme for 2D groundwater simulation in steady state for homogeneous and isotropic aquifer. Describe about the boundary conditions and flow coefficients. [8]

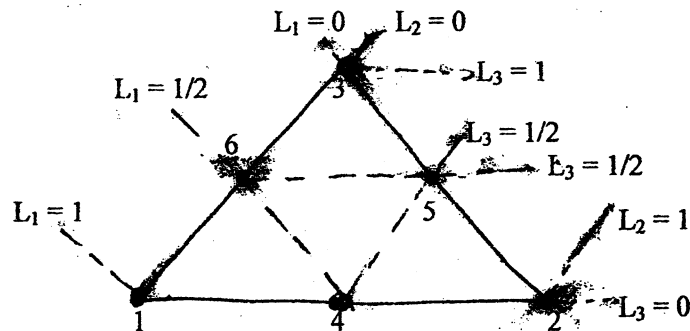
**Group B**  
**(Structure Part)**

4. Describe briefly the various solution techniques used for solving civil engineering problems. Also give their advantages and disadvantages. [8]
5. Explain different solution techniques of linear equations. Write the algorithm for conjugate gradient method. [5+3]
6. Explain the terms axi-symmetric problem with examples. Derive strain-displacement and constitutive relationships that exist in plane stress problem for isotropic material. [4+6]

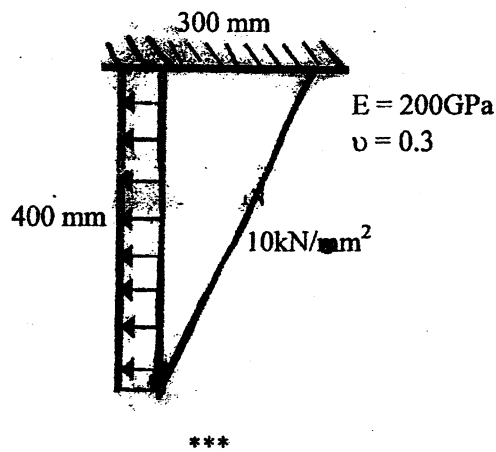
7. a) Determine the support reactions and deflections at mid-span for the given structure. Also draw bending moment diagram. [10]



- b) Derive shape function for the element as shown in figure below. [6]



8. A steel plate of thickness 10 mm is being loaded in the structural system as shown in figure below. Calculate stresses at the centroid of the plate. [10]



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

**Subject:** - Computational Techniques in Civil Engineering (CE751)

- ✓ 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.
- ✓ Candidate should use separate answer book for each group (Water and Structure).
- ✓ Assume suitable data if necessary.

**Group A**  
**(Water)**

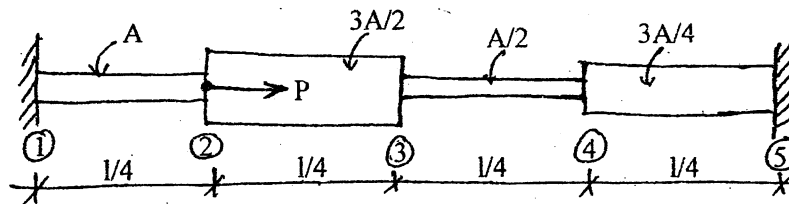
1. a) Derive the first order accurate implicit Finite Difference equation for kinematic wave model in the non-linear form. [6]
- b) Using the Finite Difference equation developed in question (a), compute the discharge at 1 km d/s of location X at time 14:00 hrs, for the following data: [6]
 

Rectangular channel, width = 20 m, Bed slope = 0.001, Manning's n = 0.03  
 Discharge at location X at time 14:00 hrs = 14 m<sup>3</sup>/s  
 Discharge at location X at time 13:45 hrs = 12 m<sup>3</sup>/s  
 Discharge at 1 km d/s of location X at time 13:45 hrs = 11 m<sup>3</sup>/s  
 No lateral flow, wetted perimeter approximately equal to width of channel.
2. Define characteristic curve and method of characteristics (MOC). Develop the characteristic equations from the partial differential form of the unsteady pipe flow equations. [2+6]
3. Explain the continuity equation used in groundwater flow analysis. Write down the algorithm for simulation of seepage under a dam. [3+5]

**Group B**  
**(Structure)**

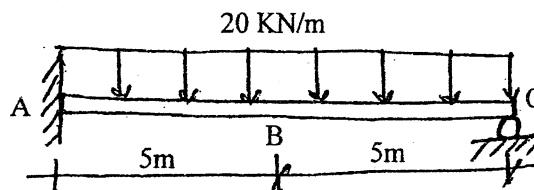
1. List the computational techniques used in Civil Engineering. Why FEM is predominating others? Explain briefly the steps involved in FEM. [2+2+4]
2. a) Write the algorithm for conjugate gradient method. [3]
- b) Solve the given system of equations using conjugate gradient method. [5]
 
$$\begin{bmatrix} 3 & 0 & 2 \\ 0 & 1 & 1 \\ 2 & 1 & 3 \end{bmatrix} \begin{Bmatrix} x_1 \\ x_2 \\ x_3 \end{Bmatrix} = \begin{Bmatrix} 1 \\ 0 \\ -1 \end{Bmatrix}$$
3. a) Derive the constitutive relation ( $\{\sigma\} = [D] \{E\}$ ) for an elastic isotropic material. [6]
- b) What are the conditions at which axisymmetric stress exists? Write the stress-strain relations for axisymmetric condition. [4]

4. a) For the given stepped bar obtain nodal displacements at nodes 2, 3 and 4. Also obtain forces developed at the supports. [8]

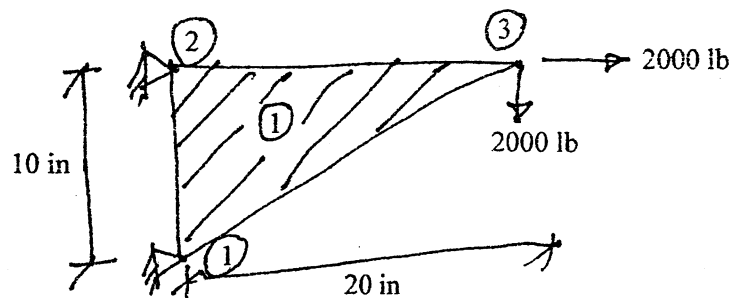


Take  $E = \text{constant}$  and cross-sectional areas as indicated in the figure.

- b) For the given beam find deflection at point B and rotations at points B and C. Take  $EI$  as constant throughout the beam. Discretise the beam into two elements. [10]



- c) A thin plate is subjected to the loads as shown in figure below. The plate thickness is 0.3 in and the other dimensions are shown in figure. Given that the Poisson's ratio  $= 0.3$  and the modulus of elasticity  $E = 30 \times 10^6$  psi. Determine nodal load displacements and the elemental stresses. [8]



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

**Subject:** - Computational Techniques in Civil Engineering (CE751)

- ✓ 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.
- ✓ Candidates use separate answer book for each group.

**Group A**

1. With the help of mechanics, explain various numerical methods for solving civil engineering problems. Given their advantages and disadvantages. [8]
2. a) Derive the expression for Lamé constants. [5]  
b) Define plane stress and plane strain problems with necessary conditions and suitable examples. [5]
3. a) Derive the shape function for the element as shown in the Fig. 1. [8]

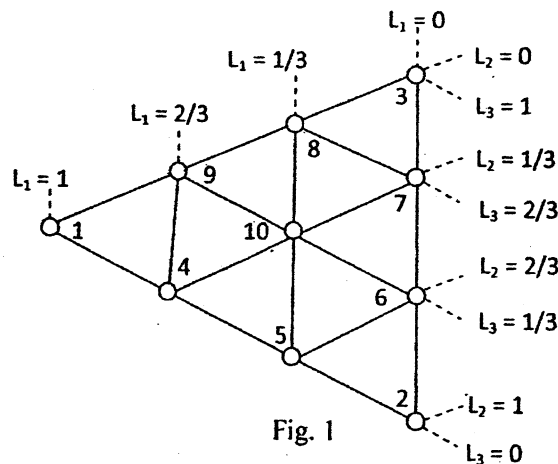


Fig. 1

- b) Considering plane stress condition, find out the nodal displacements and stresses of the CST element as shown in Fig. 2.  $E = 30 \times 10^6$  psi,  $t = 0.3$  in,  $\gamma = 460$  lb/in<sup>3</sup>,  $\nu = 0.3$ ,  $T_3 = 360$  psi with usual notations. [12]

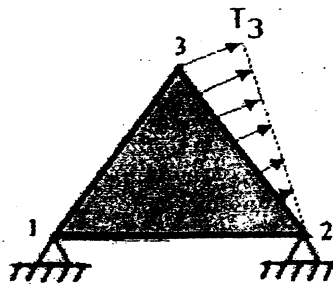


Fig. 2

**Group B**

4. a) Why conjugate gradient method is used in computation over Gaussian methods? [4]  
b) Solve the following equation by using conjugate gradient method (max. 5 iterations) [8]

$$\begin{bmatrix} 3 & 0 & 1 \\ 0 & -1 & 3 \\ 1 & 3 & 0 \end{bmatrix} \begin{Bmatrix} x_1 \\ x_2 \\ x_3 \end{Bmatrix} = \begin{Bmatrix} 1 \\ -12 \\ 2 \end{Bmatrix}$$

5. a) Write down the complete governing equations describing the movement of fluid. [2]  
b) Derive the kinematic wave approximation for the movement of fluid. [4]  
c) Derive a second order accurate finite difference scheme of linear kinematic wave equation which computes discharge for unknown time and location. [8]
6. Prepare an algorithm to compute discharge and head based on the following form of finite difference equations for unsteady pipe flow problem using rectangular grid. [8]

$$H_{pi} = H_{i-1} - B(Q_{pi} - Q_{i-1}) - RQ_{i-1} |Q_{i-1}|$$

$$H_{pi} = H_{i+1} + B(Q_{pi} - Q_{i+1}) + RQ_{i+1} |Q_{i+1}|$$

Where H = head, Q = discharge,  $H_{pi}$  and  $Q_{pi}$  = head and discharge at point of intersection of two characteristics, B and R = coefficients.

