TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Bhadra

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

Subject: - Civil Engineering Materials *(CE 506)*

- ✓ 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. Enlist the criteria for selection of suitable engineering materials at a site. Define Hygroscopicity and Fatigue. [1+2]
2. Why is dressing carried out on the quarry site? Write down the factors that damage the stones of structures. [2+2]
3. What are the qualities of good floor tiles? Describe properties of over burnt brick. [2+2]
4. What is pozzolanic material? Explain the manufacture process of lime. [1+2]
5. Explain the manufacturing process of 53 grade OPC cement. What is the 7 and 28 days crushing strength of this cement? [4+2]
6. State stepwise procedure of preparing cement mortar for construction works. Mention the uses of mortar. [2+2]
7. Explain in brief about the defects in timber due to natural forces. Differentiate between natural and artificial seasoning. [2+2]
8. Define quenching and tempering. What is the role of Cobalt, Manganese, Chromium and Nickel in the respective alloy of steel? [2+2]
9. Define ingredients of varnish. How is knot treated for painting in wood works? [2+2]
10. What is insulating materials? Differentiate bitumen and asphalt. [2+2]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Baishakh

Exam.	Back		
Level	BE	**Full Marks**	40
Programme	BCE	**Pass Marks**	16
Year / Part	II / I	**Time**	$1\frac{1}{2}$ hrs.

Subject: - Civil Engineering Materials (*CE 506*)

- ✓ 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 properties of material with suitable examples. Toughness, Ductility, Hardness. [3]
2. What are the considerations to be made while selecting the building stones? What do you mean by natural bed of stone? [3+1]
3. Describe classification of bricks with uses. Define Earthen ware. [3+1]
4. Define calcination & slaking of lime. What the uses of pozzolanic materials. [1+1]
5. Describe Bogue's Compound. What is meant by initial setting time and final setting time of cement? [3+2]
6. What are the functions and qualities of a good mortar? [3]
7. Describe any two defects of timber during growth of tree. List out different types of seasoning of timber. [2+2]
8. Define ferrous and non-ferrous metals with examples. Illustrate different types of commercial products of steel with sketches. [2+4]
9. What are emulsion paint and enamel paint? Write the functions of varnish. [2+2]
10. What are the differences between asphalt, bitumen and tar? Define insulating materials and composite materials. [3+2]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Bhadra

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

Subject: - Civil Engineering Materials *(CE 506)*

- ✓ 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 briefly the properties: Porosity, Creep and Brittleness. State the scope of construction materials in transportation. [3+1]
2. Differentiate between sedimentary and igneous stones. How stone can be preserved? [2+2]
3. Write briefly the brick manufacturing process. How do you classify the brick? Explain. [3+1]
4. What is pozzolanic materials? Why they can be added to a lime? Explain different types of hydraulic lime. [1+1+2]
5. Briefly illustrate the procedure to determine the compressive strength of cement in laboratory. Why hydration of cement takes place? [3+1]
6. State any two merits and demerits of lime mortar. What is a gauged mortar? Describe functions of good mortar. [1+1+2]
7. What are the merits of timber over steel in civil engineering construction works? Explain any four defects in timber caused due to seasoning to it. [2+2]
8. Differentiate between mechanical and heat treatment of steel. How will you define annealing and red shortness of steel? [3+2]
9. What do you understand by distemper? Explain any four defects in paints. [1+2]
10. Why are plastic materials used extensively as construction materials? What is epoxy and adhesive? [2+2]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Ashwin

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

Subject: - Civil Engineering Material *(CE 506)*

- ✓ 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. Describe importance of study of Civil Engineering Materials for engineers. Define the terms: creep, hygroscopicity, specific heat capacity and tenacity. [1+2]
2. Describe briefly the characteristics of good building stones. How the stones are deteriorate and pressured? [2+2]
3. What is efflorescence in brick? Explain briefly the manufacturing process of bricks. [1+3]
4. Define pozzolanic materials. Differentiate between fat lime and hydraulic lime. [1+2]
5. Explain functions of compounds present in cement clinker. Explain any three types of cement. [3+2]
6. Define mortar and explain its engineering characteristics. Differentiate between cement and lime mortar. [2+1]
7. What are the uses of Timber? Why it is essential seasoning before using and also highlights the new modified timber. Which are extensively used in our building? [1+3]
8. What are the types of metal that are used in modern Civil Engineering works? Why they are popular in using in the form of Alloys? [5]
9. What are the ingredients of paints, explain? Describe types of paints with their uses. [2+2]
10. Why are plastic materials used extensively as building material nowadays? Differentiate between asphalt and tar with respect of their properties and uses. [3+2]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Chaitra

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

Subject: - Civil Engineering Materials *(CE 506)*

- ✓ 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 factors affecting the selection of civil engineering materials. [3]
2. Write down the requirements of stone to be used for the structural purpose. What are the causes of deterioration of stones? [2+2]
3. What are the essential constituents of good brick earth? Write with their percentage composition. Define glazing of ceramic materials with its objectives. [1+1+2]
4. Explain different types of lime with its properties and suitable uses. [3]
5. Draw a flow chart for wet process of cement manufacture. Explain different constituents of cement clinker with their function. [2+3]
6. State stepwise procedure of preparing cement mortar for construction works. Also, mention the functions of mortar used in building construction. [2+1]
7. Why seasoning of timber is important prior to use? Explain different methods of preserving the timber. [2+2]
8. Explain various ferrous and non-ferrous products used in construction and explain their merits and demerits. What are the purposes of heat treatment process of steel? [3+2]
9. Compare paints and varnishes. Write the steps of preparing the older surface for painting. [2+2]
10. Define asphalt. Write down the properties and uses of asphalt. Why tar is preffered in parking lot construction. [2+2+1]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Chaitra

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

Subject: - Civil Engineering Material *(CE 506)*

- ✓ 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 scope of Civil Engineering Material for controlling a project quality? Explain any two mechanical properties. [2+1]
2. Why is dressing carried out on stones? Segregate stones into different categories based on Geological classification: [4]
   a) Prophyry b) Surpentine c) Pegmatite d) Laterite
3. How do you determine the quality of good brick Earth? Explain different classes of brick with their properties. [1+3]
4. Define the terms Slaking and Calcination of lime. Explain the properties and uses of different types of hydraulic lime. [1+2]
5. Define the terms cement clinker and cement water proofer. Explain constituents of OPC with their correct proportions and benefits in a sound cement. [1+4]
6. What are the types of mortar? How the mortar is selected for particular work? Describe its properties and uses. [1+2]
7. State merits and demerits of timber used as civil engineering material. Also, mention the objectives of seasoning of timber. What is the reason behind creosoting a timber? [2+1+1]
8. Why heat treatment of steel is done? Explain different alloys of steel. [1+4]
9. Discuss about varnish with its types. Explain any six defects of paints in brief. [2+2]
10. Answer **any two** of following: [5]
    a) What are specific field of using Aspalt, Bitumin and Tar.
    b) Why the ACP is so popular in mordern building material?
    c) Give the various types and reasons of using glass in building.
    d) What are the uses of plastic material?

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04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Ashwin

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

Subject: - Civil Engineering Materials *(CE506)*

- ✓ 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. As a civil engineer, what are the major factors which you consider most for the selection of material in civil engineering project in Nepal? Write short notes on significant mechanical properties of civil engineering materials. [2+2]
2. Write down the purposes of dressing of stones. What are the methods to preserve the stone from deterioration? [2+2]
3. Why bricks are commonly used material in construction work? Elaborate briefly the properties of harmful ingredient in bricks. [2+2]
4. Classify the lime on the basis of purity and functions with their suitability in engineering field. [4]
5. Sketch out the graph related to the contribution of clinker compound to strength with respect to time of cement compound. Define Admixtures and cement water proofers. [3+2]
6. State stepwise procedure of preparing cement mortar for construction works. Also, mention the functions of mortar used in building construction. [2+2]
7. Define timber and its seasoning. Elaborate macrostructure and microstructure study of exogenous timber. [1+3]
8. What is the prime importance of carbon present in steel? Distinguish between Plain carbon steel and Alloy steel. [1+3]
9. What are the functions of paint? Explain in detail anti-termite treatment procedure to be applied in foundation? [1+2]
10. Why are plastic materials used extensively as building material nowadays? Write down gypsum products available in market and their applications. [2+2]

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04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Chaitra

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

Subject: - Civil Engineering Materials *(CE506)*

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

1. How is civil engineering materials classified? Define the terms: fatigue and resilience. [2+4]
2. What are the selection critaria of good building stone? Explain about importance of natural bed of stone. [2+2]
3. Why the drying of brick is extremely important steps in manufacturing brick? Describe about standard test of brick. [1+3]
4. Define pozzolanic agents used as admixtures and explain manufacturing process of lime. [1+2]
5. Explain about manufacture flow diagram of cement. Briefly illustrate the procedure to determine the compressive strength of cement in laboratory. [1+3]
6. Write down the properties of mortar? Write down the steps of applying cement mortar? [1+2]
7. What are the commercial forms of timber which are being widely used in the market? Draw a clear sketch of cross section of timber log and show the each components of growth. [1+3]
8. What are the commercial Product of Metal? What are the purposes of heat treatment process of metal? [2+2]
9. What do you understand about distemper? State the basic ingredients of paints. [2+2]
10. Distinguish the tar with bitumen? Define borosilicate glass and thermoplastic. [2+2]

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04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Ashwin

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

Subject: - Civil Engineering Materials *(CE506)*

- ✓ 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 briefly the following properties of civil engineering materials: Creep, Malleability and Hardness. [3]
2. Explain the characteristics of good building stone. Explain the factors which deteriorate the stone. [2+2]
3. What is efflorescence in brick? Explain the manufacturing process of bricks. What is glazing? [1+2+1]
4. Explain the properties and uses of lime. [2]
5. Describe the manufacturing process of cement with the help of suitable flow diagrams. What is cement water proofer? Explain. [1+4]
6. List the function of mortar. Also describe the characteristics of good cement mortar to be used in different civil engineering works. [1+2]
7. Describe with the help of sketches, growth and structure of tree. Also describe the suitability of timber in the design of civil engineering structures. List the engineering properties of timber. [3+2+1]
8. Describe the importance of steel as a civil engineering material according to their composition and properties. Write down the properties and uses of non-ferrous metals. [3+2]
9. Write down, in brief, the procedure of using emulsion on the wall surface. [3]
10. What are the specific uses of asphalt, bitumen and tar? Explain briefly about insulating materials used in construction. [3+2]

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04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Chaitra

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

Subject: - Civil Engineering Materials *(CE506)*

✓ 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 criteria for the selection of the materials in the Civil Construction projects? Define the terms resilience and creep. [2+1]
2. What are the objectives of surface dressing of stone? How does the deterioration of stone take place? [2+2]
3. What are the different types of field test of brick? Explain the role of clay and alumina in brick production. [2+2]
4. List the properties and uses of Pozzolanic material. [2]
5. Define the terms cement clinker and admixtures. What are the major ingredients of cement, explain with functions. [1+4]
6. How mortar can be formed? How do you select mortar according to civil engineering construction? [1+2]
7. Why seasoning of timber is important prior to use? Explain different methods of preserving the timber. What are the characteristics of good timber? [1+3+2]
8. What are upper critical and lower critical points of metal in heat treatment process? On the basis of these points, explain normalizing process of heat treatment with neat sketches. [2+2]
9. Why paints are used in the civil structures? Explain types of paints with their uses. [2+2]
10. Define the terms asphaltic materials and gypsum products. Explain types of plastics and their uses. [2+3]

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07 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Shrawan

Exam.	New Back (2066 & Later Batch)		
Level	BE	**Full Marks**	40
Programme	BCE	**Pass Marks**	16
Year / Part	II / I	**Time**	1 ½ hrs.

Subject: - Civil Engineering Materials *(CE506)*

- ✓ 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. Describe briefly the factors which influence the selection of civil engineering material? What are the significant properties to be considered while using engineering materials? [2+1]
2. Define cataclastic metamorphism and plutonic metamorphism of rock formation. Explain about importance of natural bed stone. [2+1]
3. What are the qualities of good bricks? Why we should be careful about the harmful ingredients in brick earth? [2+2]
4. Differentiate quick lime with hydraulic lime. What do you mean by calcination and slaking of lime? [2+2]
5. Describe the manufacturing process of 53 Grade OPC with the help of flow diagram. [5]
6. Write down the functions of mortar in civil engineering units? What are the precautions to be observed while applying cement mortar? [1+2]
7. Why seasoning of timber is important prior to use? Explain the macrostructure elements of exogenous tree with neat sketch. [1+4]
8. What is the difference between Ferrous and Non Ferrous materials? Why the modern engineering world is very much willing to use the composite materials? [2+3]
9. Write down, in brief, the procedure of using emulsion on the wall surface. [4]
10. Distinguish Asphalt with Tar. Nowadays use of composite materials are predominant compare to conventional natural building material in engineering. Why? Give reasons. [2+2]

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04 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2072 Chaitra

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

Subject: - Civil Engineering Materials *(CE506)*

- ✓ 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. Why a subject Civil Engineering Materials is supposed to be essential part of the science and technology? Define materials properties; hydroscopecity, soundness, hardness and creep. [1+2]
2. What is the deterioration of stone and how it is preserved? [4]
3. What are the different types of field test of brick? Explain the role of clay and alumina in brick production. [2+2]
4. Why the uses of lime could not be neglected in this modern age? Highlight the properties and uses of lime. [1+2]
5. Define clinker. What are the chemical compounds present in the clinker? Explain the functions of any two compounds present in clinker. [1+2+2]
6. How mortar can be formed? How do you select mortar according to civil engineering construction? [1+2]
7. Why and how the timber is being widely used in all engineering works? Describe briefly the method of seasoning the timber. [4]
8. What do you mean by quenching of steel? Distinguish between Cast iron and Mild steel. [2+2]
9. What do you mean by paint and Varnishes? What is the purpose of using it? [4]

OR

Give the reasons of using anti-termite treatment.

10. Define asphalt, bitumen and tar with their best applications in civil engineering field. [2+2+2]

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04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Kartik

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	40
Programme	BCE	Pass Marks	16
Year / Part	II / I	Time	1 ½ hrs.

Subject: - Civil Engineering Materials *(CE506)*

✓ 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 civil engineering materials. How do you select the appropriate material? [1+2]
2. Define dressing of stone. Mention the different methods of stones preservation. Explain one of them. [1+1+2]
3. What are earthen ware and glazing? Write down the types of tiles to be used in Civil Engineering. [2+2]
4. What is lime as a construction material? Write down their properties. [1+2]
5. What are cement water proofers? Draw the flowchart showing the manufacturing process of cement? [2+3]
6. What are the different types of mortar? Write down their functions. [1+2]
7. Why is seasoning of timber done? Explain the seasoning process of timber. [1+3]
8. Why are Aluminum Alloys so important in modern engineering practice? Write down the difference between iron and steel. [3+2]
9. Define distempers. How will you apply paint on wood? Describe briefly. [1+3]
10. What is glass as a construction material? Write down their uses in Civil Engineering. [1+4]

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07 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Shawan

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

Subject: - Civil Engineering Materials *(CE506)*

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

1. How do you classify the civil engineering materials? Give the list only. [3]
2. What is building stone? Describe the characteristics of good building stones. [1+3]
3. Explain the procedure to determine the compressive strength of brick. [4]
4. Distinguish between Fat lime and Hydraulic lime. [3]
5. What are the different compounds present in cement clinker and explain its role in cement with the relative graph. What is meant by grade C - 43 cement? [4+1]
6. Describe the properties of good mortar. [3]
7. Draw net cross sections of an exogenous tree and show its various components. [4]
8. What do you mean by heat treatment process? List out the objectives of heat treatment.. [5]
9. What are the main function of a point and varnish? [4]
10. What do you understand by bituminous material? Write down the properties and uses of asphalt? [1+4]

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04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Chaitra

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

Subject: - Civil Engineering Materials *(CE506)*

- ✓ 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 properties of civil engineering materials? Highlight the importance of the subject. [1+2]
2. What is natural bed of stone? What are the different technical parameters for selecting good building stones? [1+3]
3. Explain briefly the harmful ingredients in good brick earth, stating their effects on the properties of the brick. Write down characteristics of good brick. [2+2]
4. What do you mean by calcination and hydration of lime? Explain Hydraulic lime and fat lime with its properties. [1+2]
5. Define initial and final setting time of cement. What are the ingredients of cement, explain its functions in cement. [1+4]
6. What is mortar? How is an appropriate type of mortar selected? [1+2]
7. What are the characteristics of good timber? Write down the defects of timbers. [2+2]
8. Define heat treatment. Explain its objective. How will you define annealing, Explain it. [1+2+2]
9. Distinguish between the paint and varnishes. Write down the uses of antitermite treatment. [2+2]
10. Define bitumen and tar. Explain different types of glasses and its uses. [2+3]

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07 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Chaitra

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

Subject: - Civil Engineering Materials *(CE506)*

- ✓ 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 factors affecting the selection of construction material? [3]
2. What are the qualities of a good building stone? [4]
3. Write down the field tests to find the suitability of bricks for construction? [4]
4. What are the properties and uses of lime? [3]
5. Show the manufacturing process of cement with the help of flow diagram. [5]
6. What is mortar? How can the appropriate type of mortar be selected? [3]
7. What are the advantages of seasoning of timber? State the various defects in timber. [2+2]
8. Write down the differences between Ferrous and Non Ferrous metal. [5]
9. Describe different types of paints and varnishes. [4]
10. What are the specific uses of Asphalt, Bitumin and Tar? [5]

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01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Chitra

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

Subject: - Civil Engineering Material *(EG463CE)*

- ✓ 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 hardness, Resilience and Malleability. Explain in brief the study objectives of "Civil Engineering Material". [3+5]

   b) Define yield and strain hardening related to tensile strength test for steel. How the yield point of brittle material is found out from stress/strain diagram? Draw stress/strain diagram for ductile and brittle materials. [3+2+3]