7. Explain the 1D implicit model to evaluate the river stage water table interaction. [8]

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

**Subject:** - Computational Techniques in Civil Engineering (CE751)

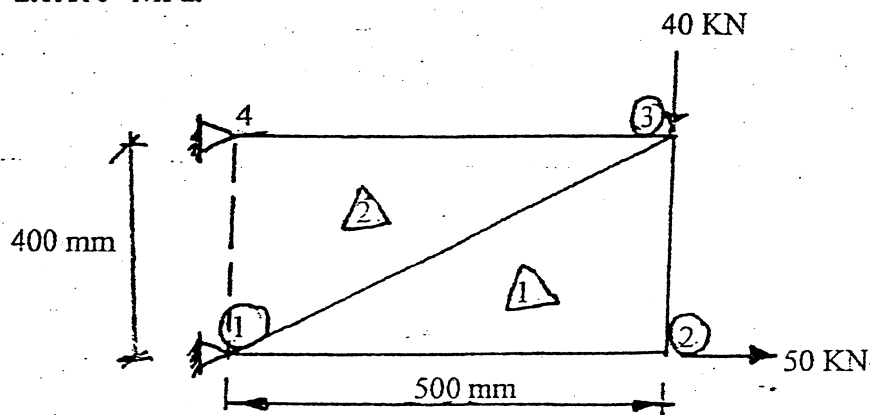
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.
- ✓ Candidates use separate answer book for each group.

**Group A**

1. Explain foundation of finite element method. Why this method is less appropriate for large deformation problem? How do you choose numerical method for different problems? Illustrate with examples. [8]
2. Write an algorithm and a program (C or Fortran or Matlab) for fast Fourier transform. With a suitable example explain what parameters can be identified with the help of time domain and frequency domain. [12]
3. (a) Derive equilibrium equations for 3D state of stress in a solid. [5]
 

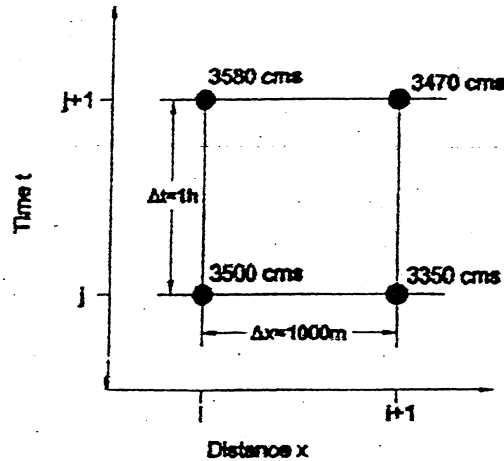
(b) What do you understand by axisymmetric problem? Write the constitutive relations and strain displacement relation for axisymmetric condition. [5]
4. (a) Formulate stiffness matrix for a bar element. Rotate the same bar element and formulate stiffness matrix for 2D truss element. [10]
 

(b) Determine the stiffness matrices for the element as shown in Fig. 1.  $A=300 \text{ mm}^2$  and  $E=2.1 \times 10^5 \text{ MPa}$ . [10]

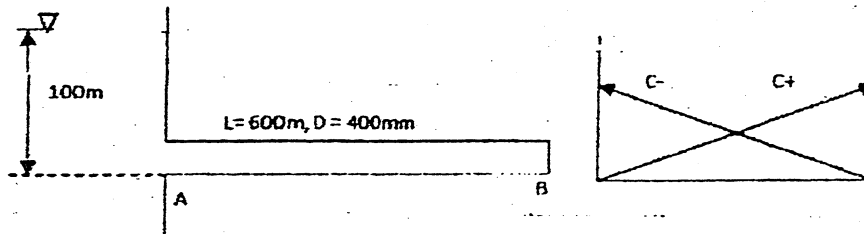


### Group B

1. a) The value of flow rate  $Q$  at four points in the space-time grid are shown in figure below.  $\Delta t = 1$  h,  $\Delta x = 1000$  m and  $\theta = 0.55$ , calculate the values of  $\partial Q / \partial t$  and  $\partial Q / \partial x$  by four point implicit method.  $\theta$  = weighting factor. [6]



- b) A flood of  $150 \text{ m}^3/\text{s}$  peak discharges passed a gaging station at 12:00 noon on a river. There is a community adjacent to the river 7.2 km downstream. What will be the value of peak discharge at that community at 12:00 noon if the velocity of flow is  $1.2 \text{ m/s}$  and peak discharge at that community at 9:00 A.M is  $100 \text{ m}^3/\text{s}$ . Assume width of river as inside and use first order accurate numerical scheme of kinematic wave equation, Take  $\Delta x = 7.2$  km and  $\Delta t = 1$  hrs. [6]
2. A pipe conveys water from a reservoir as shown in the figure. Take  $f = 0.02$ ,  $C = 1200 \text{ m/s}$ . The hydraulic grad line (HGL) at the reservoir is given as  $H_{PA} = 100 + 3 \sin(\pi t)$ . The discharge at the downstream end is zero at all times. By using only one reach, compute discharge from A and elevation of hydraulic grad line at B at 3 Sec using discretized equation of the method of characteristics in the form of HGL and discharge. [8]



3. Finite difference equation for simulating river stage-water table interactions considering one dimensional flow. [8]

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

***Subject: - Geographic Information System (GIS) (Elective)***

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any **Seven** questions. ***Question No. 10 is compulsory.***
- ✓ **All** questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. Define GIS? Discuss on various applications of GIS?
2. What are various properties of map projections? Discuss on the Universal Traverse Marcator (UTM) projection system
3. What are various applications of GPS? Highlight the importance of GPS in GIS.
4. Discuss the importance of layers in Digital Mapping? Identify at least 7 layers to develop a map of a City like Patan. Also discuss on importance classification of a layer into sub classes with example of building for better management of GIS data.
5. What are various steps in GIS database design methodology? Design simple ER model of GIS database for parcel database management to assist tax management for a municipality
6. What is remote sensing? How remote sensing is associated with GIS? Also discuss on importance of reflectance and atmospheric windows in remote sensing.
7. What do you understand by cartography? Develop model of cartographic communication. Sketch for various components of Map?
8. As a GIS professional sketch an operation of analysis model to assist decision maker, in finding suitable location, with the given information and conditions below.  
A local developer has approached the City of Katmandu, Planning and Economic Development Department with plans to construct a family oriented amusement park. The planning and economic development department would like to assist the developer in finding suitable location for the facility. The ideal location would meet the following conditions:
  - Agriculture or vacant land use

- Within the census block (Population) group with high concentration of target age group (10-30 Years old) and target median household income (Greater than Rs. 120,000)
- At least one kilometer away from the core city areas (downtown)
- Within 500 meters of the highway

What data sets are required for the planning and economic department to perform the analysis process?

9. Discuss on importance of Geo-Spatial Data Infrastructure (GSDI)? Discuss on various components of GSDI.
10. Write short note on any two of the following
  - a. Map Scale
  - b. Thermography
  - c. Digital Elevation Modeling (DEM)
  - d. Geo-referencing

**Examination Control Division**  
2072 Ashwin

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

**Subject: - Optical Fiber Communication (Elective II) (EX76501)**

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

1. Explain the historical development of optical fiber communication? List the advantage and disadvantages of optical fiber communication. [3+1]  
1+1
2. Find the acceptance angle and numerical aperture of a fiber with a core index of reflection of 1.57 and a cladding index of refraction of 1.51. [2+2]  
2+2
3. Define slab waveguide and cylindrical waveguide? Using Maxwell's equation, derive wave equation for cylindrical waveguide. [2+2]  
1+1
4. Distinguish between phase velocity and group velocity. Discuss modes in a planar optical guide. [3+2]  
1+1
5. A multimode step index fiber with a core diameter of 80  $\mu\text{m}$  and a relative index difference of 1.5% is operating at a wavelength of 0.85  $\mu\text{m}$ . If the core refractive index is 1.48, estimate: (i) The normalized frequency for the fiber, (ii) the number of guided modes. [2+2]  
2+2
6. Explain the main causes of chromatic dispersion. How can dispersion be minimized in the optical fiber communication. [2+3]  
1+1
7. What are the types of optical light source? Draw energy state diagram and light output current characteristics of an ideal semiconductor laser indicating absorption and emission of radiation. Also draw light output as a function of frequency. [2+3+2]  
1+1+1
8. Define quantum efficiency of optical detector. A photodiode has a quantum efficiency of 65% when photons of energy  $1.5 \times 10^{-19}$  J are incident upon it. (i) At what wavelength is the photodiode operating? (ii) Calculate the incident optical power required to obtain a photocurrent of 2.5  $\mu\text{A}$  when the photodiode is operating as describe above. Describe the working mechanism of Distributed Bragg Reflector (DBR) laser. [1+3+3]
9. Why the high capacity optical fiber communication systems used digital system using intensity modulation of the optical source. What is an Eye pattern in binary digital transmission? [3+2]  
1
10. What are optical Couplers and their types? Explain the fabrication method of fused Star Coupler. Write short notes on Fresnel loss in fiber joint. [3+4+4]  
2+2+2
11. Consider an EDFA being pumped at 980-nm with a 30-mW pump power. If the gain at 1550-nm is 20dB, what are the maximum input and output power? What is Integrated optics and what are its advantages over electronic circuit. [4+1+2]  
4+1+1

12. Write short notes on PON and FTTH. A 622 Mbps optical transmission system is to operate at a wavelength of 1550 nm. Apart from the transmitter and receiver, the optical links contains an optical amplifier with 7 dB gain at 45 km of the links. The transmitter available has a minimum coupled output power of +3 dBm. While the receiver has a worst case sensitivity of -27 dBm. Two types of fiber with different specifications are available as shown in the table below. Four connectors are to be used in the system with a loss of 0.15 dB each, while the splice loss for both fiber types is 0.05 dB maximum. Calculate the dispersion penalty associated with the use of each fiber. Prepare a power budget for each system and decide which fiber type should be used and why? Assume transmitter and receiver are situated at Kathmandu and Pokhara, respectively.

[5+12]

Fiber type	Total Dispersion	Attenuation	Maximum distance between splices
X	5 ps/km	0.3 dB/km	0.7 km
Y	7 ps/km	0.4 dB/km	0.6 km

2+

Fiber type	Total Dispersion	Attenuation	Attenuation standard deviation
A	7 ps/km	0.36 dB/km	0.05 dB/km
B	9.5 ps/km	0.33 dB/km	0.04 dB/km

Joint type	Avg. attenuation	Attenuation standard deviation
Fusion splice	0.03 dB	0.012 dB
Connector	0.25 dB	0.04 dB

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

**Subject: - Optical Fiber Communication (Elective)**

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

1. a) Describe the block diagram of an optical fiber based communication system. Illustrate some advantage of optical fiber based communication system. [4+2]  
b) Find the core radius necessary for single-mode operation at 1320 nm of a step-index fiber with core index 1.480 and cladding index 1.478. What are the numerical aperture and maximum acceptance angle of this fiber? [5]
2. a) Describe the optical signal guiding principle in the optical fiber. What are acceptance angle and Numerical aperture of the fiber? [3+3]  
b) Calculate the limitation in transmission length caused by fiber loss if the loss is 0.2dB/km, mean optical launched power is 0.029 mW and mean optical received power is 0.001 mW. [5]
3. a) What is optical fiber loss? Describe briefly the loss mechanism. [2+4]  
b) When  $3 \times 10^{11}$  photon reach with a wavelength of 850 nm are incident on a photodiode, on average  $1.2 \times 10^{11}$  electrons are collected at the terminals of the device. Determine the quantum efficiency and the responsivity of the photodiode at 850 nm. [5]
4. a) What are modal dispersion and chromatic dispersion in the fiber? Describe the demerit of dispersion. [4+2]  
b) Calculate the intrinsic connection losses for two 62.5/125  $\mu\text{m}$  MMGI fiber manufactured by Samsung fiber company caused by Diameter mismatch and NA mismatch [The fiber has core radius  $a=62.5 \pm 3 \mu\text{m}$  and  $NA=0.275 \pm 0.015$ ] [5]
5. Describe the photo detection principle of the optical receiver. Compare the properties of avalanche photo diode and PiN photo diode. [3+3]
6. a) Distinguish between spontaneous and stimulated emission radiation. Briefly describe about distributed feedback laser diode principles. [2+4]

b) A local link to be installed having the following requirements and characteristics. Max bit rate: 16Mbps, installation length: 4 km, operating wavelength 850 nm, rise time of lightwave equipment: 4ns and LED spectral width: 20 nm. Will MM 62.5/125 $\mu$ m fiber support the required bit rate? The modal BW: 160MHz.km and chromatic dispersion is 0.21ns/nm.km is given in the fiber data sheet [6]

7. A 560 Mb/s optical transmission system is to operate at a wavelength of 1550 nm over an unrepeated distance of 51 km. The transmitter available has a minimum coupled output power of +2 dBm, while the receiver has a worst case sensitivity of -28 dBm. Two types of fibre with different specifications are available as shown in Table 1 below. Two connectors are to be used in the system with a loss of 0.5 dB each, while the splice loss for both fibre types is 0.05 dB maximum.

Calculate the dispersion penalty associated with the use of each fibre. Prepare a power budget for each system and decide which fibre type should be used and why. [10]

**Table 1**

Fibre type	Total dispersion	Attenuation	Maximum distance between splices
A	8 ps/km	0.4 dB/km	700 metres
B	10 ps/km	0.35 dB/km	600 metres

8. Write Shot notes on (Any Two)

[4×2]

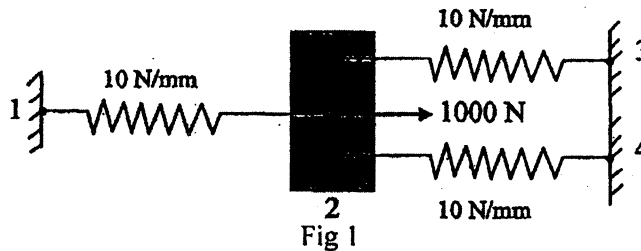
- i. DWDM
- ii. Cut-off wavelength
- iii. Optical couplers

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

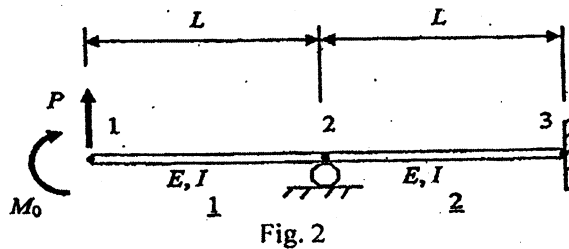
**Subject: - Finite Element Methods (Elective II)**

- ✓ 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) Mention various numerical methods used in civil engineering problems. Also compare their advantages, disadvantages. [4+4]
- (b) For the given spring system shown in Fig. 1, obtain the global stiffness matrix, displacements at each nodes and reaction at each supports, if external force at node 2 is 1000N and the Stiffness  $K_1=K_2=K_3=10\text{N/mm}$  are given. Use the minimum potential energy approach. [12]



- 2 Obtain the nodal displacements and reaction forces of the two-member beam structure loaded as shown in Fig. 2. Neglect axial deformation. Also draw the shear force and bending moment diagram for this beam. Given that,  $L_1=L_2=1\text{m}$ ,  $P=50\text{KN}$ ,  $M_0=40\text{KN-m}$ ,  $E_1=E_2=20000\text{MPa}$ ,  $I_1=I_2=6*10^6\text{mm}^2$ . [20]



- 3 (a) Write down the steps to formulate stiffness matrix for isoparametric quadrilateral elements. [10]

- (b) Derive shape functions for 9 node Lagrangian element as shown in the Fig. 3. [10]

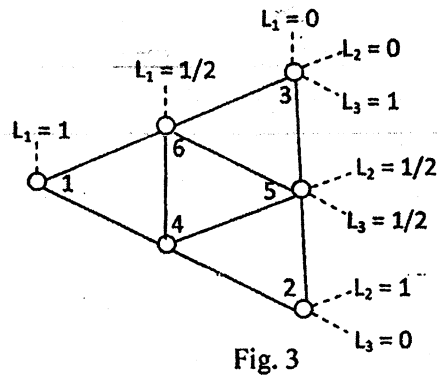


Fig. 3

- 4 Find out the stiffness matrices (Local and global) for the truss shown in the Fig. 4. Calculate vertical displacement at node 1.  $E = 200 \text{ KN/m}^2$  and  $A = 30 \text{ cm}^2$ . [15+5]

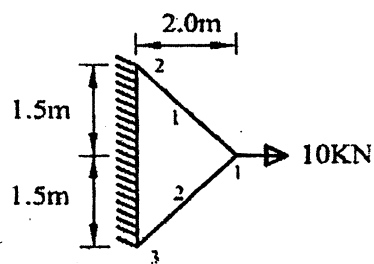


Fig. 4

5. Derive the stiffness matrix for bar element using natural coordinate system. [20]

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

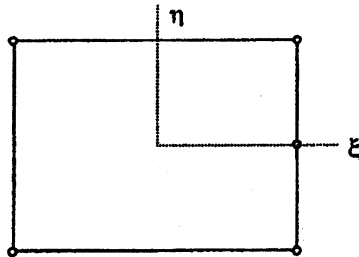
**Subject:** - Finite Element Method (EG785CE)(Elective II)

- ✓ 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.
- ✓ Assume suitable data if necessary.

1. Write down the basic steps for solving a structure using Direct Stiffness Method. Prepare the computer algorithmic steps for solving a plane truss using DSM with suitable example. Why it is said to be the most suitable method of computing, using computer algorithm, explain. [16]
2. The flexibility matrix  $[F]$  of the structure is given below; the displacement vector  $\{\Delta\}$  due to external loads in the determinate primary structure is also given. Write the program algorithm for using Gauss Elimination Approach and find the value of the redundant forces using the approach. Hints:  $\{\Delta\} = [F]\{P\}$  [16]

$$[F] = 1/EI * \begin{pmatrix} 125 & 62.5 & -25 \\ 62.5 & 333.33 & -37.5 \\ -25 & -37.5 & 10 \end{pmatrix}; \quad \{\Delta\} = 1/EI * \begin{Bmatrix} 221.67 \\ -1440 \\ 139 \end{Bmatrix}$$

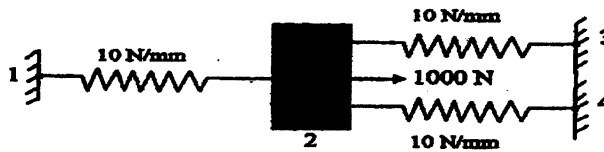
3. a) A 5 node plane stress element has the following geometry. Sketch a suitable set of shape functions and write down the expression for the shape functions in terms of Natural coordinates. [6]



- b) A bar of length 3m is composed of two different sections. At the center of the bar, the bar has its x-section area of  $3000\text{mm}^2$  and its length is 1m, on either side of which the x-section area is  $1500\text{mm}^2$  and the length are equal to 1m each. An axial load of 1200 kN is applied at the center of the bar. Determine the nodal displacement at the center of the bar. Take  $E = 78 \times 10^6 \text{ kN/m}^2$ . [10]

4. a) Drive the expression for shape function of Constant strain triangular element, also draw the Shape function diagram. [8]
- b) Drive the expression for Strain-Displacement matrix for the constant strain triangle by using the Jacobian transformation matrix. [8]

5. Write down the main concept of minimum potential approach with suitable relations. For the given spring system, obtain the global stiffness matrix, displacements at each node and reaction at each supports, if external force at node 2 is 1000N and the Stiffness  $K_1=K_2=K_3=10\text{N/mm}$  are given. Use the minimum potential energy approach. [4+12]



6. Write short notes (Any Four)

[4x4]

- i. Computing Perimeter of a Circle using FEM.
- ii. Rayleigh Ritz Method.
- iii. Application of FEM.
- iv. Shape function for a Beam Element.
- v. Shape function for a three node bar element.