2. a) Differentiate between mechanical treatment and heat treatment of steel. Explain isothermal annealing and tempering process of heat treatment with neat sketch. [3+5]

   b) Define true stress and engineering stress. In a steel, percentage of carbon content is 0.80%; then find out the percentage of finite, cementite and pealite. [4+4]

3. a) What are the different types of wood? Explain in brief strength along and perpendicular to the grain of wood. [4+4]

   b) A mild steel specimen of 10 mm diameter and 300 mm long, which resist the maximum tensile load of 250 KN at 2 mm diameter. If the material resist 120 KN yield load by elongating 8 mm then what is the modulus of roughness and resilience. [8]

4. a) List out the different composition of OPC. Explain the role of different compounds present in cement clinker. [3+5]

   b) Define plastic material. Differentiate between asphalt and bitumen. [2+6]

5. a) Describe the composition of good brick earth. Explain the properties of good quality of brick. [3+5]

   b) Define Microstructure examination of steel and describe the different micro structure of steel. [2+6]

6. Write short notes on: (any four) [4×4]

   i) Chemical bond
   ii) Types of glass
   iii) Properties of steel
   iv) Rapid hardening cement
   v) Setting action of lime

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3/23

01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Ashad

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

Subject: - Civil Engineering Material *(CE506)*

- ✓ 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 ductile materials different from brittle ones? [3]
2. What stones are said to be good in civil engineering construction? Write down the process of stone deterioration? [2+2]
3. What are the field tests on brick quality? Mention the steps for efflorescence test of brick. [2+2]
4. Write down properties and uses of lime. [1+2]
5. What is meant by 43-grade cement? Write down the engineering application of admixtures? [2+3]
6. What are the properties and uses of good mortars? [3]
7. Draw cross sections of hard and soft wood with detail elements. [4]
8. What are Aluminum and its Alloys? Write down the differences between ferrous and non ferrous materials. [6]
9. Write short notes on: [2×4]
   a) Distemper
   b) Tar
   c) Types of paint
   d) Gypsum product

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01 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2069 Chaitra

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

Subject: - Civil Engineering Material *(CE506)*

- ✓ 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 basic physical properties of Civil Engineering Materials? Write down the importance of subject. [2+1]
2. Define natural bed of stone. Write down the methods of preservation of stone. [1+3]
3. What are the constituents of brick Earth? Write down their functions. [2+2]
4. Define pozzolanic material. Enumerate the properties of pozzolanic material. [1+2]
5. What are the different ingredients of cement? Draw the flowchart showing the manufacturing process of cement. [3+2]
6. What is mortar? How can the appropriate type of mortar be selected? [3]
7. What is seasoning of timber? Explain about its preservation method. [2+2]
8. What are the differences between steel properties and cast iron? List out the commercial products of metal. [3+3]
9. Distinguish between the paint and varnishes. Also highlight the use of Antitermite treatment. [2+2]
10. Give the various properties and use of glass. Why are the use of composite materials so high? [4]

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01 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2068 Chaitra

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

Subject: - Civil Engineering Material *(CE506)*

- ✓ 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 briefly the following properties of the civil engineering materials: Porosity, Creep and Brittleness. [3]
2. What is the natural bed of stone? Enumerate the characteristics of a good building stones? [4]
3. What are the essential constituents of good brick earth? Write the characteristics of good brick earth. [1+3]
4. Define terms Quick lime and Hydraulic lime. How will you determine the slaking nature of lime? [1+2]
5. What are the different constituents of cement clinker? Explain the significance of testing the initial and final setting time of cement. How is it done? [1+2+2]
6. What is mortar? Explain the functions of mortar. [1+2]
7. What are the characteristics of good timber? State the various defects in timber. [3+1]
8. Explain principle of heat treatment. Describe surface hardening. [2+3]
9. Explain briefly about post construction antitermite treatment. [4]
10. Define 'asphalt'. Give the properties and uses of different types of asphalt. [5]

OR

Give the comparison between asphalt, bitumen and tar.

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07 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2068 Baishakh

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

Subject: - Civil Engineering Materials

- ✓ 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 field tests to find the suitability of bricks for construction? What is the compressive strength of the common and machine made bricks that are available in Nepal? Describe briefly the test for efflorescence for bricks. [2+1+2]
2. What is meant by grade C - 43 cement? Describe, with necessary sketches, the properties of compounds present in the clinker of cement. [1+4]
3. Define admixture and explain in brief about its engineering application. [3]
4. Define seasoning of timber. Why is it required for the good timber? Describe the methods of seasoning. [5]
5. What do you mean by heat treatment process? List out the objectives of heat treatment. Explain isothermal annealing with sketch. [5]
6. What are distempers? In what form they are commercially available? How do you prepare the commercial product in the field for painting? [1+1+2]
7. What is stone? Define its natural bed? What may be the technical parameters for selecting good building stones? [4]
8. a) Describe different types of bitumen? What is the specification of grade of bitumen? [5]
   b) Explain briefly Toughness, fatigue and malleability. [4]

OR

9. a) Distinguish between two major classifications of plastics. Name two popular plastics of each type and indicate their uses. [3+1+1]
   b) Explain the importance of study of material of construction. How civil engineering materials are classified? [3+1]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Bhadra

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

Subject: - Fluid Mechanics *(CE 505)*

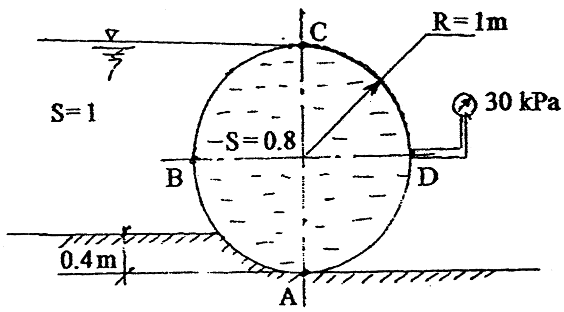
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) Explain the causes of viscosity in gases and liquids. A capillary tube of uniform bore (radius 0.2 mm and length = 6 cm) is dipped vertically in water. Find the height of water rises in tube. Take surface tension of water as 0.073 N/m. Will the length of tube affects the answer? Justify. [1+1+1+1]

   b) Derive the hydrostatic law of pressure distribution. Explain the working principle of inverted differential manometers. [4+2]

   c) Derive an expression for the time of emptying of a conical tank without inflow. [6]

2. a) Determine total pressure and its line of action on curved surface ABCDA as shown in figure below. Take length = 2 m. [8]



   b) A rectangular sectioned pontoon weighs 2 MN and has a length of 15 m. Its required to have a 600 mm of height above water when the pontoon is vertical and its centre of gravity is 300 mm above centre of cross-section. The metacentric height is to be 1.2 m when the angle of heel is 10°. Determine breadth and height of the pontoon when it is floating in fresh water. [8]

3. a) Water flows at the rate of 10.5 litres per sec through a 150 mm diameter pipe in which an orifice meter with a 100 mm diameter orifice is fitted. If the press drop across the meter is recorded as a 18 mm difference in levels of mercury in a U-tube manometer, what would be the coefficient of discharge C_d? If the orifice were 125 mm diameter, what would be the head loss in m of water, for the above values of Q, C_d and C_c? Assume $C_v = 0.95$. [8]

   b) Explain angular momentum principle, in fluid mechanics with examples. In a residential building, a pump is set up at 2 m above the underground reservoir for pumping water at a rate of 0.1 m^3/s to the overhead tank. The diameter of the suction and delivery pipes are 15 cm and 20 cm respectively. If the water level in the tank is 15 m above the water level in the reservoir, determine the power input of the pump. Take 1.5 m head loss from the reservoir to the pump and 2 m head loss from the pump to the tank. [4+4]

4. a) An incompressible fluid of density ρ and viscosity μ flows at average speed V through a long, horizontal section of round pipe of length L, inner diameter D, and inner wall roughness height ε. The pipe is long enough that the flow is fully developed, meaning the velocity profile does not change down the pipe. Pressure decreases (linearly) down the pipe in order to "push" the fluid through the pipe to overcome function. Using Buckingham-Π method, develop a non-dimensional relationship between pressure drop Δp and other parameters in the problem. [8]

   b) Derive an expression for displacement thickness in boundary layer. Calculate the friction drag on a flat plate 15 cm wide and 45 cm long placed longitudinally in a stream of oil of relative density 0.925 and kinematic viscosity 0.9 stoke, flowing with a free stream velocity of 6.0 m/s. Also find the thickness of the boundary layer at the trailing edge.s [2+6]

5. a) 360 litres per sec of water is flowing in a pipe. The pipe is bent by 120 degrees. The pipe bend tapers from diameter 360 mm to 240 mm from inlet to outlet and volume of the bend is 0.14 m^3. The pressure at the entrance is 73 kN/m^2 and the exit is 2.4 m above the entrance section. Find the force exerted on the bend. [8]

   b) The velocity components for a 2 – D incompressible flow are

   $$u = 2x + y \text{ and } v = -x - 2y$$

   Prove that stream function and potential function exist for above velocity field. Find also the equation of stream function and potential function. [2+3+3]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Baishakh

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

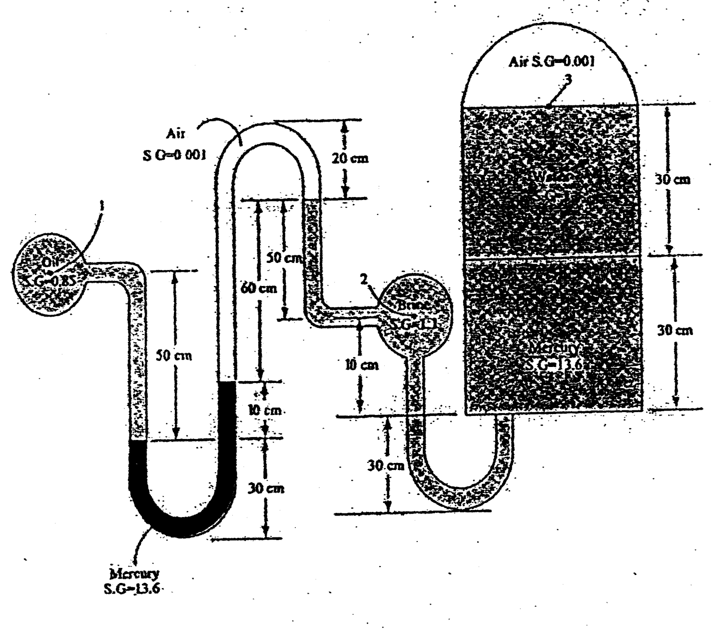
Subject: - Fluid Mechanics (*CE 505*)

- ✓ 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.*

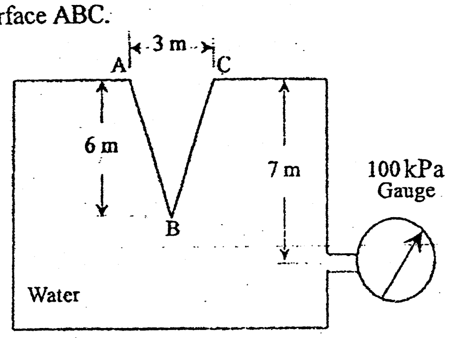
1. a) A square plate of size 1m × 1m and weighing 350 N sides down an inclined plane with a uniform velocity of 1.5 m/s. The inclined plane is laid on a slope of 5 vertical to 12 horizontals and has an oil film of 1 mm thickness. Calculate dynamic viscosity of oil. [4]

   b) Suppose the water rise predicted by the capillarity formula exceeds the height of the capillary tube. Does the water overflow? Explain with mathematical expression. [2]

   c) The two pipes are connected by a double U-tube manometer as shown in figure where the brine pipe is connected to a tank filled with different fluids. Oil and brine are flowing in parallel horizontal pipes. The pressure at the centre of oil pipe is 200 kPa. Calculate pressures at point 2 & 3. [5+5]



2. a) Pressurized water fills the tank as shown in figure below. Compute the net hydrostatic force on the conical surface ABC. [8]



b) What is the significance of metacentric height? When will the centre of gravity and centre of pressure coincide in case of plane immersed surfaces? [2+2]

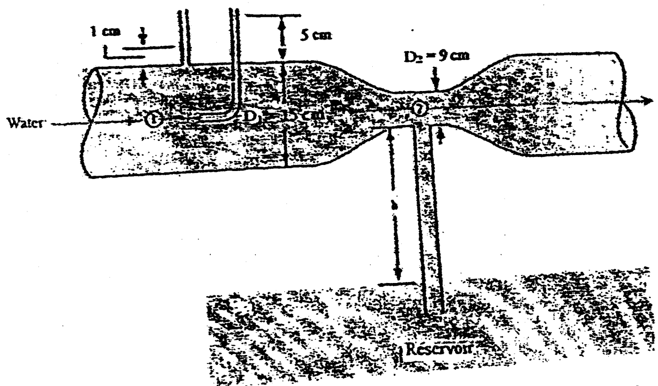
c) A water body is subjected to an acceleration in the vertically upward direction. At what acceleration will the pressure difference between two points, separated by a vertical distance, h, be zero? [4]

3. a) Given the velocity field $V = (5x)\,\hat{i} + (15y + 11)\,\hat{j} + (19t^2)\,\hat{k}$ m/s. Determine the path of particle which is at (4,6,2) m at time t = 3 s. [6]

b) The figure shows below a venturimeter where the reservoir open to atmosphere is connected to the throat by a tube.

i) What is the fluid velocity in the smaller diameter section of pipe?

ii) What is maximum height of fluid that can be lifted from reservoir (h)? Assume the fluid in lifting pipe is not moving. [5+5]



4. a) An orifice plate is used to measure the flow in hydropower canal 500m wide with a water depth of 300mm. A rectangular orifice size of 300mm wide and 100mm high is placed 5cm above the canal bed. If downstream water depth in canal is 225mm, what is the flow in the canal? Take coefficient of discharge of an orifice plate 0.63. [4]

b) What is boundary Layer? Explain boundary layer thickness and displacement thickness. Compute the ratio of these quantities for the boundary layer described by the velocity distribution $\frac{u}{U} = \left(\frac{y}{\delta}\right)^{1/7}$. [1+2+3]

c) A jet of the water. 50 mm in diameter, is striking normally with velocity of 50m/sec at the center of the plate which is hinged at its top edge and a horizontal external force is applied at the bottom edge to keep it vertical. What should be amount of the applied force? If the force is removed what will be the angle of inclination of the plate with vertical for equilibrium condition? [3+3]

5. a) What is the expression for the drag on a sphere, when Re of the flow is 0.2? Prove that the coefficient of drag for sphere for this range of the Reynolds number is given by $C_D = 24/Re$, where Re is the Reynolds number. [2+4]

b) 1:400 model is constructed to study tides. What length of time in the model corresponds to a day in the prototype? Suppose the model could be transported to the moon and tested there. What then would be the time relationship between the model and prototype? Given, 'g' of earth = 6 times 'g' of moon. [6]

c) Sphere of diameter d and density ρ_s settles at a terminal velocity V in a liquid of density ρ_l and dynamic viscosity μ. Determine an expression of velocity in which ~~velocity also depends on acceleration~~ due to gravity g. ~~Use Rayleigh's Method.~~ [4]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Bhadra

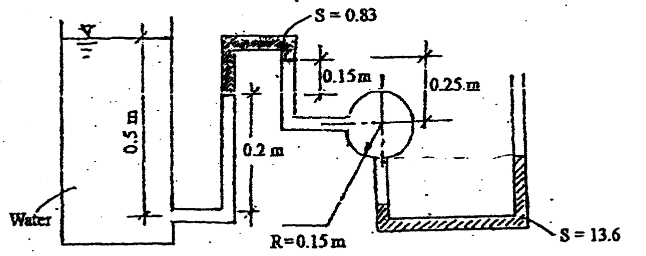
Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BAG	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Fluid Mechanics *(CE 505)*

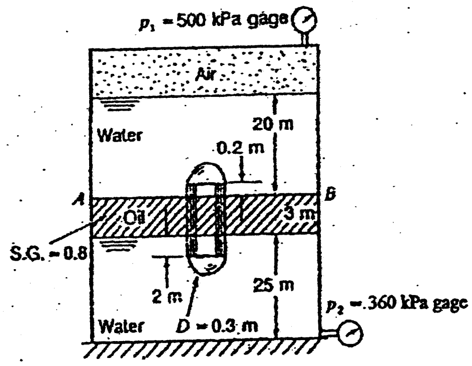
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. a) The space between two large flat and parallel walls 25 mm apart is filled with a liquid of dynamic viscosity 0.7 Pa.s. Within this space a thin flat plate 250 mm × 250 mm is towed at a velocity of 150 mm/s at a distance of 6 mm from one wall, the plate and its movement being parallel to the walls. Assuming linear variations of velocity between the plate and the walls, determine the force exerted by the liquid on the plate. [8]

   b) An inverted manometer is connected to the pipe and tank as shown in figure. What will be the differential level on U-tube connecting pipe? [8]



2. a) A tank is hermetically sealed into two compartments by plate AB. A cylinder of diameter 0.3 m with two hemispherical end is protrudes above and below the seal AB and is welded to the seal AB. what is the vertical force in the cylinder? [8]

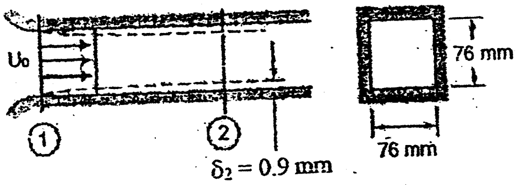


   b) A buoy, floating in sea-water of density 1025 kg/m^3 is conical in shape with a diameter across the top of 1.2 m and a vertex angle of 60°, its mass is 300 kg and its centre of gravity is 750 mm from the vertex. A flashing guiding light is to be fitted to the top of the buoy. If this unit is of mass 55 kg, what is the maximum height of its centre of gravity above the top of the buoy if the whole assembly is not be unstable? (The centroid of a cone of height h is at 3h/4 from the vertex.) [8]

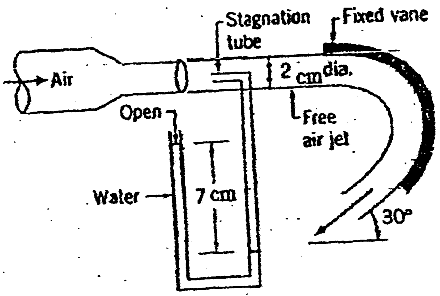
3. a) A pressurised 2 m diameter tank of water has a 10 cm dia orifice at the bottom, where water discharges to the atmosphere. The water level initially is 3m above the outlet. The tank air pressure above water level is maintained at 450 kPa absolute and the atmospheric pressure is 100 kPa. Neglecting the frictional effects, determine (i) how long it will take for half of the water in the tank to discharge and (ii) the water level in the tank after 10 sec. [6+2]

b) The x component of velocity in a two-dimensional, incompressible flow field is given by u = Axy; the coordinates are measured in meters and $A = 2m^{-1}s^{-1}$. There is no velocity component or variation in the z direction. Calculate the acceleration of a fluid particle at point (x, y) = (2, 1). Estimate the radius of curvature of the streamline passing through this point. Plot the streamline and show both the velocity vector and the acceleration vector on the plot. [8]

4. a) Air flows in the entrance region of a square duct, as shown. The velocity is uniform, U_0 = 30 m/s, and the duct is 76 mm square. At a section 0.3 m downstream from the entrance, the displacement thickness on each wall measures 0.9 mm. Determine pressure change between section 1 and 2. [6]



b) A stream of air at standard condition from 2 cm dia. nozzle strikes a curved vane as shown. A stagnation pitot tube connected to water-filled U-tube manometer is located in the nozzle exit plane. Calculate the speed of the air leaving the nozzle. Estimate the horizontal component of force exerted on the vane by the jet. [6]



c) What is laminar Sub-layer? Differentiate between the characteristics of laminar and turbulent boundary layer. [2+2]

5. a) In Buckingham – Pi method, describe the following:
(i) Guiding rule for selection of repeating variables. (ii) Rules for grouping the Pi-terms oil of kinematic viscosity 4.645×10^{-5} m²/s is to be used in a prototype in which both viscous and gravity force dominate. A model scale of 1:5 is also desired. What viscosity of model liquid is necessary to make both the Froude number and the Reynold number same in model and prototype? [2+2+4]

b) An aeroplane is designed according to the following specifications:
Weight = 13.5 kN, wing Area = 30 m², Take off speed = 30 m/s
Model tests show that the lift and drag coefficient vary with the angle of attack of the wing according to following approximate relations:

$C_D = 0.008\,(1 + \alpha)$ $\qquad$ $C_L = 0.35\,(1 + 0.2\alpha)$

For small α, where α is the angle of attack measured in degree. The atmospheric density is 1.29 Kg/m³. Find the angle of attack that ensures take-off at the design speed and power required for take off. [6+2]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Kartik

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

Subject: - Fluid Mechanics _(CE 505)_

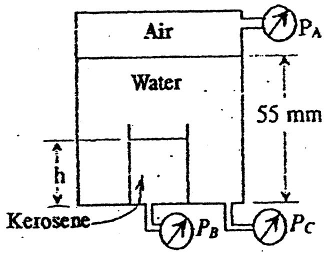
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt __All__ questions.*
- ✓ *The figures in the margin indicate __Full Marks__.*
- ✓ *Assume suitable data if necessary.*

1. a) The viscosity of one of the liquid in laboratory is determined by measurements of shear stress τ and rate of shearing strain $\frac{du}{dy}$ tested in suitable viscometer. Based on following observations, determine if the given liquid is Newtonian or Non-Newtonian fluid. Explain how you arrive at your answer. [4]

τ (N/m^2)	0.04	0.06	0.12	0.18	0.3	0.52	1.12	2.1
$\frac{du}{dy}(s^{-1})$	2.25	4.5	11.25	22.5	45	90	225	450

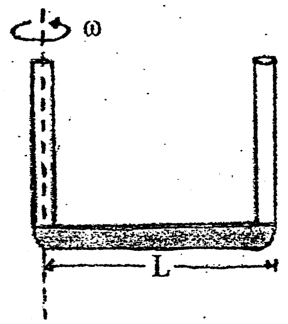
b) Under what condition inverted U-tube manometer and single column inclined manometer are used to measure pressure. [3]

c) A cylindrical tank contains water at a height of 55 mm as shown in figure below. Inside a smaller open cylinder tank containing cleaning fluid (S = 0.8) at a height h. If P_B = 13.4 Kpa and P_C = 13.42 KPa gauge, what are gauge pressure P_A and height h of cleaning fluid? Assume that the cleaning fluid the kerosene is prevented from moving to the top of the tank. [5]

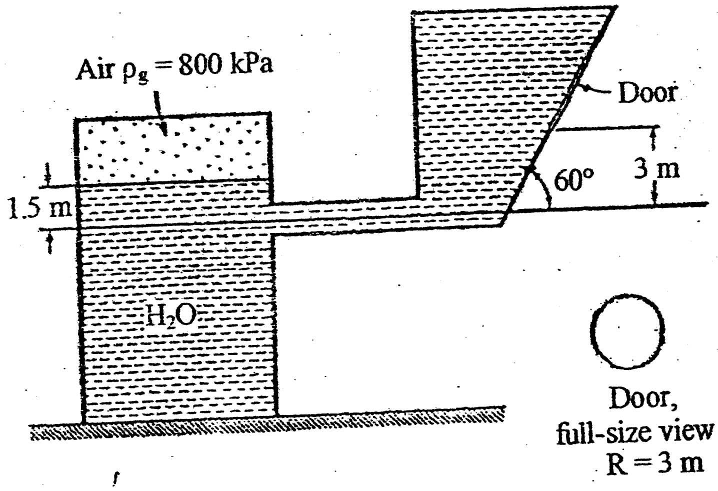


d) Write the Navier-Stokes and Bernoulli's equation (derivation not required). Explain each terms in the equations with physical meaning. [4]

2. a) The figure shows U-tube of base length L in which a liquid of density 0.85 is filled such that it completely fills the base length only. If the tube is now rotated at angular speed of 10 rad/scc as shown, find the level rise of liquid in outer arm of tube. [6]



b) Determine the force and its position from fluids acting on the door as shown in figure. [10]



3. a) Consider the flow described by the velocity field $\vec{v} = Bx(1 + At)\vec{i} + Cy\vec{j}$, with $A = 0.5\ s^{-1}$, and $B = C = 1\ s^{-1}$. Coordinates are measured in meter. Plot the streak lines traced out by the particle that passes through the point (1, 1) during the interval from t = 0 to t = 3 s. Compare with streamlines plotted through the same point at the instants t = 0, 1 and 2 s. (no need of graph paper, plot in answer copy in precision as far as possible) [4+4]

b) Derive an expression for flow through partially and fully submerged orifice. [2+2]

c) Show that the slope of Cipolletti weir is 1:4. How can you account for velocity of approach while computing the discharge over weirs? [3+1]

4. a) The diameter of a pipe-bend is 300 mm at inlet and 150 mm at outlet and the flow is turned through 120° in a vertical plane. The axis at inlet is horizontal and the center of outlet section is 1.4 m below the center of inlet section. The total volume of fluid contained in the bend is 0.085 m^3. Neglecting friction, calculate the magnitude and direction of the net force exerted on the bend by water flowing through it at 0.23 m^3/s when the inlet gauge pressure is 140 kPa. Take head loss in the bend as $0.25\ V^2/2g$, where V = velocity at inlet pipe. [9]

b) Explain the development of boundary layer along a thin flat plate held parallel to uniform flow. Also point out the salient features. [7]

5. a) A pressure drop ΔP provides a measure of the frictional losses of a fluid as it flows through a pipe. Determine how ΔP is related to the variables that influence it, namely, pipe dia. D, its length L, fluid density ρ, viscosity μ, velocity V and the relative roughness factor $\frac{\epsilon}{D}$, which is ratio of average size of surface irregularities to the pipe diameter. Use Buckingham-π method. [8]

b) Describe with the help of a sketch, the variation of drag coefficient for a cylinder over a wide range of Reynolds number. [8]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Chaitra

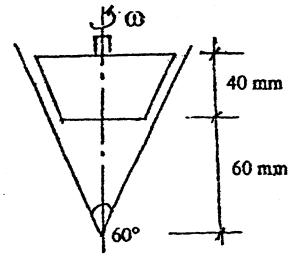
Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BAG	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Fluid Mechanics *(CE 505)*

- ✓ 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) A pressure gauge consists of U tube with equal enlarged ends and is filled with water on one side and oil of specific gravity 0.97 on the other, the surface of separation being in the tube below the enlarged ends. Calculate the diameter of each enlarged end if the tube diameter is 5 mm and the surface of separation moves 25 mm for a difference in pressure head of 1mm of water. [6]

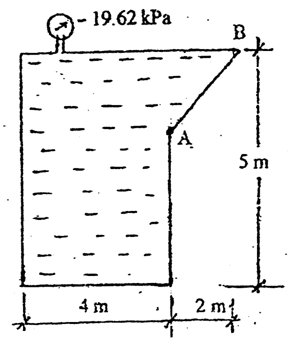
   b) Oil of viscosity $\mu = 2$ poise fills the small gap of thickness 0.2 mm. Determine the torque required to rotate the truncated cone at constant speed of 100 rpm. Neglect fluid stress exerted on the circular bottom. [6]



   c) Write Navier-Stoke's equation in three dimensional form (derivation not required). If the flow is steady and incompressible; no flow or property variation in z-direction, fully developed flow (no property variation in x direction), model the above written Navier Stoke's equation in simplified form using the assumptions. Can you develop simplified velocity distribution equation from the simplified model? [1+2+1]

2. a) A test vehicle contains a U-tube manometer for measuring differences of air pressure. The manometer is so mounted that, when the vehicle is on level ground, the plane of the U is vertical and in the fore-and-aft direction. The arms of the U are 60 mm apart, and contain alcohol of relative density 0.79. When the vehicle is accelerated forwards down an incline at 20° to the horizontal at 2 m/s^2 the difference in alcohol levels (measured parallel to the arms of the U) is 73 mm, that nearer the front of the vehicle being the higher. What is the difference of air pressure to which this reading corresponds? [8]

   b) A tank full of oil (S = 0.8) as shown in figure. Determine total pressure and centre of pressure on surface AB of the tank. Check your result with pressure diagram also. Take length of the tank 6m. [6+2]



3. a) An incompressible, frictionless flow specified by $\psi = -6Ax - 8Ay$; x, y in meters, A = 1m/s. Find

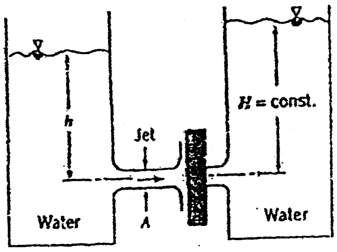
(i) sketch streamlines $\psi = 0$ and $\psi = 8m^2/s$

(ii) velocity vector at (0, 0) and its direction.

(iii)flow rate between streamlines passing through points (1, 1) and (4, 1). [2+2+2]

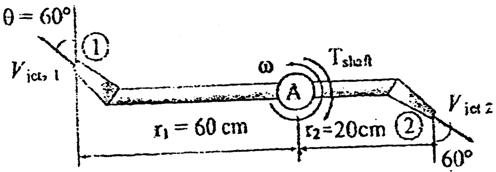
b) Prove that in Cippoletti weir the sides have a slope of 1:4. A sharp-edged notch is in the form of a symmetrical trapezium. The horizontal base is 100 mm wide, the top is 500 mm wide and the depth is 300 mm. Develop from first principles a formula relating the discharge to the upstream water level, and estimate the discharge when the upstream water surface is 228 mm above the level of the base of the notch. Assume that Cd = 0.6 and that the velocity of approach is negligible. [2+6+2]

4. a) Two large tanks containing water have small smoothy orifices of equal area. A jet of liquid issues from the left tank. Assume the flow is uniform and unaffected by the friction. The jet impinges on the vertical flat plate covering the opening of the right tank. Determine the minimum value for height, h, required to keep the plate in place over the opening of the right tank. [6]



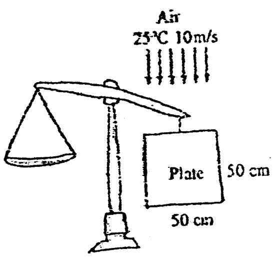
b) Flow takes place over a flat plate exposed parallel to free stream. Mention characteristics of flow and draw a neat sketch of the boundary layer development showing, (i) Laminar boundary layer, (ii) Turbulent boundary layer, (iii) Transition zone, (iv) Laminar sub layer. What is displacement thickness? [4]

c) Water enters two armed sprinkler vertically at rate of 10 litre/sec, and leaves the nozzle horizontally. The diameter of both the nozzle is 12 mm. Calculate the torque required to hold the arm stationary. [6]



5. a) The speed of propagation C of a capillary wave in deep water is known to be function only of density ρ, wavelength λ, and surface tension σ. Find the proper functional relationship, completing it with a dimensionless constant. For a given density and wavelength, how does the propagation speed change if surface tension is doubled? [8]

b) The weight of a thin flat plate 50cm × 50cm in size is balanced by a counter weight that has a mass of 2kg as shown in figure below. Now a fan is turned on, and air flows downward over both surfaces of the plate with a free-stream velocity of 10m/s. Determine the mass of the counter weight that needs to be added in order to balance the plate in this case. [8]



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TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

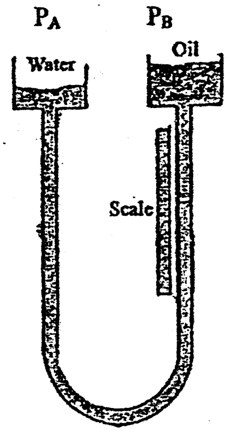
2076 Ashwin

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

Subject: **- Fluid Mechanics *(CE 505)***

- ✓ 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) A manometer consists of a U-tube, 7 mm internal diameter, with vertical limbs each with an enlarged upper end 44 mm diameter. The left hand limb and the bottom of the tube is filled with water and the top of the right-hand limb is filled with oil of specific gravity 0.83. The free surfaces of the liquids are in the enlarged ends and the interface between the oil and water is in the tube below the enlarged end. What would be the difference in pressures applied to the free surfaces which would cause the oil/water interface to move 1cm. [10]

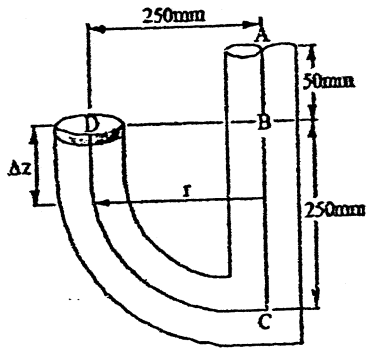


b) Explain Capillarity phenomenon. [1]

c) A 2.2 cm wide gap between two vertical plane surfaces is filled with liquid of specific gravity 0.9 and dynamic viscosity 1.75 NS/m^2. A metal plate 1.5m×1.5m×0.2cm thick and weighing 40N is placed midway in the gap. Find the force required if the plate is to be lifted with constant velocity of 0.15 m/s. [5]

2. a) Cylindrical tank 2 m diameter and 4 m long, with its axis horizontal, is half filled with water and half filled with oil of density 880 kg/m^3. Determine the magnitude and position of the net hydrostatic force on one end of the tank. [8]

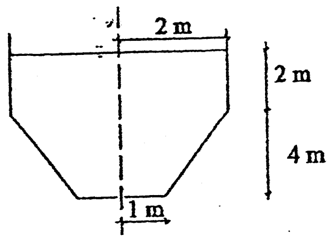
b) A tube ABCD has the end A open to atmosphere and the end D closed as shown in figure below. The portion ABC is vertical while the portion CD is a quadrant of radius 250 mm with its centre is B, the whole being arranged to rotate about its vertical axis ABC. If the tube is completely filled with water to a height in the vertical limb of 300 mm above C find (a) the speed of rotation which will make the pressure head at D equal to pressure head at C, (b) the value and position of the maximum pressure head in the curved portion CD when running at the speed. [5+3]



3. a) Steady, incompressible flow in xy plane with $\vec{V} = \frac{A}{x}\bar{i} + \frac{Ay}{x^2}\bar{j}$ where $A = 2m^2/s$ and coordinates are in meters. Find
   i) equation for steamline through (x,y) = (1,3)
   ii) time required for a fluid particle to move from x=1m to x=3m. [3+3]

   b) The velocity of a fluid varies with time t. Over the period from t=0 to t=8 s the velocity components are u= 0 m/s and v = 2 m/s; while form t= 8s to t = 16 s the components are u= 2 m/s and v = -2 m/s. A dye streak is injected into the flow at a certain point commencing at time t=0 and the path of a particle of fluid is also traced from that point starting at t=0. Draw to scale the streakline and pathline of the particle. [4]

   c) Find the time of emptying a cylindrical vessel attached with conical vessel as shown in the figure below with the provided data herein. There is no inflow into the tank. Orifice of diameter 10cm is at the bottom of the tank. Take discharge coefficient as 0.6. [6]



4. a) Air flows over a flat plate 2m long and 1.5m wide at a velocity of 6.5 m/s. Determine the shear stress, and displacement thickness at distance of 1.8m form the leading edge. Also determine the drag force on the face of the plate. [2+2+4]

   b) The diameter of a bend is 300 mm at inlet and 150 mm at outlet and the flow is turned through 120° in vertical plane, the axis of inlet is horizontal and the centre of the outlet section is 1.5 below the centre of the inlet section, the total volume of fluid contained in the bend is $0.09\ m^3$. Neglecting friction, calculate the magnitude and direction of the force exerted by the water on the bend by the water flowing through it at 300 lps when the inlet pressure is 130 KPa. [8]

5. a) A river carrying a discharge of $3500\ m^3/s$ has a depth of 2.25 m width of 1500m. From the point of view of availability of space the horizontal scale of 1:400 is chosen. Assuming slope scale to be unity, determine the depth and discharge scales for the model. [8]

   b) A jet plane which weighs 170 KN has a wing area of $25m^2$. It is flying at a speed of 200 km/hr. When the engine develops 580 KW, 70% of this power is used to overcome the drag resistance of the wing. Calculate the coefficient of lift and coefficient of drag for the wing. Take density of air = $1.25\ kg/m^3$. [8]

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TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING **Examination Control Division** **2075 Chaitra**				
	Exam.	**Regular / Back**		
	Level	BE	**Full Marks**	80
	Programme	BCE, BAG	**Pass Marks**	32
	Year / Part	II / I	**Time**	3 hrs.