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

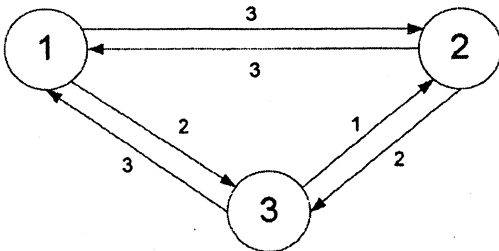
**Subject: - Traffic and Transport Modeling (Elective II)**

- ✓ 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**.
- ✓ Assume suitable data if necessary.

- What is transportation planning? Explain the role of models in transportation planning. [3+5]
  - What are the base year inventories required for transport modeling? [8]
- What are the factors to be considered for zoning? [8]
  - The trip rate (y) and the corresponding household sizes (x) from a sample are shown in table below. Compute the trip rate if the average household size is 3.25 [8]

	Household size (x)			
	1	2	3	4
	1	3	4	5
	3	4	5	8
Trips per day (y)	3	5	7	8

- Classify the different types of trips. [8]
  - A three zone have been connected by a transportation network as indicated in the figure below. The number next to each link represents the travel cost. Assume all intrazonal travel cost as 1. The total trip production and attraction of all zones are given in the table. [8]



Zone	Productio n	Attractio n
1	100	220
2	200	165
3	250	165

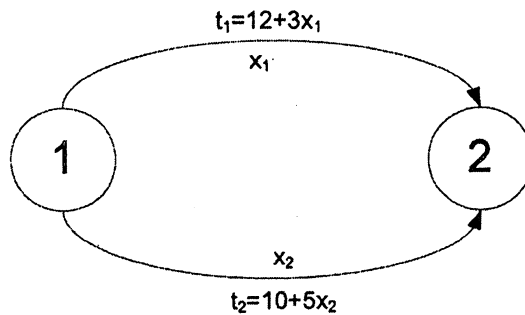
Determine the OD trip matrix using a doubly constrained gravity model using accessibility  $F_{ij} = f(c_{ij}) = 5 \times e^{(-0.5c_{ij})}$  as the trip distribution function. (Perform only two iterations)

- 4 a) What is generalized cost function? What are the advantages and disadvantages of growth factor method? [2+2+2]
- b) A mode choice model for a city includes the following modes: car (C), light rail (L), buses (B) and rapid rail (R) with utility functions (U) as shown in the table below. [5+5]

Utility Function	Cost (C)	Time (T)
$U(C)=3.2-0.3*C-0.04*T$	5	30
$U(L)=1.0-0.2*C-0.04*T$	3	25
$U(B)=-0.1*C-0.01*T$	2.5	40
$U(R)=1.5-0.3*C-0.05*T$	6	20

Where C is the cost and T is the travel time in min.

- i) Based on an estimate that 12,000 workers will head for downtown each morning, how many workers will choose to take a particular mode?
- ii) If the government subsidizes light rail by 30%, buses by 20%, and rail rapid by 10% and at the same time increases car cost by 15%, what will be the new modal distribution?
- 5 a) What is trip assignment? List out the applications of trip assignment. [3+5]
- b) Calculate the system travel time and link flows by doing user equilibrium assignment for the network in the given figure. Verify that the flows are at user equilibrium. Assume that the total number of trips between two zones is 12. [8]



- 6 Write short notes on: [4x4]
- Aggregate and disaggregate modeling
  - Diversion curves
  - Different methods of travel survey
  - Urban transportation planning process

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**Examination Control Division**  
2066 Magh

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

**Subject: - Traffic and Transport Modeling (Elective 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**.

✓ Assume suitable data if necessary.

- 1 a Define transport planning. Describe the system approach to Transport planning. [8]
- b The Spot speeds at a particular location on a highway are known to be normally distributed with a mean of 80 kmph and standard deviation of 15 kmph. What is the probability that if a sample of 100 vehicles are tested that the mean speed observed will exceed 75 kmph? [8]

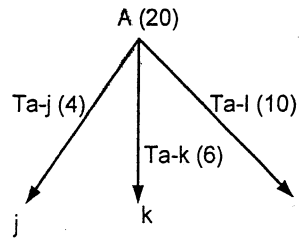
Z	3.00	3.10	3.20	3.30	3.40
$\Phi(Z)$	0.99865	0.99903	0.99931	0.99952	0.99966

- 2 a Write different types traffic forecasting models. Explain travel demand function. [8]
- b Classify the trips. What are the factors affecting trip production and generation? [8]
- 3 a Balance the work trips (production and attractions. [8]

Zone	Unbalanced work trip		Balanced work trips	
	Trip Attraction	Trip Production	Trip Attraction	Trip Production
1	100	3000		
2	300	2000		
3	500	3000		
4	600	800		
5	800	900		
6	1200	1000		
7	3000	500		
8	3000	100		
9	2000	1200		
10	500	1500		
Sub Total				
External Station				
11	300	50		
12	500	100		
13	300	25		
Sub Total				
Total				

- b What is the main objective of trip distribution modeling? Write down the different methods of trip distribution. [8]

- 4 a An origin zone *A* with 20 base year trips going to *j*, *k*, *l* numbering 4, 6, and 10 respectively, has growth rate of 2, 3, 4 and 5 for *A*, *j*, *k* and *l* respectively in 25 years. Determine future trips from *A* to *j*, *k* and *l* in future year. [8]



- b What are the various factors affecting mode choice? Write down different mode choice models. [8]
- 5 a Assuming the observable utilities  $U_i$  for a particular group of people can be given by the following function:

$$U_{car} = 1 - 0.15K_{car} - 0.1T_{car}$$

$$U_{bus} = 0 - 0.15K_{bus} - 0.1T_{bus}$$

$$U_{bicycle} = 0.5 - 0.1T_{bicycle}$$

In this situation,  $T$ , and  $K$  are travel time and travel cost respectively and they are having the following values:

	Car	Bus	Bicycle
$T$ , minute	5	15	20
$K$ , Rs*100	0.2	0.17	-

Calculate the probability that a particular travel mode will be chosen by individuals in this group. [8]

- b What is the application of trip assignment model? In order to relieve congestion on an urban street network, an expressway is proposed to be constructed. The travel time from one zone centroid to another via the proposed motorway is estimated to be 10 minutes whereas the time for the same travel via existing street is 18 minutes. The flow between the two zone centroids is 1200 vehicles per hour. Assign the flow between the new motorway and existing streets. [8]
- 6 Write Short note on: (any four) [4x4]
- Four stage transport model
  - Travel impedance and deterrence function
  - Transport generated air pollutants
  - Elasticity model
  - Land-use transport cycle

05M TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2071 Magh

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

**Subject:** - Traffic Engineering and Management (*Elective II*) (CE76513)

- ✓ 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. On a specific section of highway, studies show that the speed - density relationship is

$$V = V_f \left[ 1 - \left( \frac{k}{k_j} \right)^{3.5} \right]$$

It is known that the capacity is 3800 veh/hr and the jam density is

140 veh/km. What is the space mean speed of the traffic at capacity and what is the free flow speed.

2. An observer standing at a point along a three lane roadway found that all vehicles in Lane 1 are travelling at 50 kmph, all vehicles in Lane 2 are travelling at 75 kmph and all vehicles in Lane 3 are travelling at 100 kmph. There is also a constant spacing of 0.8 km between vehicles. If spot speed data were collected for all vehicles as they cross the observation point for 30 minutes, what will be the time mean speed and space mean speed for the traffic stream?
3. Define acceleration noise with mathematical expression and mention its significance. In a two lane one way stream of 1000 vph with 360 vehicles in Lane A and the remaining vehicles in Lane B. 8% of vehicles in Lane A have gaps less than 1 sec and 18% of the vehicles in Lane A have gaps less than 2 seconds. Compute the average waiting time for the driver to make a lane change. Assume driver speed in Lane B is 40 kmph and stream speed is 50 kmph.
4. A four lane urban freeway is located on rolling terrain and has 3.6 m lanes, no lateral obstructions within 1.8 m of the pavement edges and an interchange every 3.2 km. The traffic stream consists of cars, buses and large trucks. A weekday directional peak hour volume of 1800 vehicles (familiar users) is observed, with 700 arriving in the most congested 15 minimum period. If a level of service no worse than C is desired, determine the maximum number of large trucks that can be present in the peak hour traffic stream.
5. Explain the design principles of intersection channelization. What are the different types of grade separated intersection?
6. A pretimed four phase signal has critical lane group flow rates for the first three phases of 200, 187 and 210 veh/hr. The saturation flow rates are 1800 veh/hr/lane for all phases. The lost time is known to be 4 seconds for each phase. If the cycle length is 60 seconds, what is the estimated effective green time of the fourth phase? Also explain permitted and protected movements.