Subject: - Fluid Mechanics *(CE 505)*

- ✓ 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) An oil and water manometer consists of U-tube 4mm diameter with both limbs vertical. The right-hand limb is enlarged at its upper end to 20mm diameter. The enlarged end contains oil with its free surface in the enlarged portion and the surface of separation between water and oil is below the enlarged end. The left hand limb contains water only, its upper end being open to the atmosphere.

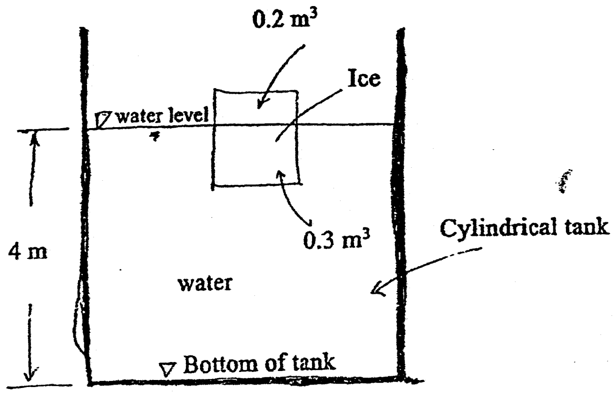
   When the right-hand side is connected to a cylinder of gas the surface of separation is observed to fall by 25mm, but the surface of oil remains in the enlarged end. Calculate the gauge pressure in the cylinder. Assume that the specific gravity of the water is 1.0 and that of the oil 0.9. [8]

   b) Write down the expression for Navier-Strokes equations and Euler equations of fluid motion in 2D with definition of each term. Also write their applications. [4]

   c) Explain the concept of control volume and continiuum in fluid mechanics. Define viscosity with its expression. [2+2]

2. a) A pipe 25mm in diameter is connected to the centre of the top of a drum 0.5m in diameter, the cylindrical axis of the pipe and the drum being vertical. Water is poured into the drum through the pipe until the water level stands in the pipe 0.6m above the top of the drum. If the drum and pipe are now rotated about their vertical axis at 600rev/min what will be the upward force exerted on the top of the drum. [8]

   b) $0.5m^3$ of ice floats in a cylindrical tank maintaining 4m depth as shown in figure below. What will be the depth of water if ice completely melt in the tank? [8]



3. a) Velocity field $\vec{v} = Bx(1+At)\vec{i} + cy\vec{j}$ with $A=0.5s^{-1}$, $B=C=1s^{-1}$. The coordinates are measured in meters.

   i) Plot the pathline of the particle that passed through the point(1,1,0) at time t=0.

   ii) Plot the streamlines through the same point (1,1,0) at instants t=0,1 and 2s. [4+4]

   b) A tank of constant cross-sectional area of $3.2m^2$ has two orifices each $8.8mm^2$ in area in one of its vertical sides at heights 5m and 2m respectively above the bottom of the tank. Calculate the time taken to lower the water level from 8m to 3m above the bottom of tank. Assume $C_d=0.62$. [8]

4. a) Explain concept of Boundary layer thickness. Displacement thickness and Momentum thickness with their applications each. [6]

   b) A jet of water with a velocity U and jet area. A strikes a flat plate normal to it. Determine the force of impingement, power developed and efficiency

   i) when the plate is at rest. [3]

   ii) when the plate is permitted to move along the direction of a velocity u. Also determine condition of maximum possible efficiency. [3]

   iii) what would be the possible maximum efficiency if series of plates were to face the jet in quick succession? [4]

5. a) A 3mm diameter sphere made of steel (sp. wt. $75KN/m^3$) falls in glycerine (sp. wt. $12.5\ KN/m^3$) of viscosity $0.893\ NS/m^2$ at a terminal velocity. Determine the terminal velocity and drag force on the sphere. [4]

   b) In a flow through a small orifice discharging freely into atmosphere under a constant head (H), the flow discharge (Q) depends on diameter of pipe (d), constant head, dynamic viscosity (μ), density of fluid (ρ) and acceleration due to gravity (g). Using Rayleigh's methods develop the relation in terms of non-dimensional terms. [6]

   c) A spillway model is to be built geometrically similar scale of 1/16 across a flume of 60cm width. The prototype is 12.5m high and the maximum head on it is expected to be 2m. (i) What height of the model and what head on the model should be used? (ii) If the flow over the model at a particular head is 20 lps, what flow per m length of the prototype is expected? [6]

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01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Ashwin

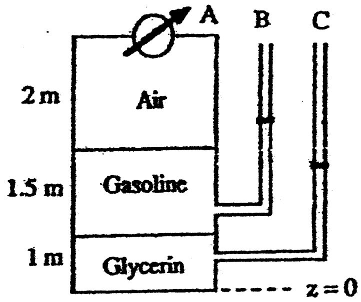
Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE, B.Agri.	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject:* - Fluid Mechanics *(CE505)

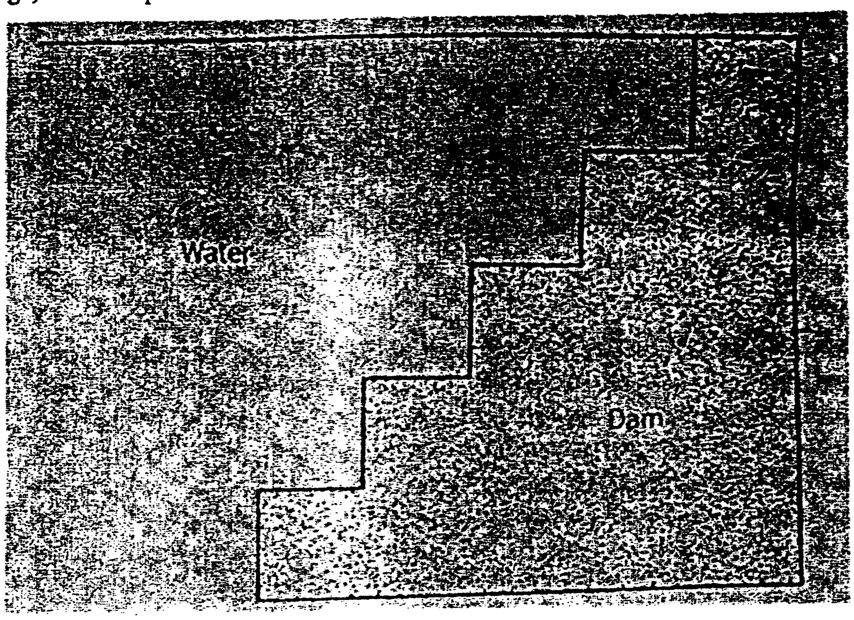
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt __All__ questions.*
- ✓ *The figures in the margin indicate __Full Marks__.*
- ✓ *Assume suitable data if necessary.*

1. a) A stationary bearing of length 30 cm and internal radius 8.025 cm has been used to provide lateral stability to a 8 cm radius shaft rotating at a constant speed of 200 rpm. The space between the shaft and bearing is filled with a lubricant having viscosity 2.5 poise. Find the torque required to overcome the friction in bearing. Take the velocity profile as linear. [8]

   b) In Fig. below, sensor A reads 1.5 kPa (gage). All fluids are at 20°C. Determine the elevations Z in meters of the liquid levels in the open piezometer tubes B and C. [8]



2. a) For the geometry shown, what is the vertical force on the dam? The steps are 0.3m high, 0.3 m deep and 3 m wide. [6]

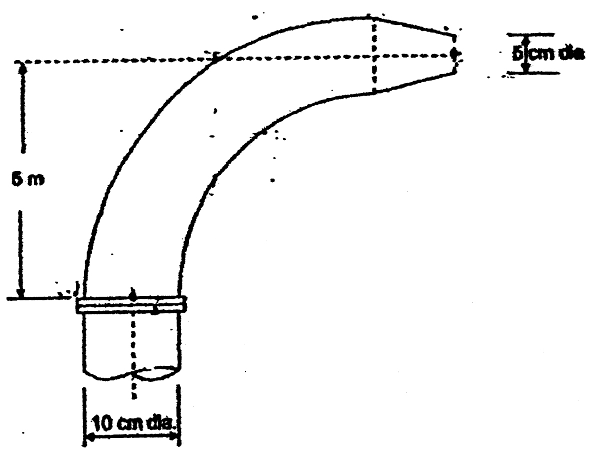


b) A thin-walled, open-topped tank in the form of a cube of 500 mm side is initially full of oil of relative density 0.88. It is accelerated uniformly at 5 m/s2 up a long straight slope at arctan (1/4) to the horizontal, the base of the tank remaining parallel to the slope, and the two side faces remaining parallel to the direction of motion. Calculate (a) the volume of oil left in the tank when no more spilling occurs, and (b) the pressure at the lowest corners of the tank. [4+6]

3. a) A discharge of 12 lps is passed over a 45 degree sharp-edged triangular notch under a head of 21 cm. The same discharge is passed over a sharp-crested rectangular notch of length 30 cm, the head being 7.8 cm. Calculate the coefficient of discharge of two notches. What is the magnitude of error that would cause 2 percent error in discharge in the two cases. [8]

   b) A velocity for a steady, in compressible flow in the xy plane is given by $\vec{V} = \vec{i}\,A/x + \vec{j}\,Ay/x^2$, where $A = 2\ m^2/s$, and the coordinates are measured in meters. Obtain an equation for the streamline that passes through the point (x, y) = (1, 3). Calculate the time required for a fluid particle to move from x = 1m to x = 2m in this flow field. [8]

4. a) Water flows into atmosphere through a vertical bend nozzle assembly as shown in figure below. The pipe diameter is 10 cm and nozzle exit diameter is 5 cm. The rate of flow of water is 2400 lpm. The interior volume of the assembly is 18.2 litres. The head loss in the bend is $0.5\frac{v^2}{2g}$ and in the nozzle it is $2\frac{V^2}{2g}$, where V is the velocity of water in the pipe. Compute the hydrodynamic force on the system. [8]



   b) Define boundary layer separation and stagnation point with the help of figure. [3]

   c) When a jet of fluid strikes series of Semicircular vanes, show that the maximum efficiency of the system is 1. [5]

5. a) The wall shear stress τ_w in a boundary layer is assumed to be a function of stream velocity U, boundary layer thickness δ, local turbulence velocity u', density ρ, and local pressure gradient dp/dx. Using (ρ, U, δ) as repeating variables, rewrite this relationship as a dimensionless function. [8]

   b) A jet plane which weighs 19920N has a wing area of $25m^2$. It is flying at a speed of 200km/hr. When the engine develops 588.5KW, 80% of this power is used to overcome the drag resistance of the wing. Calculate the coefficient of lift and coefficient of drag for the wing. Take density of air = 1.25 kg/m^3. [8]

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02 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

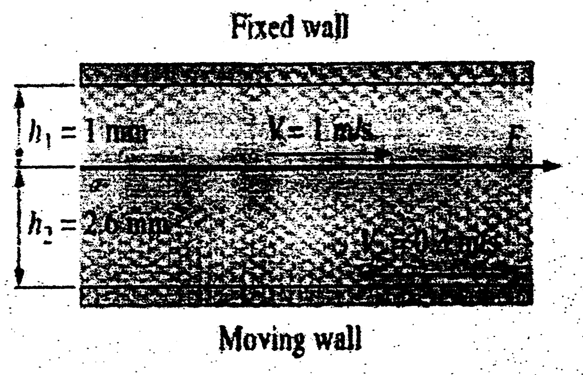
2074 Chaitra

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

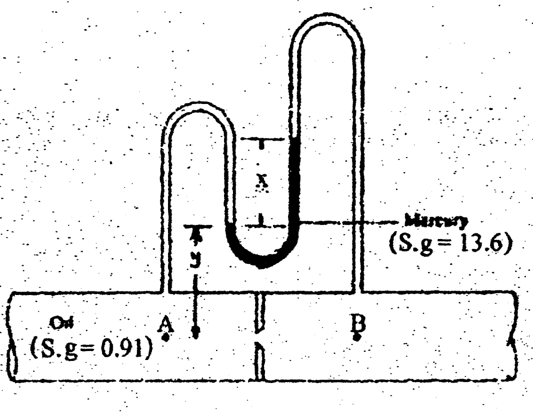
Subject: - Fluid Mechanics *(CE505)*

- ✓ 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) Thin 40 cm × 40 cm flat plate is pulled at 1 m/s horizontally through a 3.6 mm thick oil layer sandwiched between two plates, one stationary and the other moving at a constant velocity of 0.3 m/s, as shown in figure. The dynamic viscosity of oil is 0.027 pa.s. Assuming the velocity in each oil layer to vary linearly i) plot the velocity profile and find the location where the oil velocity is zero. ii) determine the force that needs to be applied on the plate to maintain this motion. [4+4]



b) A differential manometer is attached to a pipe as shown in figure. Calculate the manometric height difference x, for pressure difference 2.68 KPA. [8]



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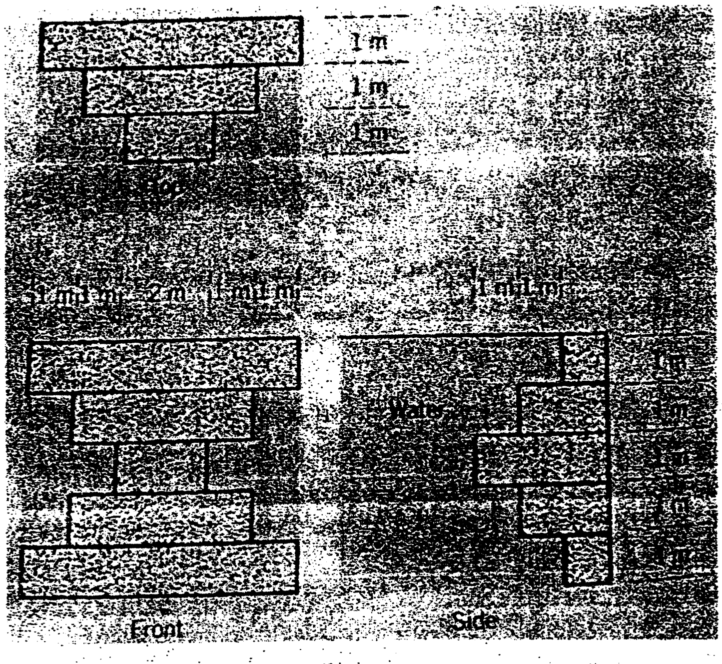
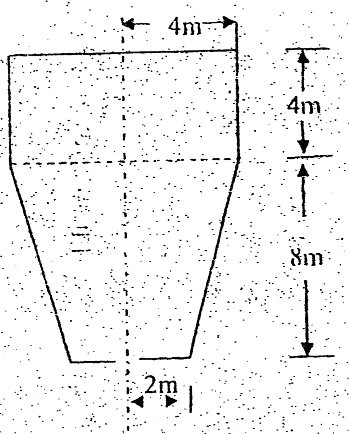
2. a) For the geometry shown, what is the vertical force on the dam? [10]



b) An open-topped tank, in the form of a cube of 900 mm side, has a mass of 340 kg. It contains 0.105 m^3 of oil of relative density 0.85 and is accelerated uniformly up along slope at arctan (1/3) to the horizontal. The base of the tank remains parallel to the slope, and the side faces are parallel to the direction of motion. Neglecting the thickness of the walls of the tank, estimate the net force (parallel of the slope) accelerating the tank if the oil is just on the point of spilling. [6]

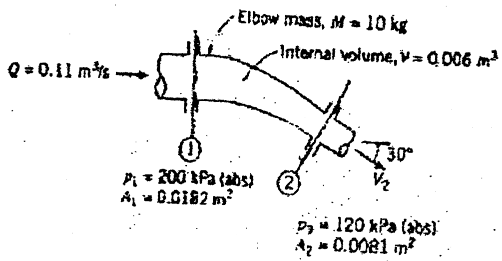
3. a) Find the time of emptying of cylindrical vessel with conical vessel as shown in the figure. There is no inflow into the tank. An orifice of 10 cm diameter is at the bottom of the tank. Take $C_d = 0.6$. [6]



b) The velocity field is given by $\vec{V} = Ax\,\vec{i} - Ay\,\vec{j}$; the units of velocity are m/s; x and y are given meters; $A = 0.3 s^{-1}$

(i) Obtain an equation for the streamlines in the xy plane [3]
(ii) Plot the streamline passing through the point $(x_o, y_o) = (2, 8)$ [1]
(iii) Determine the velocity of a particle at the point (2, 8) [1]
(iv) If the particle passing through the point (x_o, y_o) is marked at time $t = 0$, determine the location of the particle at time $t = 6$ s. [3]
(v) Show that the equation of the particle path (pathline) is the same as the equation of the streamline. [2]

4. a) Reducing elbow is shown in figure. Fluid is water. Find the force components needed to keep elbow from moving. [8]



b) With appropriate sketches define boundary layer thickness and momentum thickness and discuss their application. [2×4]

5. a) For models governed by gravity forces, obtain the scaling ratios for time, discharge, force and power. [8]

b) Water flows over 0.3 m long and 0.1 m wide flat plate at 15 m/s parallel to it. Calculate (i) drag force on that portion of plate over which the boundary layer is laminar (ii) total drag force on both sides of the plate. $\rho = 998\ kg/m^3$ and viscosity $= 10^{-6}\ m^2/s$. [8]

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02

TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2074 Ashwin

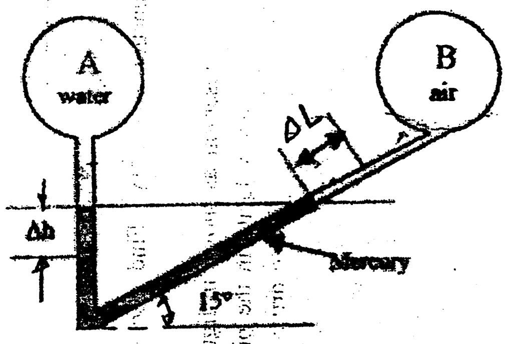
Exam.	Back		
Level	BE	**Full Marks**	80
Programme	BCE, B. Agri.	**Pass Marks**	32
Year / Part	II / I	**Time**	3 hrs.