Lane Width (m)	Reduction in Free-Flow Speed, $f_{LW}$ (km/h)
3.6	0.0
3.5	1.0
3.4	2.1
3.3	3.1
3.2	5.6
3.1	8.1
3.0	10.6

Right-Shoulder Lateral Clearance (m)	Reduction in Free-Flow Speed, $f_{LC}$ (km/h)			
	Lanes in One Direction			
	2	3	4	$\geq 5$
$\geq 1.8$	0.0	0.0	0.0	0.0
1.5	1.0	0.7	0.3	0.2
1.2	1.9	1.3	0.7	0.4
0.9	2.9	1.9	1.0	0.6
0.6	3.9	2.6	1.3	0.8
0.3	4.8	3.2	1.6	1.1
0.0	5.8	3.9	1.9	1.3

Interchanges per Kilometer	Reduction in Free-Flow Speed, $f_D$ (km/h)
$\leq 0.3$	0.0
0.4	1.1
0.5	2.1
0.6	3.9
0.7	5.0
0.8	6.0
0.9	8.1
1.0	9.2
1.1	10.2
1.2	12.1

Number of Lanes (One Direction)	Reduction in Free-Flow Speed, $f_N$ (km/h)
$\geq 5$	0.0
4	2.4
3	4.8
2	7.3

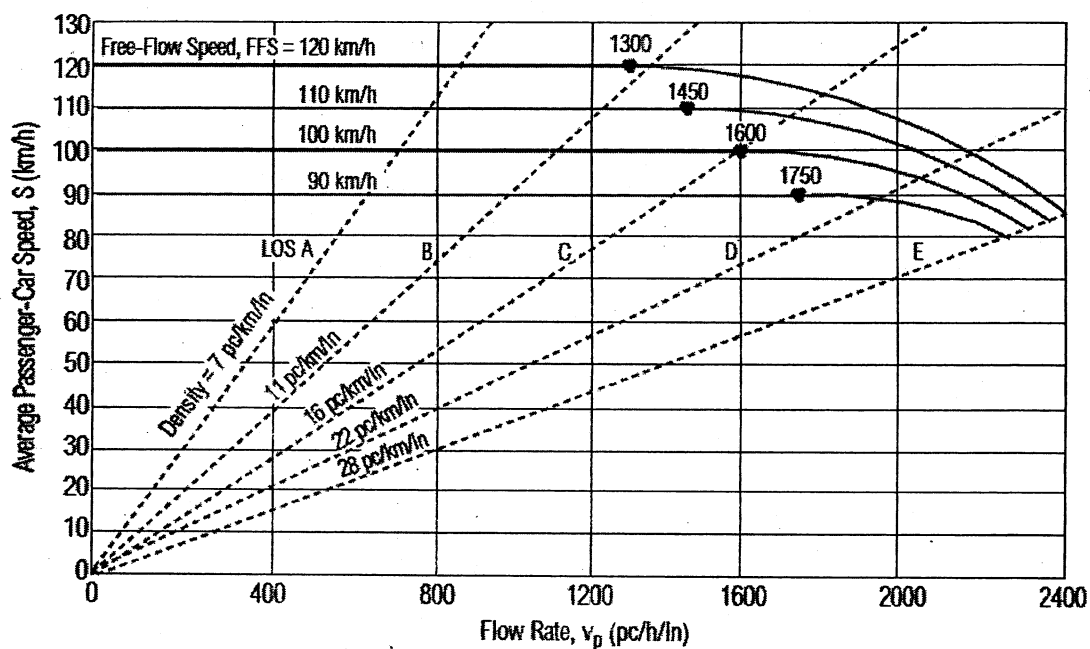
Note: For all rural freeway segments,  $f_N$  is 0.0.

Factor	Type of Terrain		
	Level	Rolling	Mountainous
$E_T$ (trucks and buses)	1.5	2.5	4.5
$E_R$ (RVs)	1.2	2.0	4.0

7. After observing the arrivals and departures at a highway toll booth over a period of 1 hour, the observer notes that the arrival and departure rates follow deterministic regime, but instead of being uniform they change overtime according to some function. The arrival rate is given by the function  $= 2.1 + 0.15 t - 0.0034 t^2$  and the departure function  $= 1.3 + 0.06 t$  where  $t$  is in minutes after the beginning of observation period. Assuming D/D/1 model compute the following
- the time when the queue will vanish
  - the time when there will be maximum queue
  - the length of maximum queue
  - total delay
  - average delay per vehicle in minutes
8. Describe the different parameters of congestion measurement. Calculate the time gap for a platform of 29 school children, 5 in a row, consecutive time 2 sec and width of crossing section is 7.5 m, walking speed of children is 0.8 m/s and assume start up lost time as 3 sec.
9. Consider the EB approach of an intersection with two lane groups: EB/L and EB/TH+R. The cycle length and green times for the lane groups are as: cycle length = 65 sec, green time for EB/L = 12.5 sec and green time for EB/TH+R = 24.5 sec. The signal is isolated and  $V/C = 0.9$  for EB/L and 0.85 for EB/TH+R. The saturation flow can be computed from a given headway of 2.05 sec. Assume analysis period of 15 minutes and lane group flow as left turn = 300 vph and TH+R = 1100 vph. Calculate
- delay for the left lane group
  - delay for TH+R lane group
  - aggregate delay for EB approach
10. What is ramp metering? Explain in brief the factors that affect level of service of signalized intersection.

\*\*\*

Criteria	LOS				
	A	B	C	D	E
FFS = 120 km/h					
Maximum density (pc/km/ln)	7	11	16	22	28
Minimum speed (km/h)	120.0	120.0	114.6	99.6	85.7
Maximum v/c	0.35	0.55	0.77	0.92	1.00
Maximum service flow rate (pc/h/ln)	840	1320	1840	2200	2400
FFS = 110 km/h					
Maximum density (pc/km/ln)	7	11	16	22	28
Minimum speed (km/h)	110.0	110.0	108.5	97.2	83.9
Maximum v/c	0.33	0.51	0.74	0.91	1.00
Maximum service flow rate (pc/h/ln)	770	1210	1740	2135	2350
FFS = 100 km/h					
Maximum density (pc/km/ln)	7	11	16	22	28
Minimum speed (km/h)	100.0	100.0	100.0	93.8	82.1
Maximum v/c	0.30	0.48	0.70	0.90	1.00
Maximum service flow rate (pc/h/ln)	700	1100	1600	2065	2300
FFS = 90 km/h					
Maximum density (pc/km/ln)	7	11	16	22	28
Minimum speed (km/h)	90.0	90.0	90.0	89.1	80.4
Maximum v/c	0.28	0.44	0.64	0.87	1.00
Maximum service flow rate (pc/h/ln)	630	990	1440	1955	2250



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

**Subject: - Design of Bridges (Elective II)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any **Eight** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ IRC:6, IRC:21 and IRC:5 are allowed to use.
- ✓ Assume suitable data if necessary.

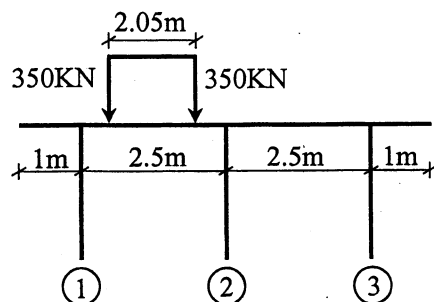
1. Write short note on IRC live load used in the design of bridge and sketch the followings: [10]

- IRC Class AA Wheel Loading
- IRC Class AA Track Loading
- AASTHO HS-20-44 Loading (Standard Truck Loading)

2. Find the effective width of slab at mid span and at support of a simply supported slab bridge. Take [10]

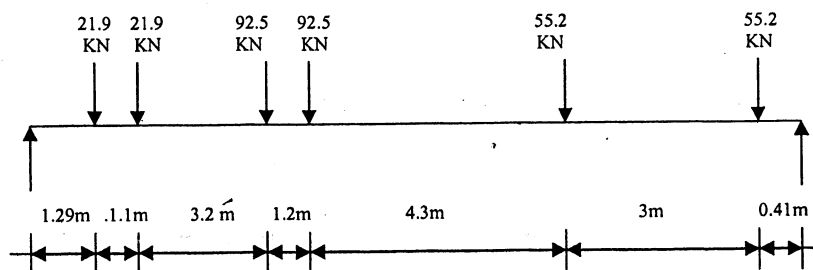
Effective span = 6m  
Carriage way = 7m  
Kerb width = 0.5m  
Thickness of wearing course = 70mm  
Load = Class AA track load

3. Find the maximum reaction of girder 2 for the given loading by Courbon's method. [10]



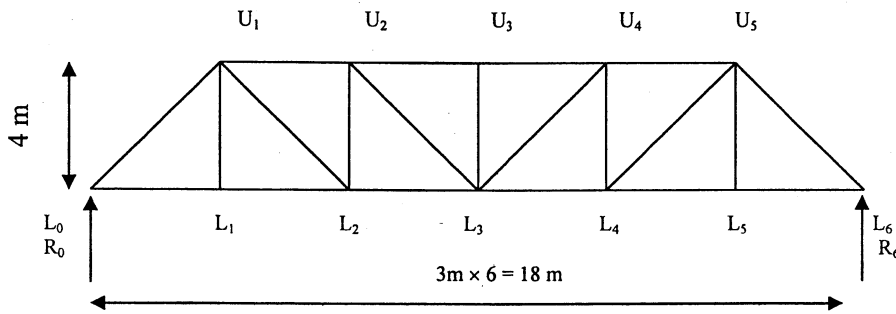
Cross section of bridge deck with Class AA track load

4. Find the longitudinal position of the following wheel loads so that BM will be maximum at mid span of bridge. [10]



5. Explain how the restrained slab panel of bridge deck is designed by Pigeaud's method. [10]

6. Draw the influence line diagram of the reaction force ( $R_0$ ) and the member ( $U_2L_3$ ) of the bridge truss as shown below and find maximum reaction and axial force for IRC Class AA track load. [10]



7. Describe the following components of bridge with sketches. [10]

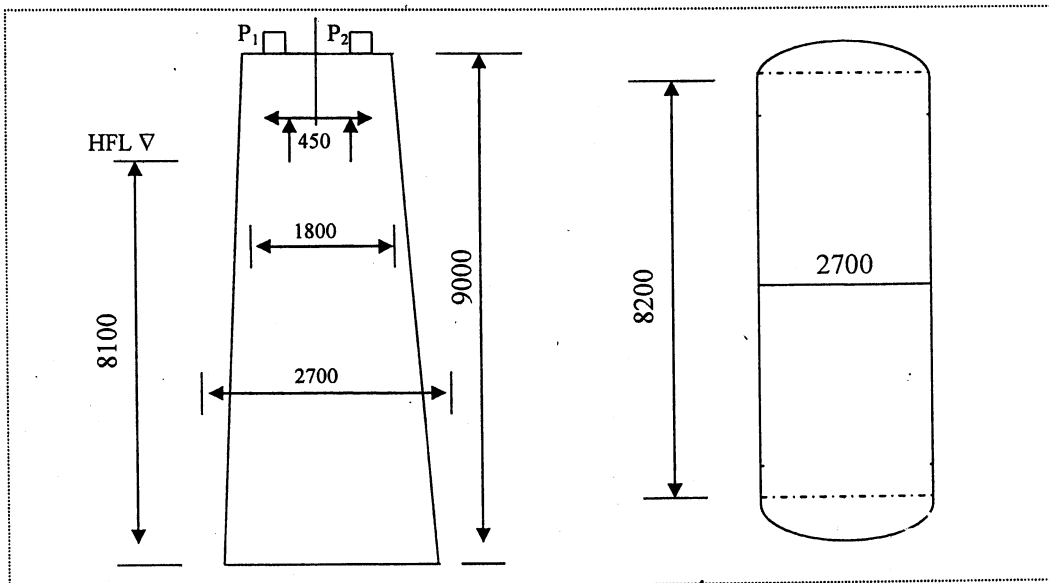
- Abutment
- Pier
- Bridge bearing
- Bridge foundation
- Bridge deck

8. Describe the importance of bridge maintenance. [10]

9. Describe the governing factors for the selection of bridge deck. [10]

10. Calculate the stresses on foundation of the pier shown below from the following data: [10]

- Bridge span = 21.3m
- Dead load from each span = 2250 KN
- Reaction due to live load on one span = 900 KN
- Intensity of pressure due to water current =  $4.5 \text{ KN/m}^2$
- Material for pier: cement concrete M20 grade
- Assume other data if necessary.



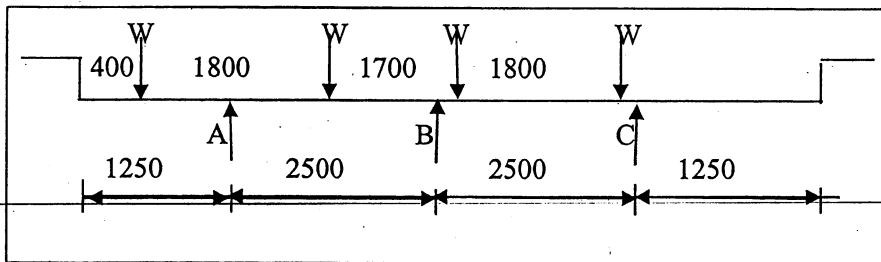
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Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

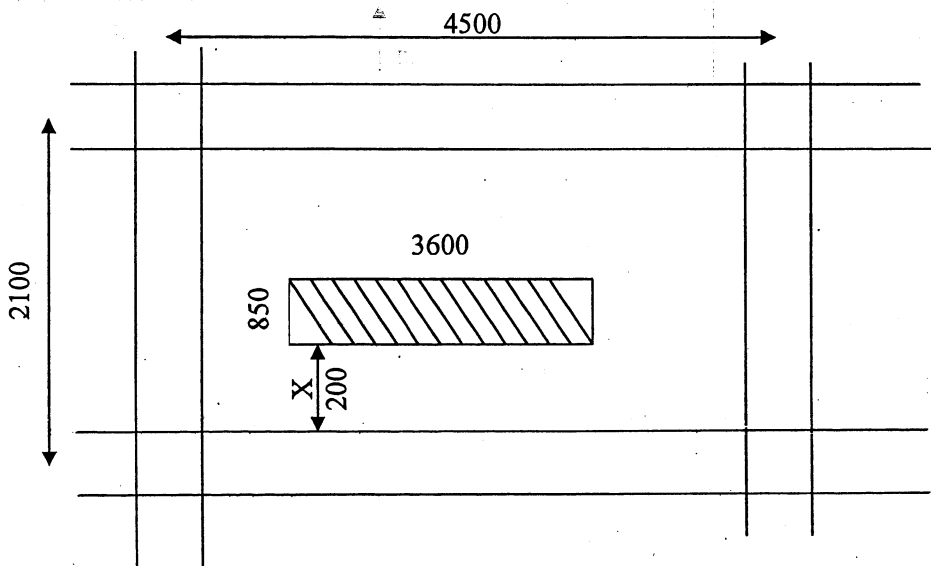
**Subject: - Bridge Engineering (Elective I)**

- ✓ 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. Calculate the reactions on each Girder of the following figure by the use of Courbon's Method. Use eccentricity as;  $e=0.7\text{m}$

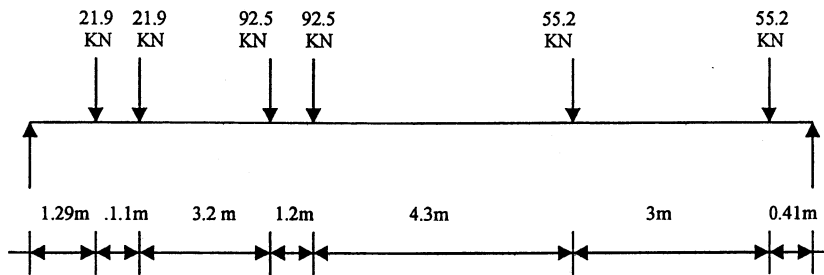


2. Calculate the effective width of the slab for the wheel load as shown below:

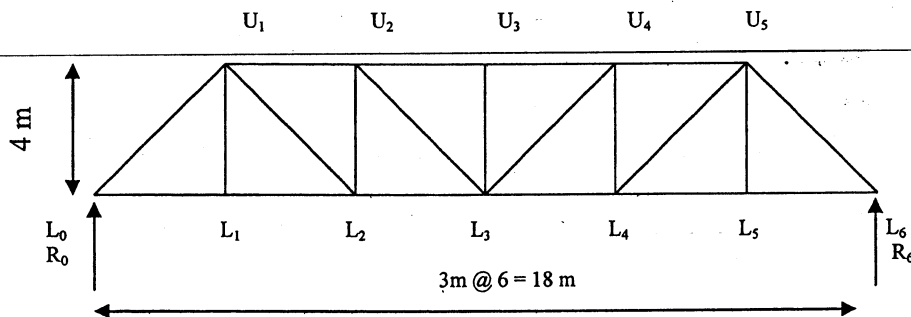


$$b_{eff} = b_w + 2x\left(1 - \frac{x}{l}\right)$$

3. Design a concrete slab bridge having an effective span of 6.0m; spanning in one direction for a concentrated load of 350 kN and it is distributed over the perpendicular direction of the span to a distance of 4.0m. Calculate the maximum bending moment due to the live load and dead load. The wearing surface of the slab is 80mm and the thickness is assumed to be of 450mm.
4. Calculate the maximum bending moment which produces by the wheel load as shown below:



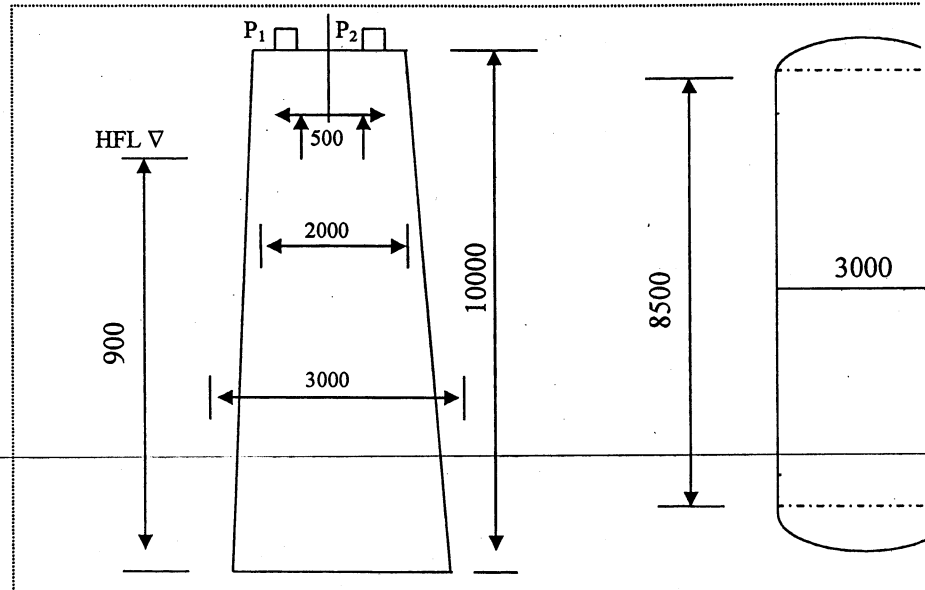
5. Draw the influence line diagram of the reaction force ( $R_0$ ) and the member ( $U_2L_3$ ) of the bridge truss as shown below:



6. Describe the followings with some sketches:
- Abutment
  - Pier
  - Bridge girder
  - Bridge deck
7. Describe the importance of bridge maintenance.
8. Describe the lateral and longitudinal positioning of the wheel load in the bridge superstructure.