Subject: - Fluid Mechanics *(CE505)*

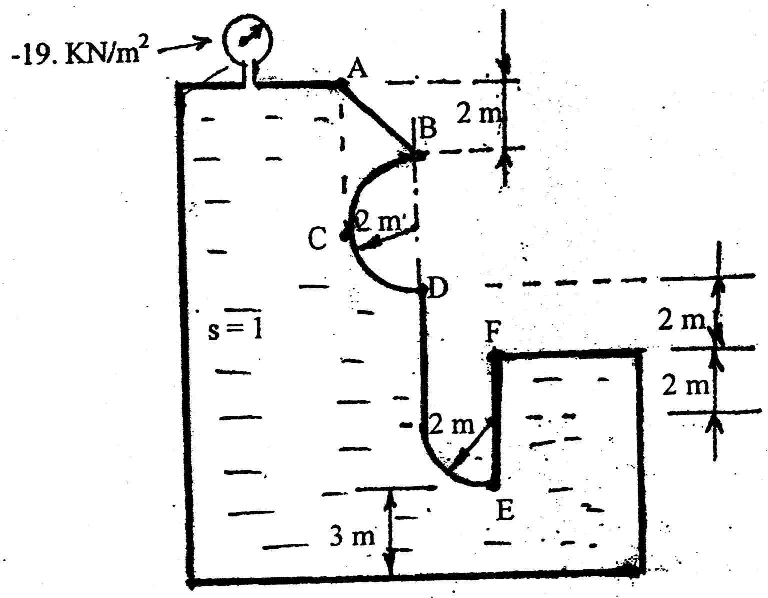
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt __All__ questions.*
- ✓ *The figures in the margin indicate __Full Marks__.*
- ✓ *Assume suitable data if necessary.*

1. Derive an expression for surface tension and capillarity. A 15 cm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 15.10 cm both cylinders are 25 cm high. The space between the cylinders is filled with a liquid whose viscosity is unknown. If a torque of 12 Nm is required to rotate the inner cylinder at 100 rpm determine the viscosity of the fluid. [2+4]

2. In the figure below the pressures at A and B are the same, 100 kPa. If water is introduced at A to increase P_A to 130 kPa, find the new positions of the mercury. The connecting tube is an uniform 1-cm in diameter. Assume no change in the liquid densities. [6]

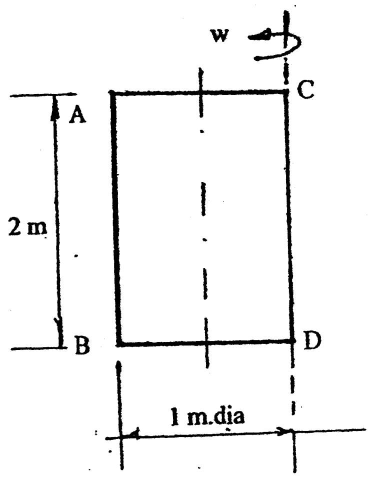


3. a) Find the resultant pressure force due to water on a curved surface BCDEF of 10 m length as shown in figure below. [8]



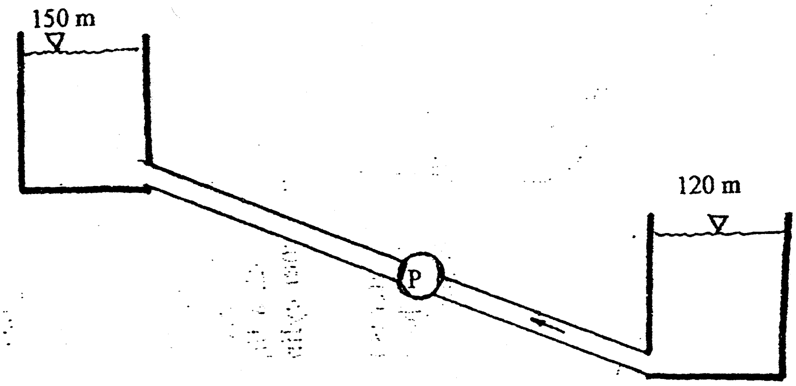
b) Explain the use of hydrometer and shortly explain the conditions of stability of floating bodies. [6]

c) A closed cylindrical tank of 1 m diameter and 2 m high is completely filled with water. If it is being rotated about its vertical axis with uniform speed of 100 rpm, Draw pressure intensity diagram along surface AB and AC with values. [6]

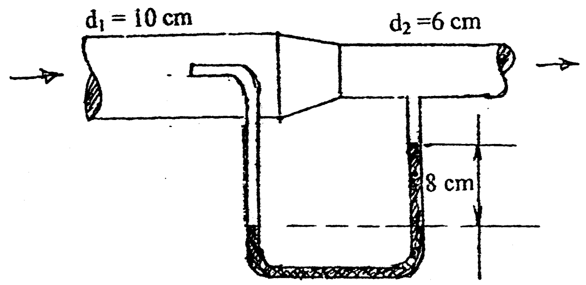


4. Sketch the streamlines represented by the stream function $\psi = x^2+y^2$. Find also the velocity and its direction at point (3,4). [3+3]

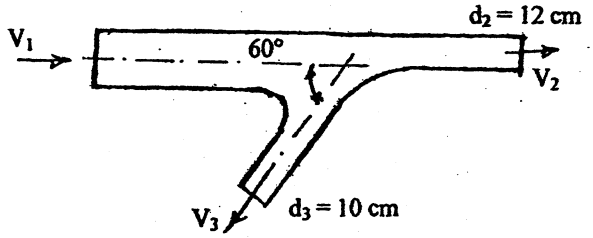
5. Water is pumped at $0.12 m^3/s$ from the lower to the upper reservoir as shown in figure below. Pipe friction losses $h_f = 27v^2/2g$, where V is the average velocity in the pipe (diameter = 15 cm). If pump is 75% efficient, what horse power is needed to drive it? Draw TEL and HGL. [5+3]



6. In figure below the flowing fluid is CO_2 (density = 3 kg/m^3). Neglect losses. If p_1 = 170 kPa and the manometer fluid is meriam red oil (S.G = 0.827). Estimate : (a) p_2 and (b) the gas rate in m^3/h. [4+5]



7. Ignoring friction losses, calculate the magnitude and direction of resultant force, exerted on the bend when water discharges at the atmosphere as shown in figure below. Both nozzles discharge water with a velocity of 20 m/sec. Consider the axes of the pipe and the nozzles lie in a horizontal plane. [8]



8. Define boundary layer concept. Explain the terms boundary layer thickness, laminar sub-layer and point of separation of boundary layer with sketch. [5]

9. Distinguish between pressure and friction drags. Explain with sketches, why the aerofoil is designed as streamlines body. [5]

10. Distinguish between distorted and undistorted modeling. Explain the working principle of dimensional analysis by Buckingham's Π theorem. [2+5]

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02 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Chaitra

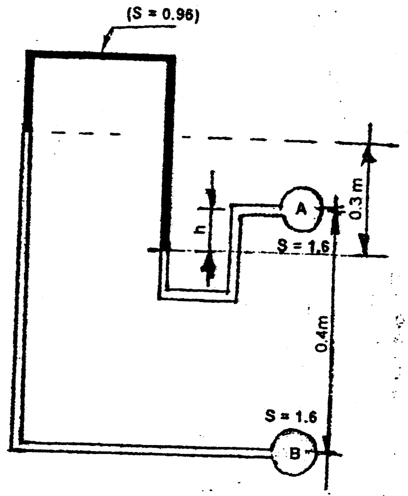
Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, B. Agri.	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Fluid Mechanics *(CE505)*

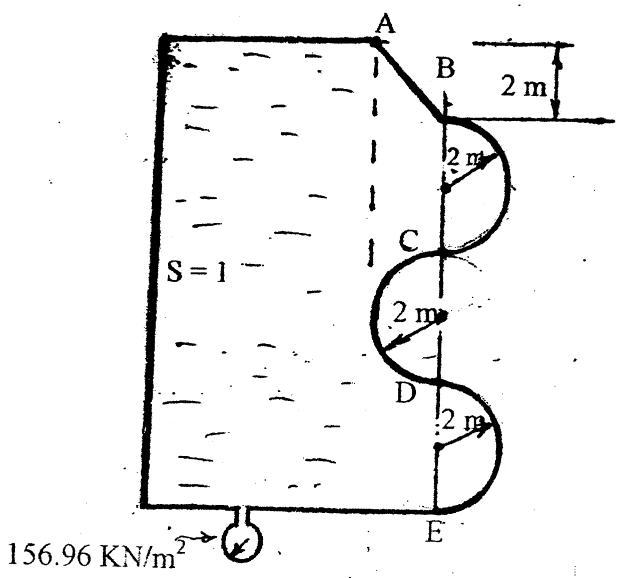
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt __All__ questions.*
- ✓ *The figures in the margin indicate __Full Marks__.*
- ✓ *Assume suitable data if necessary.*

1. Explain Cavitation and vapor pressure. Prove that capillary depression (**h**) in the tube of radius r when inserted in mercury (sp.gr.S_1) above which a liquid of sp.gr. S_2 lies is given by $h = \dfrac{2\sigma\cos\theta}{r\gamma(S_1 - S_2)}$ [2+4]

2. Find the pressure difference between pipes A and B which filled with liquid of sp.gr. 1.6 and monometric reading as shown in figure. [6]



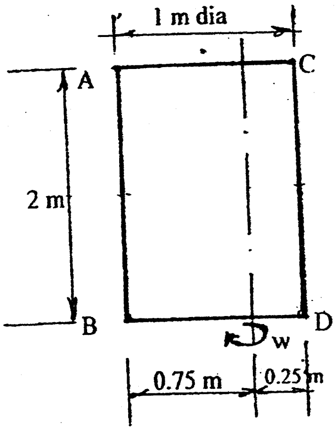
3. a) Find the resultant hydrostatic pressure force due to water on a curved surface BCDE as shown in figure below. Consider the length of the surface is 10 m. [8]



P. T. O. →

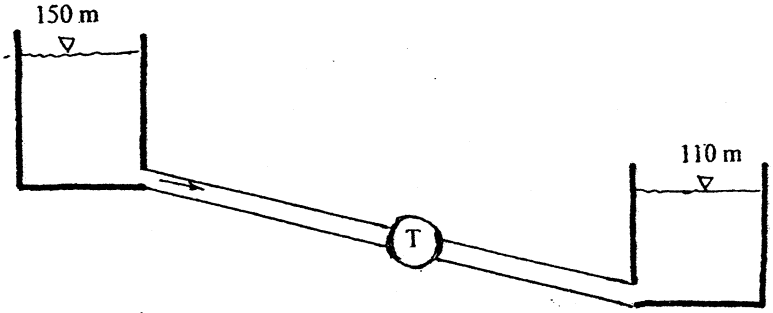
b) Define metacentre and find the expression for metacentric height. [6]

c) A closed cylindrical tank completely filled with water is being rotated with constant speed of 100 rpm about its axis vertical as shown in figure below. Draw the pressure intensity diagram along AB and AC, with values. [6]



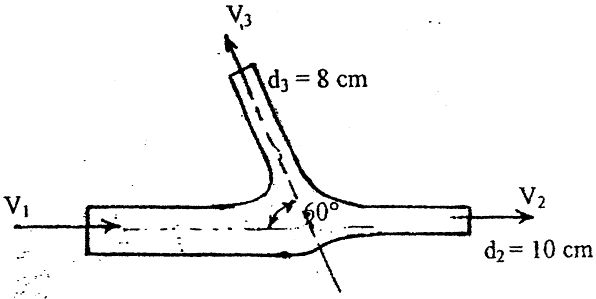
4. Given $\vec{V} = 4xy\hat{i} + 2y^2\hat{j}$, find stream function and plot several streamlines in first quandrant. The coordinates are in meters. [3+3]

5. The turbine system in figure below draws water from the upper reservoir through a uniform diameter pipe to produce power for a city. For a design flow rate of 1.2 m^3/s, the friction loss in 5 m. Estimate the power in KW extracted by the turbine. Draw TEL and HGL. [5+3]



6. A sharp-edged notch in the form of a symmetrical trapezium. The horizontal base is 100 mm wide, ,the top is 500 mm wide and the depth is 300 mm. Derive from the first principles a formula relating the discharge to the upstream water level, and estimate the discharge when the upstream water surface is 228 mm above the level of the base of notch. Assume that $C_d = 0.6$ and that the velocity of approach is negligible. [7+2]

7. Ignoring friction losses, calculate the magnitude and the direction of resultant force exerted on the bend when water discharges at the atmosphere as shown in figure below. Both nozzles discharge water with a velocity of 15 m/sec. The axes of systems are lie in a horizontal plane. [8]



8. Define boundary layer concept with sketch. Explain clearly the phenomenon of boundary layer separation and how it can be prevented. [5]

9. Find the expression for pressure and friction drags. What do you understand by a streamline body? Give some examples of streamline body. [5]

10. Explain the laws of similarity between model and prototype. In a flow through a small orifice discharging freely into atmosphere under a constant head (H), the flow discharge (Q) depends on diameter of pipe (d), constant head, dynamic viscosity (μ), density of fluid (ρ) and acceleration due to gravity (g). Using Rayleigh's methods develop the relation in terms of non-dimensional terms. [2+5]

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02 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Shrawan

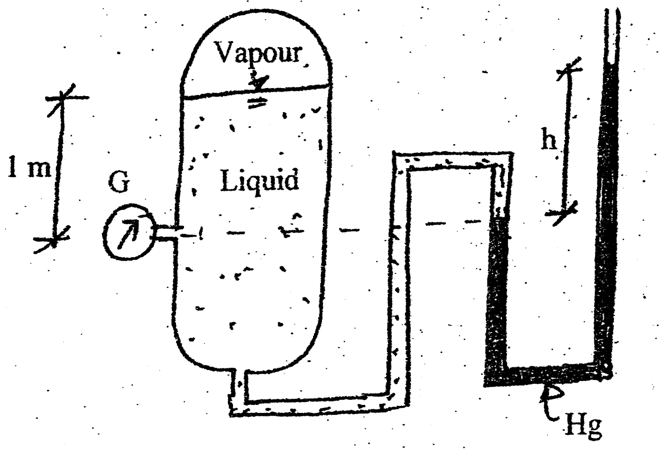
Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE, B. Agri.	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Fluid Mechanics *(CE505)*

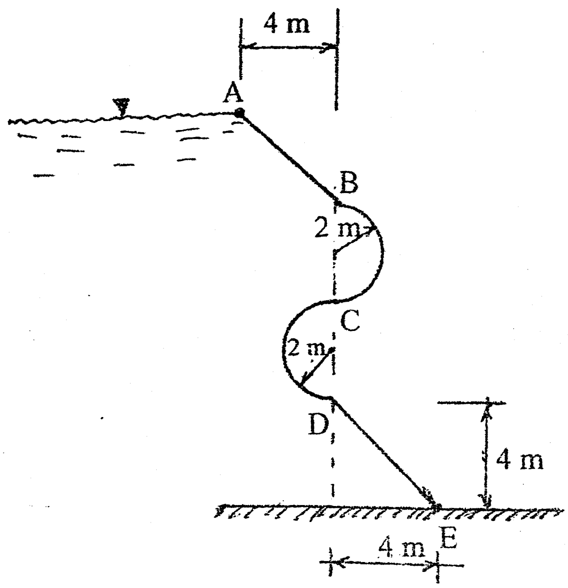
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Explain the determination of viscosity by viscometer. A pressure vessel has an internal volume of 0.5 m^3 at atmospheric pressure. It is desired to test the vessel at 3000 bar by pumping water into it. The estimated variation in the change of the empty volume of the container due to pressurization to 3000 bar is 0.6 percent. Calculate the mass of water to be pumped into the vessel to attain the desired pressure level given the bulk modulus of water as 2000 Mpa. [2+4]

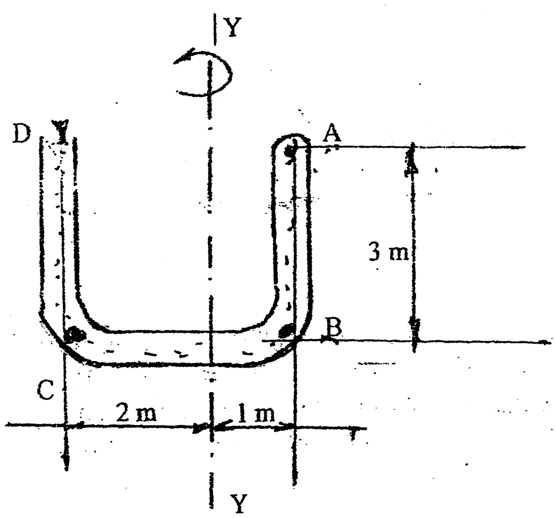
2. Define absolute and gauge pressure. Determine (i) the gauge pressure reading on the pressure gauge and (ii) the height h, of the mercury monometer. Take liquid density = 800 kg/m^3, vapour pressure = 120 Kpa (abs) and atmospheric pressure = 101 kpa (abs). [2+5]



3. a) Find the resultant pressure force on curved surface ABCDE due to liquid with specific gravity S = 1..1 take length of the curved surface (normal to the paper as 20 m.) [8]



b) The U-tube AB and CD shown in figure below filled with water. The tube AB is sealed where as tube CD is open to atmosphere. Find the pressure intensities at the points A, B and C where it is rotating with axis Y-Y with uniform rotation of 60 rpm. [7]



c) What are the importance of Metacentre? How do you determine the metacentric height of a rectangular vessel in laboratory? [7]

4. Velocity vector of flow field is given by $\vec{V} = 2x^3\vec{i} - 6x^2y\vec{j}$. Determine the equation of stream line. Also determine expression of ψ and ϕ. [3+3]

5. Integrate Euler's equation along a streamline and obtain Bernoulli's equation (No derivation of Euler equation required). What will be the Bernoulli's equation between two points where there are head losses, work done by a machine (turbine) and energy supplied by the machine (pump) between those points. [2+2]

6. a) What is Cippoletti notch? A tank of area A is provided with an arifice 40 mm in diameter at its bottom. Water flows into tank at a uniform rate from the top and is discharged through the orifice. It is found that when the head of the water over the orifice is 0.68 m, the water surface rose at 0.0014 m/sec. but, when the head of water is 1.24 m, the water surface rose at 0.00062 m/sec. Find the rate of inflow and the cross-sectional area of the tank. Take $C_d = 0.62$. [2+4]

b) A venturimeter is to be fitted in a horizontal pipe of 0.15 m diameter to measure a flow of water which may be anything up to 240 m^3/ hour. The pressure head at the inlet for this flow is 18 m above atmospheric and the pressure head at the throat must not be lower than 7 m below atmospheric. Between the inlet and the throat there is an estimated frictional loss of 10% of the difference in pressure head between these points. Calculate the minimum allowable diameter for the throat. [6]

7. A 5 cm diameter jet delivering 56 liters of water per sec impinges without shock on a series of vanes moving at 12 m/s in the same direction as the jet. The vanes are curved so that they would, if stationary, deflect the jet through an angle of 135°. Fluid resistance reduces the relative velocity at exit from the vanes to 0.90 of that at entrance. Determine (a) the magnitude and direction of the resultant force on the vanes (b) The work done per second by the vanes. [5+3]

8. Define the concept of boundary layer. Explain the growth of boundary layer in a close canduit (pipe flow). Give three examples of use of boundary layer concept. [1+3+1]

9. An aircraft weighting 1000KN when empty has a wing area of 220 m^2. It is to take off at a velocity of 300 Km/hr and a 20° angle of attack. Determine the allowable weight of cargo and power required for the engine. Take density of air as 1.2 kg/m^3. Assume coefficient of lift for the wing at 20°, angle of attack as 1.42 and coefficient of drag as 0.17. [3+2]

10. List out the guiding rules for the choice of repeating variables in Buckingham π method. Also state the rules that apply to form the groups of dimensionless π-term. A pipe line of 2 m diameter is to be designed to carry the oil at the rate of 5 m^3/s with specific gravity 0.8 and viscosity of 0.042 poise. Test were conducted using a pipe of 20 cm diameter with water having viscosity of 0.01 poise. Calculate the velocity and rate of flow required for model. [2+3]

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02 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Chaitra

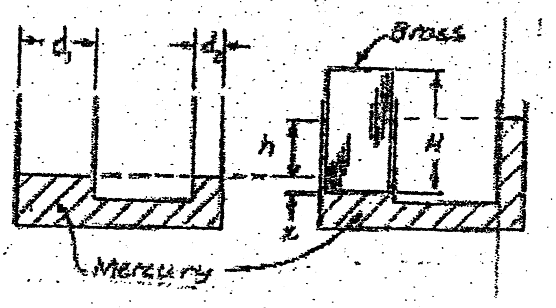
Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, B. Agri.	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Fluid Mechanics *(CE505)*

- ✓ 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.*

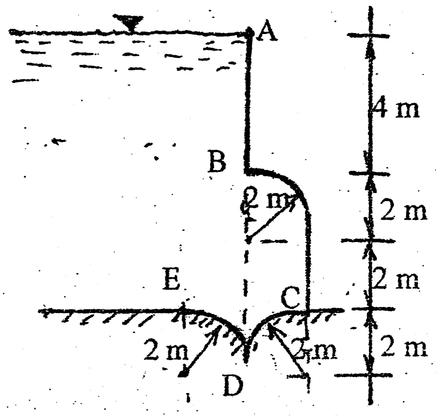
1. Explain the determination of viscosity by viscometer. A U-tube is made up of two capillaries of bores 1.5 mm and 2mm respectively. The U tube is held vertical and partially filled with liquid whose surface tension σ = 0.075 N/m. Find out the mass density of the liquid if the difference in two menisci is 2 mm. Assume angle of contact is zero. [3+3]

2. Given: Container of mercury with vertical tubes d_1 = 39.5 mm Brass cylinder with D = 37.5 mm and H = 76.2 mm is introduced into larger tube, where it floats. Take S_{brass} = 8.5. [3+3]

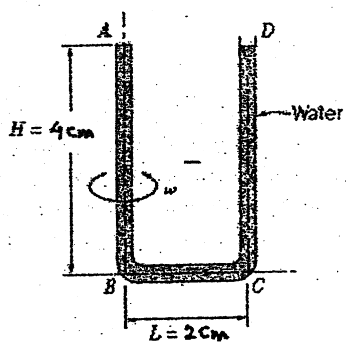


Find: (a) Pressure on bottom of cylinder
(b) New equilibrium level; h, of mercury

3. a) Find the resultant pressure force on curved surface ABCDE due to liquid with specific gravity S = 1.25 take length of the curved surface (normal to the paper) as 10 m. [8]



b) The U-tube shown in figure below is filled with water. It is sealed at A and open to the atmosphere at D. The tube is rotated about vertical axis AB at 1600 rpm. If the U-tube is now spun at 300 rpm, what will the pressure be at A? If a small leaks appear at A, how much water will be lost at D? [6]



c) Explain the metacentre with appropriate diagram. Write down the steps for determining metacentric height in laboratory experiment. [6]

4. a) Consider fully developed two-dimensional flow between two infinite parallel plates separated by distance h, with the both top and bottom plate stationary and forced pressure gradient $\frac{dP}{dx}$ driving the flow $\left(\frac{dP}{dx} \text{ is constant and negative}\right)$. The flow is steady, incompressible and two-dimensional in x-y plane. The velocity components are given by: [3]

$$u = \frac{1}{2\mu}\frac{dP}{dx}(y^2 - hy); \quad v = 0$$

Where μ is fluid's viscosity. Is this flow rotational or irrotational?

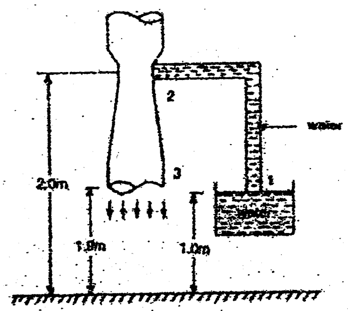
b) A steady, incompressible, two dimensional velocity field is given by [3]

$$\vec{V} = (1 + 2.5x + y)\hat{i} + (-0.5 - 3x - 2.5y)\hat{j}$$

Where 'x' and 'y' are in m and magnitude of velocity in m/s. Determine, if there are any stagnation points in this flow field and if so, where they are.

5. Develop Bernoulli's equation based on Euler's equation of motion. Explain the four applications of this principle in engineering. [2+2]

6. a) Figure below shows a venturimeter with its axis vertical and arranged as a suction device. The throat area and the outlet area of the venturi are $0.00025 m^2$ and $0.001 m^2$ respectively. If the venturi discharges into the atmosphere, determine the minimum discharge in the venturi at which flow will occur up the suction pipe. [7]



b) A sharp edged rectangular notch 30 cm long and a right-angled triangular notch are to be used alternatively for gauging a discharge estimated to be about 20 lit/s. Find in each cases the percentage error in computing the discharge that would be introduced by an error of 1 mm in observing the head over the Notch. [5]

7. A 120° bend-cum reducer has 300 mm diameter at inlet and 200 mm diameter at the outlet end. When the bend-cum reducer carries 0.30 m^3/s of water, pressure at section 1(inlet) is 210 KN/m^2. Assume no energy losses in the bend and determine the components of force exerted by the bend on the flow. Assume the weight of the bend plus water in it to be 1500 N. Assume section 2 (outlet) to be 0.40 m above sections 1(inlet). [8]

8. Define the concept of boundary layer. Explain the growth of boundary layer along a thin plate, when liquid is flowing over it, both for laminar and turbulent flow. Give two examples of use of boundary layer concept. [1+3+1]

9. A thin circular cylinder of infinite length is placed transversely in fluid stream, draw (Sketch only) the changes in flow pattern and drag coefficient with respect to variation in Reynold number. Define the terms associated with the Aerofoil with neat sketch. [3+2]

10. a) Define distored model and its importance in model analysis. [1+2]

b) A pipeline of 2 m diameter is to be designed to carry the oil at the rate $5m^3/s$ having sp.gr. 0.92 and viscosity $\mu = 0.04$ poise. Tests were conducted using a pipe of 20 cm diameter and water as a liquid. Find the velocity and rate of flow required for the model pipe. Take μ (water) = 0.01 poise. [5]

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02 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2072 Kartik

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

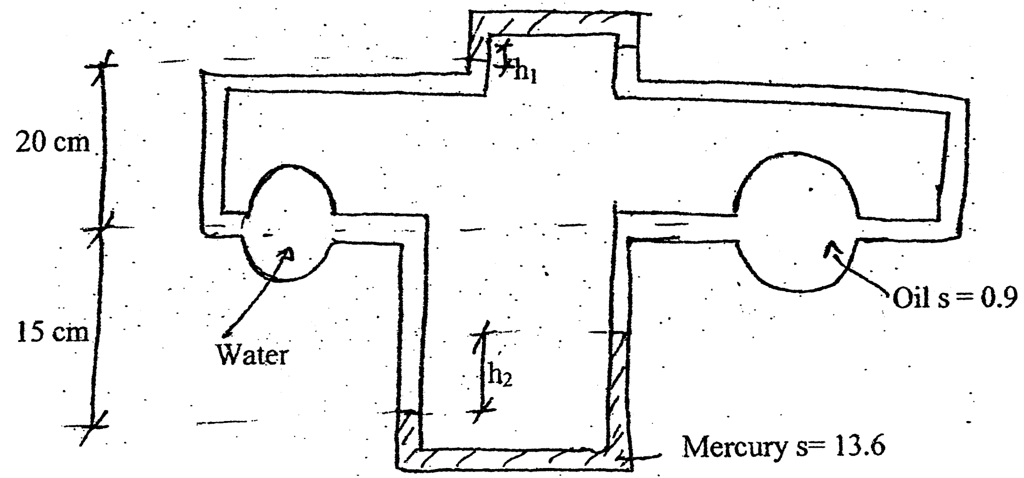
Subject: - Fluid Mechanics *(CE505)*

- ✓ 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.*
- ✓ *Graph paper will be provided.*

1. a) Explain the lab experiment to determine the viscosity of fluid using capillary tube viscometer. [4]

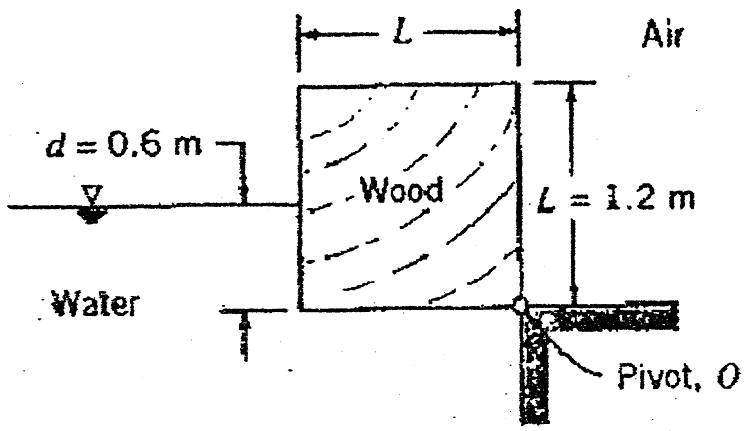
   b) Define compressibility of fluid. [2]

2. Two U-tube manometers are upright and the other inverted type, are connected across a water line and an oil line as shown in figure below. If $h_1 = 5cm$ what shall h_2 be? [6]

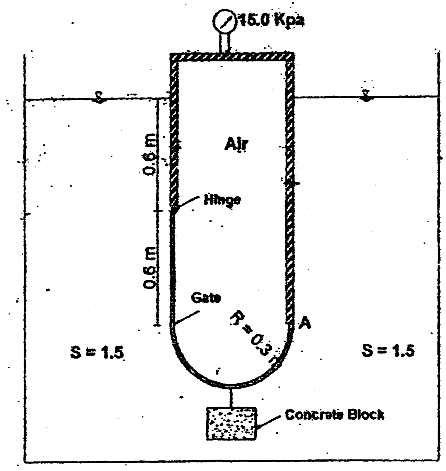


3. a) Given: Long, square wooden block pivoted on one edge, in equilibrium in water as shown. Friction in pivot is negligible. [7]

   Find: Specific gravity of the wood



b) A rigid gate is hinged at one end and is located between partitions in an open tank containing liquid (S = 1.5) as shown in figure. A concrete block (Sp.wt = 25 KN/m^3) is to be hung from curve portion of gate. Determine the required volume of the block so that the reaction of the gate on the partition A is zero. The gate is 0.75 m wide with a negligible weight and hinge is smooth. [8]



4. Given: Velocity field $\vec{V} = (Ax - B)\vec{i} - Ay\vec{j}$; $A = 0.2\,s^{-1}, B = 0.6\,s^{-1}$, x in m. [6]

Find: (a) Acceleration at (x,y) = (2,4)

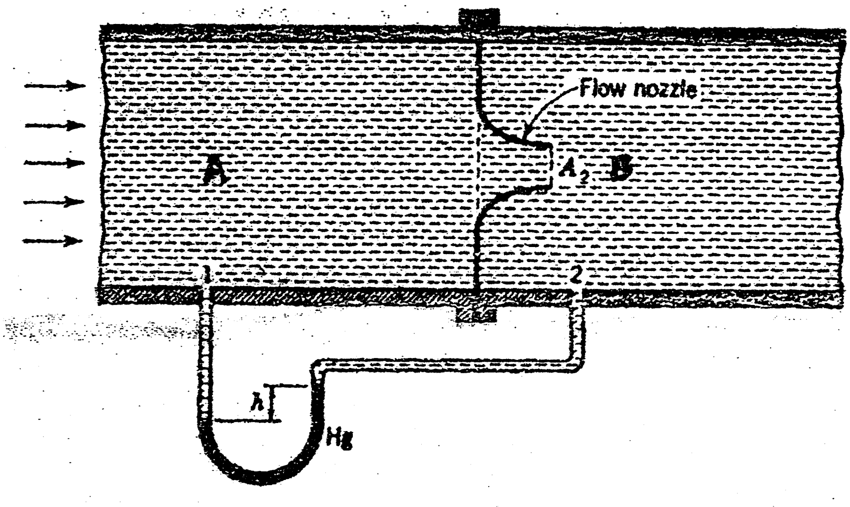
(b) Plot of streamlines

5. Explain the physical meaning of terms in Bernoulli's energy equation. Also write the limitation of this equation. [4]

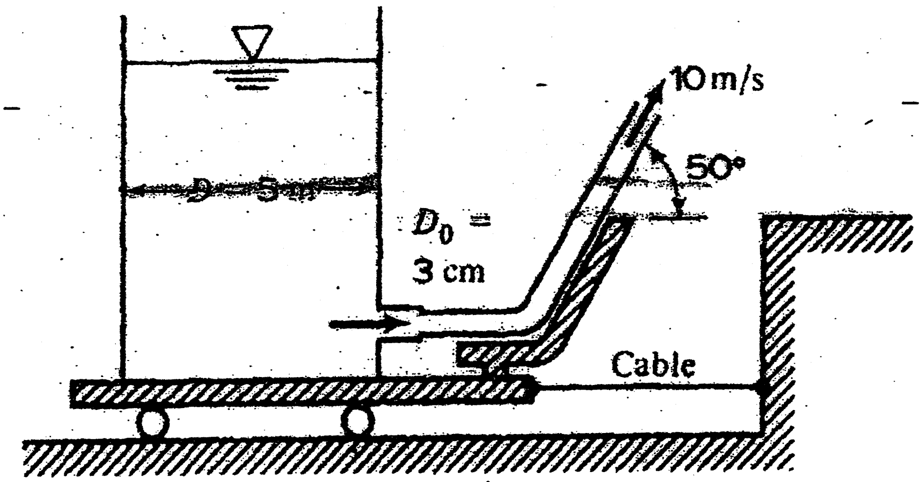
6. a) A cylindrical tank of internal diameter 0.5 m, length 1.4 m and axis vertical has a 5 cm diameter sharp-edged orifice (C_d = 0.6) in the bottom, open to atmosphere. The tank is open at the top and empty. If water were admitted into the tank from above at a constant rate of 900 liters/minute, how long will it take to just fill the tank? How much water will escape through the orifice during that period? [4+2]

b) A flow nozzle is a device inserted in to a pipe as shown in figure below. If A_2 is the exit area of the flow nozzle, show that for incompressible flow we get for Q. [6]

$$Q = C_d\left[\frac{A_2}{\sqrt{1-(A_2/A)^2}}\cdot\sqrt{2g\left(\frac{p_1 - p_2}{\gamma}\right)}\right]$$



7. The water tank in figure below stands on a frictionless cart and feeds a jet of diameter 3 cm and velocity 10 m/s which is deflected 50° by a vane. Compute the tension in the supporting cable. [8]



8. Differentiate between boundary layer thickness and displacement thickness. Derive an expression for the displacement thickness. [3+4]

9. Define aerofoil with accepted terminology with neat sketch. A wing with a span of 22 m and 64 m^2 planform area moves horizontally with a velocity of 760 kmhp. If the wing supports 280 KN. Find: [3+5]

   a) Required value of lift coefficient
   b) Induced drag
      Take density of air = 0.526 kg/m^3

10. List out the steps of Rayleigh's method used for dimensional analysis. In 1:20 model of a spillway, the velocity and discharge are 1.3m/s and 1.85 m^3/s. Compute the corresponding velocity and discharge in the prototype. [3+5]

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06 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Shawan