9. Calculate the stresses on foundation of shown pier from the following given

- Bridge span 21.3 m
- Dead load from each span = 2250 kN
- Reaction due to live load on one span = 900 kN
- Intensity of pressure due to water current  $4.5 \text{ kN/m}^2$
- Material for pier: cement concrete M 20 grade
- Also assume necessary data



10. Illustrate the type of Bearing used in the bridges and describe them.

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

**Subject: - Advanced Geotechnical Engineering (Elective 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**.
- ✓ Assume suitable data if necessary.

1. a) A vibration system consists of 6 kg, a spring stiffness of 0.7 N/m and a dashpot with a damping coefficient of 2N-s/m. Determine [8]

- (i) Damping ratio
- (ii) Logarithmic decrement.

b) Derive an expression for longitudinal elastic waves in a rod of infinite length [8]

2. a) Derive an expression for undamped free vibration for single degree of freedom system. [8]

b) From wave propagation test the velocity of compression wave ( $v_p$ ) was found 300m/s. The Poisson ratio and submerged density of soil was 0.25 and 1000kg/m<sup>3</sup> respectively. Determine (i) Modulus of elasticity (ii) shear modulus [4+4]

3. a) What is geosynthetics? Explain different types of geosynthetics with its function. [2+2+4]

b) What is geotextiles? What are the main properties and test method for geotextile. Explain physical and degradation properties. [2+4+2]

4. a) Classify the grouting materials. What are the important characteristics to be considered in choosing a grout? Explain the process of grouting. [2+2+4]

b) What is inclinometer and borehole extensometer? Explain about borehole extensometer. [2+4+2]

5. a) What is rock bolts, rock anchor and rock dowels. Explain different types of rock bolts and its application. [3+5]

b) What is shotcrete? What are the purposes of shotcrete? Explain dry and wet mix process of shotcrete. [1+2+5]

6. Write short notes on: (Any Four)

[4\*4]

i) Direction of wave propagation and particle movement

ii) Type of dynamic loading on soil

iii) Earth quake magnitude

iv) Mononobe-okabe dynamic earth pressure theory

v) General assumptions of ultimate dynamic bearing capacity of shallow foundation in sand

vi) Different types of tunnel cross-sections

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

**Subject: - Rock Slope Engineering (Elective)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any Five questions. Question No. 2 is compulsory.
- ✓ All questions carry equal marks.
- ✓ Necessary equal-area net and tracing paper are attached herewith.
- ✓ Assume suitable data if necessary.

**Question 1:**

(a) The three discontinuity sets represents an area (ref. table 1). Find mode of failure and angle of potential failure plane if angle of slope face is 42 degrees in the dip direction of 150 degrees.

Table 1 Discontinuity sets

Joint set number	Dip/dip direction (Degree)
1 Foliation ( $J_1$ )	20/290
2 Joint ( $J_2$ )	85/165
3 Joint ( $J_3$ )	78/200
4. Joint ( $J_4$ )	80/076

(b) The geometry of the potential failure slope of an area is given in Figure 1, which shows the average angle of slope face, inclination of potential failure plane, slope height etc. Find the factor of safety of this area if basic friction angle is 30 degrees and cohesive strength is 0.1 MPa.

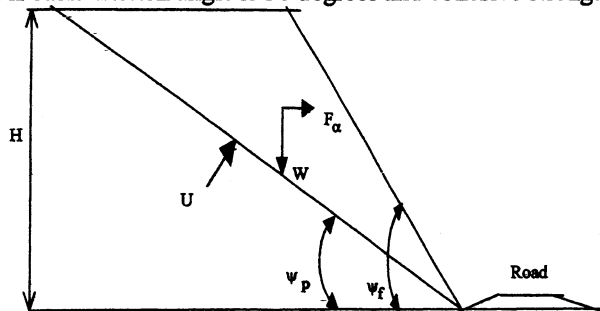


Figure 1 Schematic sketch of potential slope stability problem

In Figure 1;

- $H$  = Slope height = 60 m
- $\psi_f$  = Slope angle = 50 degrees
- $\psi_p$  = Inclination of potential failure plane = 30 degrees
- $W$  = Weight of potentially sliding rock (kN/m)
- $\gamma_r$  = Unit weight of rock mass = 26 kN/m<sup>3</sup>
- $\gamma_w$  = Unit weight of water = 10 kN/m<sup>3</sup>
- $U$  = Water pressure resultant (kN/m)
- $\alpha$  = Seismic acceleration in fraction of  $g$  ( $m/s^2$ ) = 0.25

Assume that slope having a tension crack in its upper surface, and depth of water is equivalent to depth of crack.

**Question 2:** Find the factor of safety of a potential unstable slope (wedge failure), with following input data:

	Dip/dip direction (Degree)
Plane A	45/105
Plane B	70/235
Slope Face	65/185
Upper Slope face	12/195

Slope height = 70 m  
Unit weight of rock mass = 26 kN/m<sup>3</sup>  
Unit weight of water = 10 kN/m<sup>3</sup>  
Basic friction angle = 28 degree  
Cohesive strength = 0.15 MPa

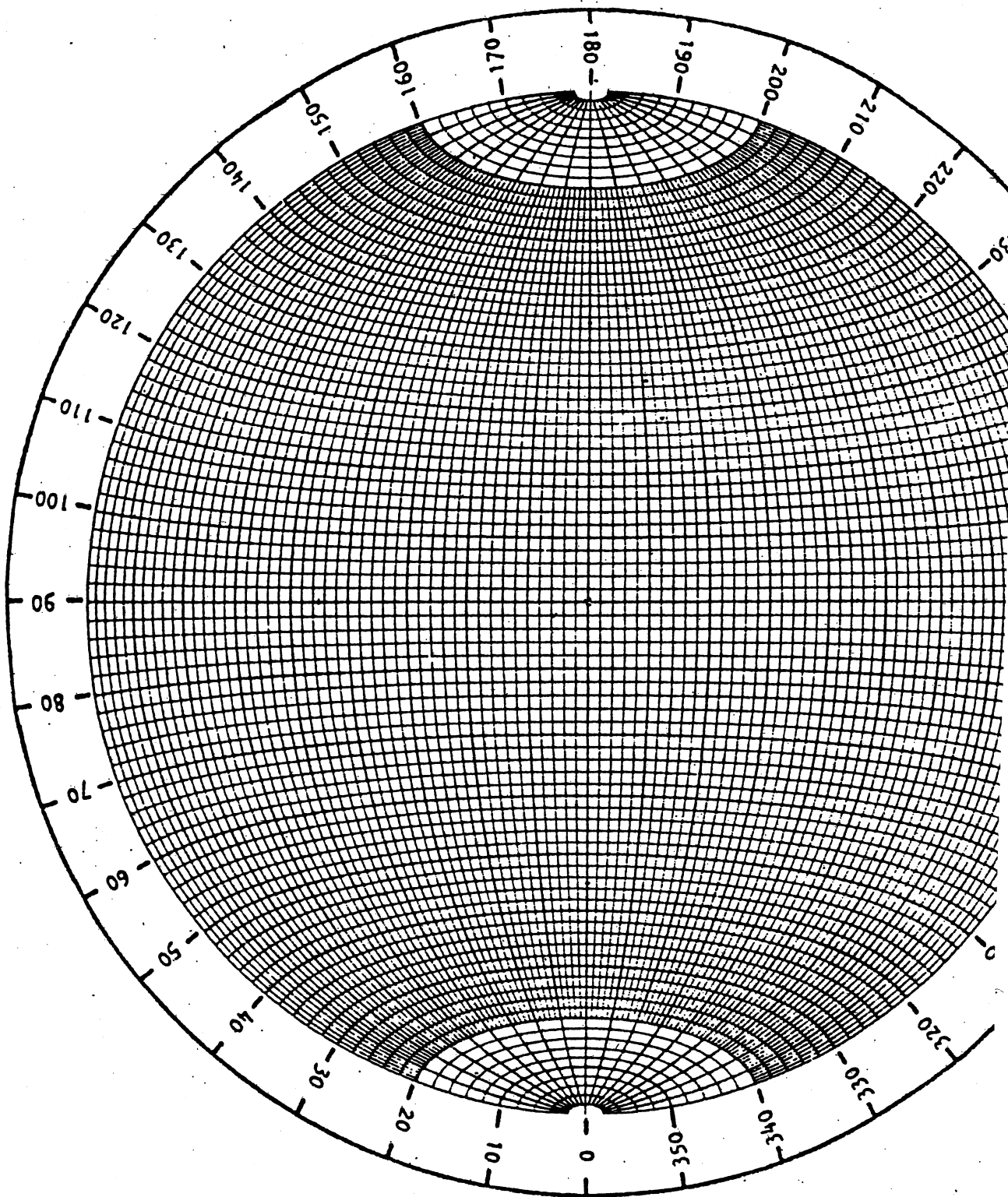
**Question 3:** Write notes on:

- Planning of slope stability program
- Probabilistic method in rock slope stability analysis
- Conditions and types of Toppling failure
- Shear strength of planar and rough surfaces of rock masses

**Question 4:** Define the circular failure in rock mass. State the various assumptions which are made in deriving the circular failure charts. Discuss the steps to use the charts to determine the factor of safety of a potential unstable slope.