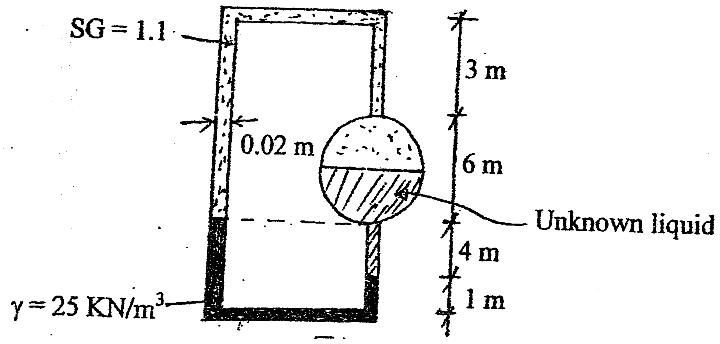
Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE, B.Agri.	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Fluid Mechanics *(CE505)*

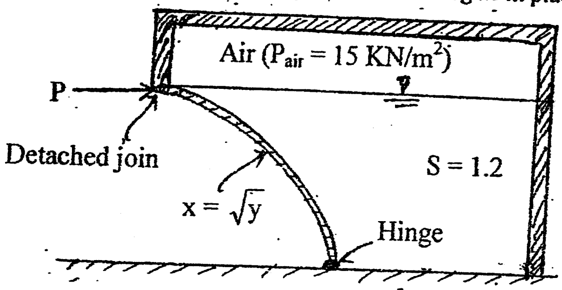
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. Explain the determination of viscosity of fluid in lab using capillary tube viscometer. Show that the capillary rise of liquid of specific gravity γ between two concentric glass tubes of radii R_1 and R_2 ($R_2 > R_1$) and contact angle θ is given by $h = \dfrac{2\sigma Cos\theta}{\gamma(R_2 - R_1)}$. (3+3)

2. State Pascal's law of pressure distribution. A 0.02 m diameter manometer tube is connected to a 6m diameter tank as shown in figure. Determine the density of the unknown liquid in the tank. (2+4)



3. Figure shows a gate whose profile is given by $x = \sqrt{y}$. It holds water to a depth of 2m behind it. If the width of gate is 5m, determine the force P required to hold the gate in place. (7)



4. An oil tanker 3 m wide, 2 m deep and 10 m long contains oil of density 800 kg/m³ to a depth of 1 m. Determine the maximum horizontal acceleration that can be given to the tanker such that the oil just reaches its top end. Further, if the tanker is closed completely with the oil and accelerated horizontally at 3 m/sec², determine the total liquid thrust on the front and rear ends and on one its longitudinal vertical sides. (2+2+2+2)

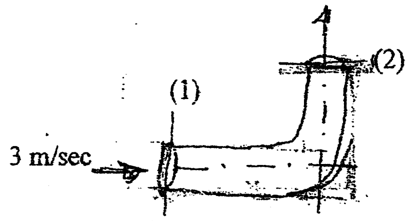
5. For the flow of an incompressible fluid, the velocity component in x direction is $u = ax^2 + by$ and velocity component in z-direction is $w = 0$. Find the velocity component v in y-direction such that $v = 0$ at $y = 0$. Also determine equation of stream function and velocity potential function. (2+2+2)
6. A pump delivers 0.08 m^3/s of water at 70 KN/m^2 to a machine which is 6m higher than the reservoir surface. The losses between the reservoir surface and machine inlet are estimated to be $7.5\frac{V^2}{2g}$ where V is the velocity of flow in 7.5 cm diameter delivery pipe from pump to machine. Determine the power required to derive pump if it is 80% efficient. (4)
7. Prove that equation of head loss in venturimeter is given by $h_L = h(1-C_d^2)$, where C_d is coefficient of discharge and h is venturihead or piezometeric head. (6)

OR

Write a program to find the time required to empty the hemispherical tank from H_1 level to H_2 level. The program should display the times required to empty by each ΔH level. (6)

8. A broad crested weir of 50m length has 50 cm height of water above its crest. Find the maximum discharge through the channel considering approach velocity when the channel has a flow depth 1m and width 50m on the upstream side of weir. (6)

9. A reducing right angled bend lies in a horizontal plane. Water enters from section 1 with velocity 3 m/sec with pressure 30 kPa and leaves towards section 2 as shown in figure below. The diameter at the entrance is 500 mm and the exit it is 400 mm. Neglecting any friction loss find the magnitude and direction of the resultant force on the bend. (8)



10. Define boundary layer concept and its phenomenon. Write down the characteristics of boundary layer formation on a thin plate, kept in flowing liquid. Describe the viscous sub-layer and absolute roughness height; explain the use of this concept in engineering application. (2+2+3)

11. a) Define airfoil with net sketch and also explain its importance. (1+1+1)

    b) Auto mobile having a projected area of $1.6m^2$ and drag coefficient $C_d = 0.35$ travels at a uniform speed of 60Km/hr in still air of density 1.2 kg/m^3. Calculate the power required to overcome the air resistance. If the drag coefficient of the automobile is reduced by 15% by improving streamlining, what percentage increase in speed could be obtained with the same power? (5)

12. a) Explain the concept of Dimension Analysis by using Buckingham's Π-theorem and principle of selecting repeating variables. (4)

    b) Distinguish between undistorted and distorted model and their advantages. For Froude model law find the discharge and velocity scale ratios for distorted modelling. (4)

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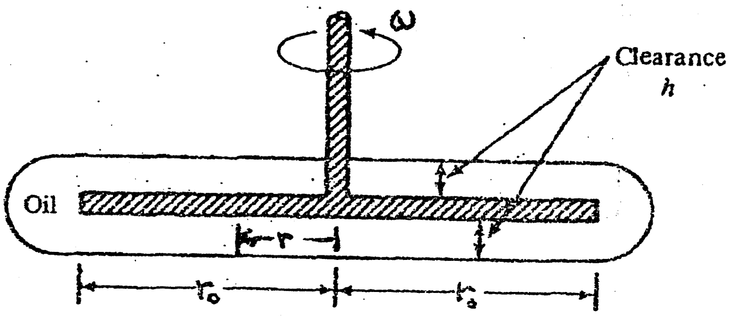
05 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Chaitra

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

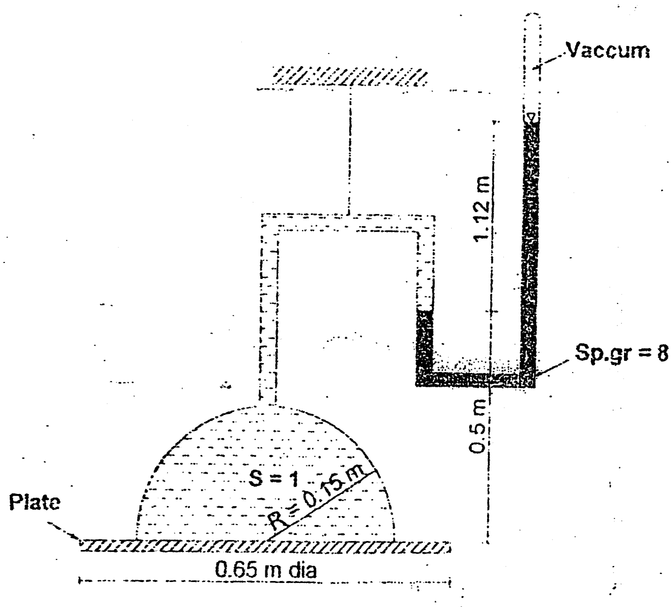
Subject: - Fluid Mechanics (CE505)

✓ 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.*

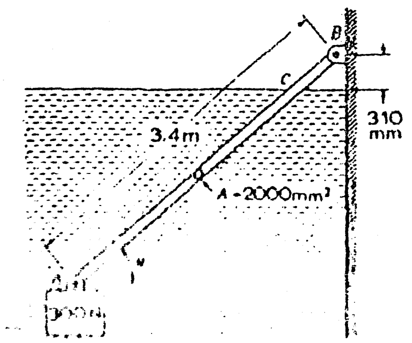
1. A disk of radius r_0 rotates at angular velocity ω inside an oil bath of viscosity μ as shown in figure below. Assuming a linear velocity profile and neglecting shear on the outer disk edges, derive an expression for the viscous torque on the disk. [6]



2. A suction cup is used to support a plate of weight W as shown in figure. For the condition shown, determine weight of plate W. [6]



3. a) A block of wood having volume of 0.034 m^3 and weighing 300 N is suspended in water as shown in figure below. A wooden rod of length 3.4 m and cross sectional area 2000 mm^2 is attached to the weight and also to the wall. If the weight of rod is 16 N, what will angle θ be for equilibrium? [8]

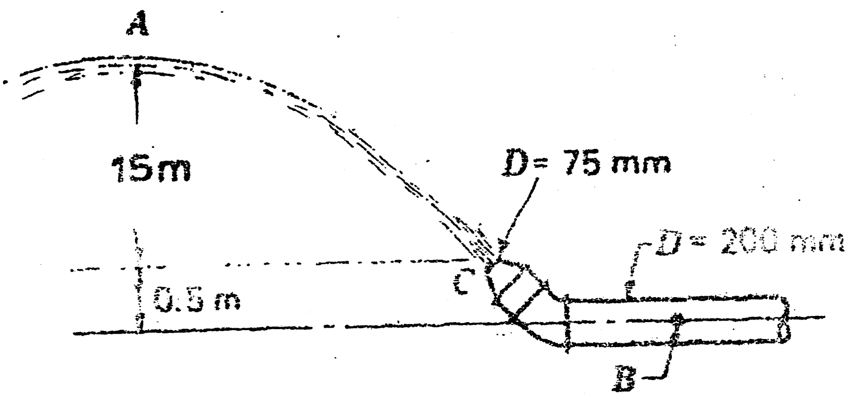


b) A student sneaks a glass of cola onto a roller coaster ride. The glass is cylindrical, twice as tall as it is wide, and filled to the brim. He wants to know what percent of the cola he should drink before the ride begins, so that none of it spills during the big drop, in which the roller coaster achieves 0.55g acceleration at a 45° angle below the horizontal. Make the calculation for him, neglecting sloshing and assuming that the glass is vertical at all times. [7]

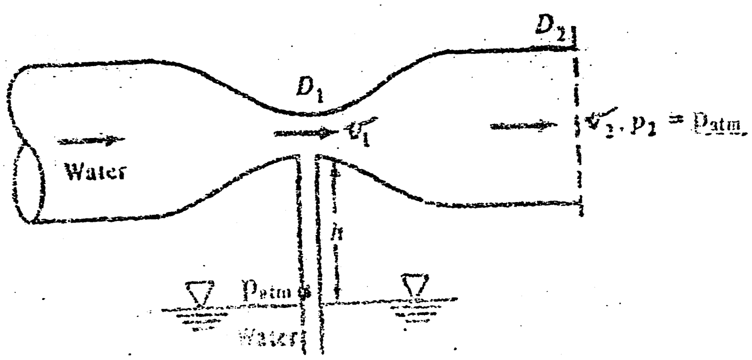
4. Given: Velocity field $\vec{V} = (Ax - B)\hat{i} - Ay\hat{j}$; $A = 0.2S^{-1}$, $B = 0.6S^{-1}x$ in m [6]

   Find:
   a) General expression for acceleration of a fluid particle
   b) Acceleration at $(x,y) = (0,4/3)$, $(1,2)$ and $(2,4)$
   c) Plot of streamlines
   d) Acceleration vectors on plot

5. If the velocity at point A in figure is 18m/s, What is the pressure at point B if we neglect friction? [4]

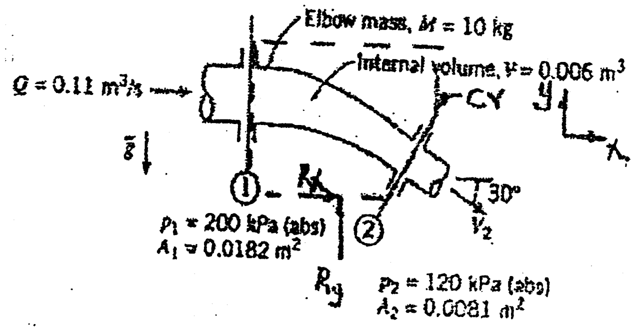


6. a) A necked-down or venturi, section of a pipe flow develops a low pressure which can be used to aspirate fluid upward from a reservoir as shown in figure below. Using Bernoulli's equation with no losses, derive an expression for the exit velocity v_2 that is just sufficient to cause the reservoir fluid to rise in the tube up to section 1. [8]



b) Derive an expression for the discharge over a triangular notch or weir. [4]

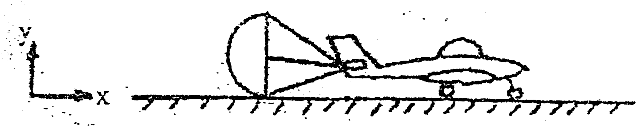
7. Given: Reducing elbow shown Fluid is water.
   Find: Force components needed to keep elbow from moving. [8]



8. The velocity distribution in a laminar boundary layer on a flat plate is given by $\frac{u}{U} = a + bm + cm^2 + dm^3$ Where u = local velocity, U = free stream velocity, m = y/δ, δ = boundary layer thickness. Find the coefficients a, b, c and d and compute the displacement thickness. [4+3]

9. Given: Military aircraft with M = 8000 kg, lands at 350 km/hr and is slowed by a parachute with $A = 10\ m^2$ area. [8]

   Find:
   a) Estimate of time needed to slow to 200 km/hr
   b) Maximum deceleration rate
      Model the chute as an open hemisphere.



(Neglect drag of aircraft)

10. a) What is similitude? Explain kinematic and dynamic similarity. [3]
    b) Describe Reynold's and Froude's model law with their applications. [5]

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02 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2070 Chaitra

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

Subject: - Surveying I *(CE504)*

- ✓ 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) Write the principles of surveying. [6]

   b) A steel tape standardized in catenary condition at 20°C temperature and 12 kg pull was found to be 29.985 cm. A line measured with this tape under a pull of 16 kg and at a mean temperature of 28°C was found to be 680 m long. Assuming that the tape is supported at every 20 m length. Find the true length of the line given that cross sectional area of tape = 0.03 cm^2, Young's modulus of elasticity, $E = 2.10 \times 10^6 kg/cm^2$, coefficient of linear expansion, $\alpha = 11 \times 10^{-6}/°C$ and weight of tape = 10 gm/cc. [10]

2. a) Explain fore bearing, back bearing, Magnetic bearing and true bearing. [6]

   b) In a traverse survey following FB and BB were recorded at a place where local attraction was suspected. [10]

Lines	AB	BC	CD	DE	EA
FB	22°15'	39°30'	191°45'	330°15'	242°45'
BB	200°30'	222°30'	13°00'	147°45'	62°45'

Find the correct bearings and included angles.

3. a) Explain reciprocal and precise leveling. [6]

   b) During fly leveling the following note is made: [10]

   BS: 0.62, 2.05, 1.42, 2.63 and 2.42 m
   FS: 2.44, 1.35, 0.53 and 2.41 m

   The first BS was taken on a BM of RL 1000.00m. From the last BS it is required to set 4 pegs each at a distance of 30 m on a rising gradient of 1 in 200. Enter these notes in the form of a level book and calculate the R.L.of the top of each peg by the rise and fall method. Also calculate the staff readings on each peg.

4. a) Explain Radiation and Intersection methods of plane table survey. [6]

   b) Compute the mean horizontal angles and adjust them if necessary: [10]

Inst.Station	Target Station	Horizontal circle Readings	
		F.L	F.R
O	A	00°00'20''	180°00'40''
	B	50°45'20''	230°45'30''
	C	140°50'55''	320°51'05''
	D	250°10'10''	70°10'00''

5. Write short notes on: (any two) [2×8]

   i) Trapezoidal and Simpon's 1/3 rule
   ii) Principle of electronic distance measurement
   iii) Principles of triangulation and trilateration

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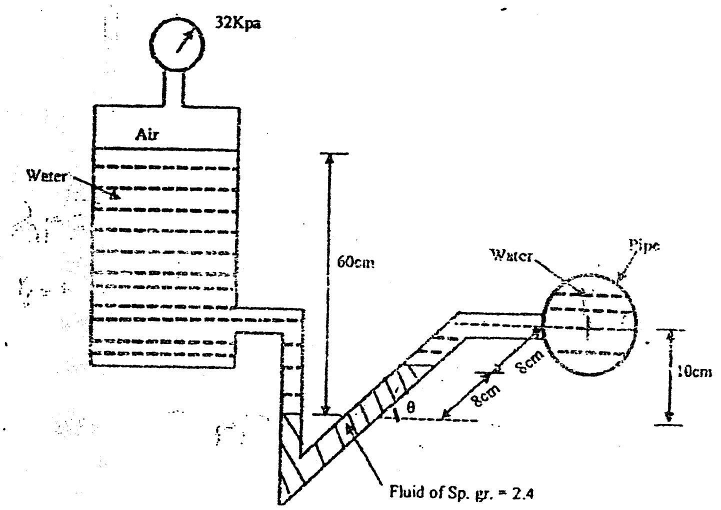
07 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Ashad

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

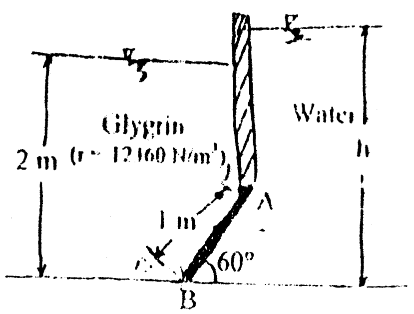
Subject: - Fluid Mechanics (CE505)

- ✓ 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__.*
- ✓ *Graph paper will be provided.*
- ✓ *Assume suitable data if necessary.*

1. What is continuum concept in fluid? Explain the cavitation phenomena. [3+3]
2. Compute the pressure of water flowing through a pipe shown in the figure below. [6]



3. Gate AB in figure below is a homogeneous mass of 180 kg, 1.2 m wide into the paper, resting on smooth bottom B. For what depth h will the force at point B be zero? [8]