**Question 5:** Explain empirical method for estimation of shear strength parameters of rock masses.

**Question 6:** What are the factors, which affect the rock slope stability? Discuss the deterministic approach for rock slope stability analysis.



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

**Subject: - Rock Slope Engineering (EG785CE) (Elective II)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any **Five** questions **Question No. 1 is compulsory.**
- ✓ **All** questions carry equal marks.
- ✓ **Necessary figures, equal area net and tracing paper are attached herewith.**
- ✓ Assume suitable data if necessary.

1. Calculate the Factor of Safety of a potential unstable slope with following input data:

Joint Set 1: 68/132 degrees (dip/dip direction)

Joint Set 2: 76/271 degrees (dip/dip direction)

Slope angle = 85/225 degree (dip/dip direction)

Upper Slope angle = 12/222 degree (dip/dip direction)

Slope height = 45 m

Unit weight of rock mass = 26 kN/m<sup>3</sup>

Unit weight of water = 10 kN/m<sup>3</sup>

Cohesive strength = 0.15 MPa

Basic friction angle = 28 degree

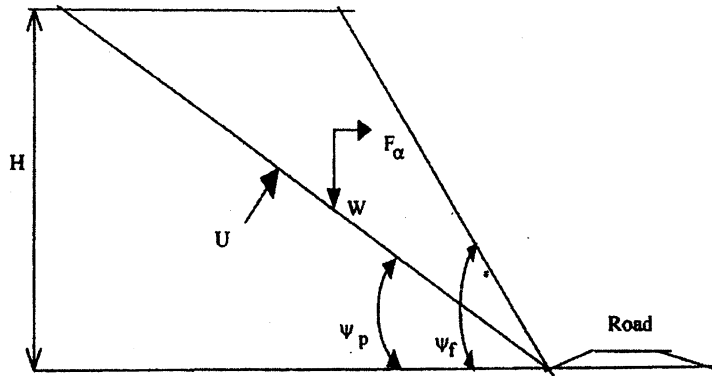
2. Write short notes on:

- a. Shear strength of **Planar** and **Rough** surface of rock mass
- b. Porosity and Permeability of rock and rock mass
- c. Methods for rock slope stability analysis
- d. The effect of water pressure in a tension crack and Reinforcement to prevent sliding

3. Explain Toppling Failure in rock mass. Discuss the conditions for sliding and toppling of a block on an inclined plane. Briefly discuss the types of Toppling failure and methods to control the rock falls.

4. Define the Circular Failure in rock mass. State the various assumptions which are made in deriving the circular failure charts. Discuss the steps to use the charts to determine the Factor of Safety of a potential unstable slope.

5. Explain basic aspects of Earthquake. Briefly discuss methods for quantification of Seismic load for rock slope stability analysis and basic methods for improving the stability of rock slope.
6. The geometry of the potential failure slope is given in Figure below. Find the Factor of Safety if basic friction angle is 28 degrees and cohesive strength is 0.1 MPa. Assume that slope having a tension crack in its upper surface, and depth of water is equivalent to depth of crack.



Schematic sketch of potential slope stability problem (plane failure)

In Figure;

H	=	Slope height = 50 m
$\psi_f$	=	Slope angle = 54 degree
$\psi_p$	=	Inclination of potential failure plane = 32 degree
W	=	Weight of potentially sliding rock (kN/m)
$\gamma_r$	=	Unit weight of rock mass = 24 kN/m <sup>3</sup>
$\gamma_w$	=	Unit weight of water = 10 kN/m <sup>3</sup>
U	=	Water pressure resultant (kN/m)
$F_\alpha$	=	m. $\alpha$ = Earthquake load (kN/m)

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

**Subject:** - Disaster Risk Management (*Elective III*) (CE78506)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any Five questions. Question No. 5 is compulsory.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. A. Define the terms Hazard, Vulnerability and Disaster. Write down the importance of hazard mapping for Municipality and VDC levels. Mention the different techniques and tools that are practiced in hazard assessment and mapping (3+2+3)

B. What is the recovery and what it covers? Write down the important lessons from past disasters in Nepal. What would be your proposed principles, approaches and strategies of disaster recovery plan for future disasters in Nepal? (2+2+4)

2. A. Explain with examples the statement "Earthquakes do not kill people, buildings do". Mention the necessary steps to avoid such killings. Which option do you prefer in damaged structures during earthquakes 1) repair, 2) retrofitting and 3) reconstruction and why? (2+3+3)

B. What do you understand about emergency exercises and disaster drills? Mention the current status of Nepal's disaster preparedness for natural hazards. Why local knowledge is important for disaster preparedness? (3+3+2)

3. A. What do you understand about glacial lakes and 2012 glacial lake outburst floods in Pokhara? How do you manage the flash flood risk? How do you interpret dozens of sinkhole formation in the Armala Kaski? (3+2+3)

Or,

What do you understand the humanitarian assistance and disaster response. Write down the readiness support, contracting and field support along with general contingency engineering practices (4+4)

B. Give your opinion on local responses to too much and too little water in the Greater Himalayan Region. What would be the possible reasons of such situations? Explain the structural and nonstructural flood control measures that are practiced in Nepal (3+2+3)

4. A. What is the action plan for disaster? How do you prepare an action plan if you are appointed as a disaster manager for urban earthquake risk management? Write down the major concerns of your planning (2+3+3)

B. How do natural disasters affect the environment and development? Give your opinion whether development increases or decreases the disaster risk. How do you implement your knowledge of Disaster Risk Management for sustainable development? (2+3+3)

5. A. How do you explain the Sindhupalchowk Jure landslide and Sunkoshi River blockage as a student of Disaster Risk Management? Give your opinions on 1) upstream and downstream threats in case of back water flow and flash floods, 2) use of the landslide dam for hydropower generation and 3) mitigation measures (2+2+2+2)

B. What do you understand about the early warning system? Was it useful for Sindhupalchowk Jure landslide? Explain the importance of instrumentation and long term monitoring system in the context of creeping/slow moving landslide. Write down the probable techniques and tools that are practiced for early warning system (2+2+2+2)

6. Write short notes any **FOUR** (4+4+4+4)

- A. Media control in disaster management/disability issues in disaster management
- B. Community resilience and vulnerability reduction
- C. Road extension and its impact on existing infrastructures in urban areas
- D. Earthquake risk reduction and recovery preparedness
- E. Cluster approach for Disaster Risk Management
- F. Traffic risk reduction/fire risk reduction assessment in the Kathmandu valley
- G. Pre-disaster initiatives and post-disaster management on earthquake disaster
- H. Role of engineer's training on earthquake resistant design of buildings/Role of mason's training on earthquake resistant building construction
- I. Disaster risk management cycle/integrated disaster risk management
- J. Seismic vulnerability evaluation guideline for private and public buildings

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

**Subject: - Environmental Impact Assessment (Elective III) (CE78504)**

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

1. a) What are the major functions and benefits of EIA? How do you classify the environment for the purpose of EIA study. (3+5)
- b) State and describe the different methods of impact prediction. (8)
2. a) For what type of projects it is necessary to prepare a scoping document? Describe the steps involved in a scoping exercise. (2+6)
- b) What are different types of impact considered in EIA for a new project? Describe various prediction methods used to determine the impacts. (3+5)
3. a) Define environmental setting of a project area. Describe the necessity, and process of baseline information collection during EIA process. (2+4)
- b) A brick factory burns 25 tonnes of coal per hour & discharges the combustion products through a stack having a physical height of 75 m. The atmospheric conditions are moderately unstable. Predict the impact of SO<sub>2</sub> emission on environment at 1500 m downwind & at a crosswind distance of 300 m on either side of plume from the chimney. (Note: SO<sub>2</sub> concentration over 120 µg/m<sup>3</sup> will increase the risk of bronchitis to human receptors.) Take following data:  
Sulphur content of coal: 6 %, Wind speed at top of chimney: 5 m/sec, Atmospheric pressure = 1200 millibar, Inside dia. of stack at exit = 0.85 m, Stack gas exit velocity = 12 m/s, stack gas exit temperature = 150°C, air temperature = 26°C. (10)
4. a) List the contents of ToR to be prepared in IEE process. What are the factors that you will consider while reviewing the impact identification and mitigation parts of an EIA report. (2+4)
- b) A new factory is proposed to be located near a river flowing through an urban area. The characteristics of the stream & factory wastewater are as follows:

Items	Stream	Wastewater
Flow	2.25 m <sup>3</sup> /sec	12300 m <sup>3</sup> /day
DO, mg/l	7.5	1
Temperature, °C	23	31
BOD <sub>5</sub> at 20°C, mg/l	1.5	175

Take  $K_{1-20}$  (base 10) = 0.15 per day,  $K_{2-20}$  (base 10) = 0.35 per day,  $\Theta_1 = 1.05$  &  $\Theta_2 = 1.02$ , Saturation DO at 20 and 30°C are 9.17 & 7.63 mg/l respectively.

Estimate the allowable BOD<sub>5</sub> value of the wastewater that should be permitted to be discharged in the river so that a minimum DO of 4.5 mg/l could be maintained. (10)

5. a) Describe the necessity of environmental protection measures and explain different types of environmental protection measures considered in EIA. (8)
- b) Discuss on the benefits of public participation in EIA and methods of public participation. (2+6)
6. Write short notes on the followings: (4x4)
- (a) Environmental auditing
- (b) Magnitude, extent and duration of impacts
- (c) Alternative analysis in EIA
- (d) Types of EIA