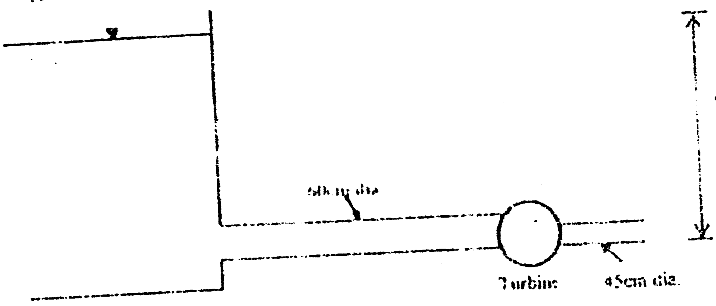


4. A very tall 10 cm diameter vase contains 1178 cm^3 of water. When spun steadily to achieve rigid body rotation, a 4 cm diameter dry spot appears at the bottom of the vase. What is the rotation rate, in rev/min, for this condition? [7]
5. The x- and y- components of fluid velocity in a two-dimensional flow field are $u = x$ and $v = -y$ respectively. Determine the stream function and plot the stream lines for $\varphi = 1, 2, 3$ [6]

6. From Euler's equation, derive the Bernoullis equation. [4]

7. Derive an expression which calculates time required to completely emptying the hemi spherical tank which was full at the beginning. [6]

8. A turbine is set 43 m below water level of a reservoir and is fed by a 60 cm diameter pipe as shown in figure below. A short pipe of 45 cm diameter discharges the water at a rate of 0.9 m^3/s from the turbine to the atmosphere. If the total loss of head is 3m of oil of sp.gr.0.9 and the turbine efficiency is 85%, find the power output of the turbine. [6]



9. A flat plate is struck normally by a jet of water 50 mm in diameter with a velocity of 18 m/s. Calculate (a) the force on the plate when it is stationary (b) the force on the plate when it moves in the same direction as the jet with a velocity of 6 m/s. [2+2]

10. When a jet of fluid strikes series of flat vanes, show that the maximum efficiency of the system is 1/2. [4]

11. The laminar boundary layer profile in a case is approximated by a cubic parabola as, $\frac{u}{U}=\frac{3}{2}\left(\frac{y}{\delta}\right)^2-\frac{1}{2}\left(\frac{y}{\delta}\right)^3$ where, u is the velocity at a distance y from the surface and $y\to\delta$, $u\to U$. Calculate the displacement thickness and momentum thickness in terms of δ and workout the shear stress at the surface. [7]

12. A kite has an effective area of 0.6 m^2 and mass 0.4 kg. It experiences a drag of 15 N in a wind speed of 40km/hr. Determine (a) the tension in the chord if it makes an angle 45° with the horizontal (b) lift coefficient for the kite, consider the density of air 1.2kg/m^3. [1+2+5]

13. The force F on a circular cylinder depends on the free stream velocity V, the diameter of the cylinder D, density of the fluid ρ, viscosity of the fluid μ and time t. By using Buckingham's π theorem, show that $F = \rho V^2 D^2 \phi\left(\frac{\mu}{\rho V D}, \frac{Vt}{D}\right)$. Take ρ, V and D as repeating variables. [8]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Bhadra

Exam.	Regular		
Level	BE	**Full Marks**	80
Programme	All (Except BAR)	**Pass Marks**	32
Year / Part	II / I	**Time**	3 hrs.

Subject: - Engineering Mathematics III *(SH 501)*

- ✓ 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. Prove that $\begin{vmatrix} a^3 & 3a^2 & 3a & 1 \\ a^2 & a^2+2a & 2a+1 & 1 \\ a & 2a+1 & a+2 & 1 \\ 1 & 3 & 3 & 1 \end{vmatrix} = (a-1)^6$ by using properties of determinate. [5]

2. Define transpose of a matrix. Prove that the transpose of the product of two matrices is the product of their transpose taken in reverse order. [1+4]

3. Find the rank of the matrix $\begin{bmatrix} 1 & 0 & -5 & 6 \\ 3 & -2 & 1 & 2 \\ 3 & -2 & -9 & 14 \\ 4 & -2 & -4 & 8 \end{bmatrix}$ by reducing it into normal form. [5]

4. State Cayley-Hamilton Theorem. Use it to find the inverse of the matrix: [1+4]

$$\begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ 2 & -4 & -4 \end{bmatrix}$$

5. Prove that the line integral $\int_C \vec{F}.d\vec{r}$ of a continuous vector function $\vec{F}$ defined in a region R is independent of the path C joining any two points in R if and only if there exists a single valued scalar function ϕ, having first order partial derivatives such that $\vec{F} = \nabla\phi$. [5]

6. Evaluate $\iint_S \vec{F}.\vec{n}\, ds$ where $\vec{F} = y^2z^2\,\vec{i} + z^2x^2\,\vec{j} + x^2y^2\,\vec{k}$ and S is the surface of the sphere $x^2 + y^2 + z^2 = 1$ above the xy-plane. [5]

7. Apply Green's theorem in plane to evaluate, $\int_C \vec{F}.d\vec{r}$ where $\vec{F} = (x^2 - xy^3)\,\vec{i} + (y^2 - 2xy)\,\vec{j}$ and C is a square with vertices (0, 0), (2, 0), (2, 2), (0, 2). [5]

8. Verify the stroke's theorem for $\vec{F} = (x^2 + y^2)\,\vec{i} - 2xy\,\vec{j}$ taken round the rectangle bounded by the lines $x = \pm a$, $y = 0$, $y = b$. [5]

9. Define Laplace transform of function f(t). Find the Laplace transform of [1+2+2]

a) $te^{-4t}\sin 3t$ b) $\frac{1-e^{t}}{t}$

10. Find the inverse Laplace transform of: [2+3]

a) $\frac{s^2}{(s+2)^3}$ b) $\tan^{-1}\frac{2}{s}$

11. Solve the following initial value problem by using Laplace transform

$y'' + 2y' - 3y = \sin t,\ y(0) = y'(0) = 0.$ [5]

12. Find the Fourier series of the function $f(x) = \frac{(\pi - x)^2}{4}$ in the interval $0 \le x \le 2\pi$. [5]

13. Obtain the half-range Fourier cosine series of sinx in the interval $0 \le x \le \pi$. [5]

14. Solve the linear programming problem maximize by simplex method [7]

Maximize: $Z = 10x_1 + x_2 + 2x_3$
Subject to: $x_1 + x_2 - 2x_3 \le 10$
$4x_1 + x_2 + x_3 \le 20$
and $x_1, x_2, x_3 \ge 0$.

15. Solve the linear programming problem by simplex method using two phase method: [8]

Maximize $Z = 3x_1 - x_2$
Subject to $2x_1 \div x_2 \ge 2$
$x_1 + 3x_2 \le 2$
$x_2 \le 4;\ x_1, x_2 \ge 0.$

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Baishakh

Exam.	Back		
Level	BE	Full Marks	80
Programme	All (Except BAR)	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Engineering Mathematics III (*SH 501*)

- ✓ 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. Applying properties of determinant, prove that $\begin{vmatrix} a & b & a & a \\ a & b & b & b \\ b & b & b & a \\ a & a & b & a \end{vmatrix} = -(b-a)^4$. [5]

2. Prove that every square matrix can be uniquely expressed as the sum of symmetric and skew-symmetric matrices. [5]

3. Find the rank of the augmented matrix and test the consistency of the system of linear equations $x+9y-z = 27$, $x-8y+16z = 10$, $2x+y+15z = 37$. Also find the solution if the system is consistent. [5]

4. State Cayley-Hamilton theorem and use it to find the inverse of the matrix: [5]
$$\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$$

5. If $\vec{F} = 3x^2yz^2\vec{i} + x^3z^2\vec{j} + 2x^3yz\vec{k}$, show that $\int_C \vec{F}.d\vec{r}$ is independent of the path of integration. Hence evaluate the integral on any path C from P: (0,0,0) to Q: (1,2,3). [3+2]

6. Evaluate the flux of $\vec{F} = (x+y^2)\hat{i} - 2x\hat{j} + 2yz\hat{k}$ over the surface of the plane $2x+y+2z=6$ lying in the first octant. [5]

7. State and prove the Green's theorem in plane. [5]

8. State stoke's theorem. Apply it to evauate $\iint_S (\nabla \times \vec{F})\cdot\vec{n}\,ds$ where $\vec{F} = (2x-y)\vec{i} - yz^2\vec{j} - y^2z\vec{k}$, S is the upper half surface of the sphere $x^2+y^2+z^2 = a^2$ and C is its boundary. [1+4]

9. Find the Laplace transform of: (i) Sinhat Cosbt (ii) $\dfrac{e^{-at} - e^{-bt}}{t}$ [5]

10. What do you mean by convolution of two functions f (t) and g(t)? Hence or otherwise find the inverse Laplace transform of $\frac{s^2}{(s^2+4)(s^2+9)}$ [1+4]

11. Using laplace transform, solve the initial value problem: $y'' + 2y' + 2y = 5\sin x$, $y(0) = y'(0) = 0$. [5]

12. Find the Fourier series to represent $f(x) = x - x^2$ from $-\pi$ to π and deduce that: [5]
$$\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \cdots$$

13. Find half range sine as well as cosine series for $f(x) = e^x$ in (0,2). [2+3]

14. Solve the following LPP by the simplex method: [7]

Maximize, $P = -x_1+2x_2$

Subject to :

$$-x_1 + x_2 \le 2$$
$$-x_1 + 3x_2 \le 12$$
$$x_1 - 4x_2 \le 4$$
$$x_1 \ge 0, x_2 \ge 0$$

15. Solve the following LPP by Big-M, method: [8]

Maximize, $P = 2x_1+5x_2$

Subject to :

$$x_1 + 2x_2 \le 18$$
$$2x_1 + x_2 \le 21$$
$$x_1 + x_2 \ge 10$$
$$x_1 \ge 0, x_2 \ge 0$$

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	All (Except BAR)	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Engineering Mathematics III *(SH 501)*

✓ 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. Use the Properties of determinant to show that:
$$\begin{vmatrix} (a+b)^2 & ca & bc \\ ca & (b+c)^2 & ab \\ bc & ab & (c+a)^2 \end{vmatrix} = 2abc\,(a+b+c)^3$$ [5]

2. Define Hermitian and Skew-Hermitian of a square complex matrix. If A is any square matrix, prove that $A + A^*$ is Hermitian and $A - A^*$ is Skew – Hermitian matrix. [5]

3. Test the consistency of the system by matrix rank method and solve it completely if consistent: [5]
$x+2y-z=0,\ 2x+3y+z=10,\ 3x-y-7z=1$

4. Find the eigenvalues of the matrix $A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$ and use them to compute
(i) eigenvalues of A^{-1}
(ii) determinant of A [2+1+1+1]
(iii) eigenvalues of adj A

5. Evaluate $\int_C \vec{F}.d\vec{r}$ where $\vec{F} = \sin y\,\vec{i} + x(1+\cos y)\vec{j}$ and C is the circular path given by $x^2 + y^2 = a^2, z = 0$. [5]

6. Evaluate $\iint_S \vec{F}.\vec{n}\,ds$ where $\vec{F} = yz\,\vec{i} + zx\,\vec{j} + xy\,\vec{k}$ where S is the surface of the sphere $x^2+y^2+z^2=1$ in the first octant. [5]

7. Apply Green's Theorem in plane to compute the area of the curve $\left(\frac{x}{a}\right)^{2/3} + \left(\frac{y}{b}\right)^{2/3} = 1$. [5]

8. State Gauss divergence theorem in vector calculus. Apply it to evaluate $\iint_S \left[(x^3-yz)\vec{i} - 2x^2y\vec{j} + 2\vec{k}\right].\vec{n}\,ds$ where S denote the surface of the cube bounded by the planes $x=0, x=a, y=0, y=a, z=0, z=a$. [1+4]

9. State the condition for existence property of Laplace transform. Find the Laplace transform of: (a) $\frac{1}{\sqrt{t}}$ (b) $\frac{1-\cos 2t}{t}$ [1+2+2]

10. State the convolution theorem for inverse Laplace transform and use it to find the inverse Laplace transform of $\frac{s}{(s^2+1)(s^2+4)}$. [5]

11. Solve the initial value problem by applying Laplace transform: [5]

$$y'' - 10y' + 9y = 5t,\ y(0) = -1,\ y'(0) = 2.$$

12. Obtain the Fourier series of $f(x) = x + x^2$ in $-\pi \le x \le \pi$. [5]

13. Express $f(x) = x^2$ as a half-range sine series in $0 < x < 3$. [5]

14. Solve following LPP by the Simplex method: [7]

Maximize, $P = x_1 + x_2$

Subject to: $2x_1 + x_2 \le 16$

$x_1 \le 6$

$x_2 \le 10$

$x_1 \ge 0,\ x_2 \ge 0$

15. Solve following LPP by the Dual Method: [8]

Minimize, $C = 21x_1 + 50x_2$

Subject to: $2x_1 + 5x_2 \ge 12$

$3x_1 + 7x_2 \ge 17$

$x_1 \ge 0,\ x_2 \ge 0$

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TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2078 Kartik

Exam.	Back		
Level	BE	Full Marks	80
Programme	All (Except BAR)	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Engineering Mathematics III *(SH 501)*

- ✓ 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. If $\begin{vmatrix} a & a^2 & a^3-1 \\ b & b^2 & b^3-1 \\ c & c^2 & c^3-1 \end{vmatrix} = 0$; where $a \neq b \neq c$, apply the properties of determinants to show $abc = 1$. [5]

2. Define an orthogonal matrix. Prove that the product of two orthogonal matrices of the same order is also orthogonal. [5]

3. For the matrix $= \begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$, find the modal matrix and the corresponding diagonal matrix. [5]

4. State Cayley-Hamilton theorem and verify the theorem for the square matrix $A = \begin{bmatrix} 1 & 3 & 7 \\ 4 & 2 & 3 \\ 1 & 2 & 1 \end{bmatrix}$. [5]

5. Prove that "for any simple closed curve C, the line integral $\int_A^B \vec{F}.d\vec{r}$ is independent of the path joining the points A and B in the region if and only if $\int_C \vec{F}.d\vec{r} = 0$. [5]

6. State Green's theorem in the plane. Using Green's theorem find the area of the hypocycloid $\left(\frac{x}{a}\right)^{2/3} + \left(\frac{y}{b}\right)^{2/3} = 1$. [5]

7. Evaluate $\iint_S \vec{F}.\vec{n}\, ds$ by Gauss' divergence theorem, where $\vec{F} = x\vec{i} - y\vec{j} + (z^2-1)\vec{k}$ and S is the cylinder formed by the surfaces $x^2 + y^2 = 4, z = 0, z = 1$. [5]

8. Verify Stoke's theorem for $\vec{F} = (x^2 - y^2)\vec{i} + 2xy\vec{j}$ taken over the rectangular bounded by the lines $x = 0, x = a, y = 0, y = b$. [5]

9. Define Laplace transform of f(t). Find the Laplace transform of:

   a) $t e^{-t} \cosh t$ b) $\frac{\sin t \sin 5t}{t}$ [1+1.5+2.5]

10. Find the inverse Laplace transform of:

    a) $\log \frac{S}{S+1}$ b) $\frac{1}{(S-2)(S^2+1)}$ [2.5+2.5]

11. Solve the initial value problem $y'' + 4y' + 3y = 0, y(0) = 3, y'(0) = 1$ by using Laplace transform. [5]

12. Find the Fourier series of $f(x) = 2x - x^2$ in $(0, 2)$. [5]

13. Obtain the half range sine series for $f(x) = e^x$ in $0 < x < 1$. [5]

14. Use Simplex method to solve following LPP: [7]

    Maximize, $P = 50x_1 + 80x_2$

    Subject to: $x_1 + 2x_2 \leq 32$

    $3x_1 + 4x_2 \leq 84$

    $x_1, x_2 \geq 0$

15. Solve the following LPP by using big M method: [8]

    Maximize, $P = 2x + y$

    Subject to: $x + y \leq 10$

    $-x + y \geq 2$

    $x, y \geq 0$

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	All (Except BAR)	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Engineering Mathematics III *(SH 501)*

- ✓ 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. Prove that $\begin{vmatrix} 1+a^2-b^2 & 2ab & -2b \\ 2ab & 1-a^2+b^2 & 2a \\ 2b & -2a & 1-a^2-b^2 \end{vmatrix} = (1+a^2+b^2)^3$ by using the properties of determinants. [5]

2. Prove that every square complex matrix can uniquely be expressed as a sum of a Hermitian and a skew-Hermitian matrix. [5]

3. Reduce the matrix $\begin{bmatrix} 1 & 0 & -5 & 6 \\ 3 & -2 & 1 & 2 \\ 5 & -2 & -9 & 14 \\ 4 & -2 & -4 & 8 \end{bmatrix}$ into normal form and hence find its rank. [5]

4. Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & -1 \\ 0 & 0 & 2 \end{bmatrix}$ and also fnd its modal matrix. [5]

5. If $\vec{F} = 3x^2yz^2\,\vec{i} + x^3z^2\,\vec{j} + 2x^3yz\,\vec{k}$, show that $\int_C \vec{F}.d\vec{r}$ is independent of the path of integration. Hence evaluate the integral on any path C from (0, 0, 0) to (1, 2, 3). [5]

6. Verify Green's Theorem in plane for $\int_c [(x-y)\,dx + (x+y)\,dy]$ where c is the boundary of the region enclosed by $y^2 = x$ and $x^2 = y$. [5]

7. Evaluate $\iint_S \vec{F}.\vec{n}\,ds$ where $\vec{F} = 4x\,\vec{i} - 2y^2\,\vec{j} + z^2\,\vec{k}$ taken over the region bounded by the cylinder $x^2 + y^2 = 4$ and the planes $z = 0, z = 3$. [5]

8. Evaluate $\int_c \vec{F}.d\vec{r}$, where c is the rectangle bounded by the lines $x = \pm a, y = 0, y = n$ and $\vec{F} = (x^2+y^2)\,\vec{i} - 2xy\,\vec{j}$. [5]

9. State the condition for existence of Laplace transform. Obtain the Laplace transform of:

   a) $\cos^3 2t$ (b) $\dfrac{\cos at - \cos bt}{t}$ [1+1.5+2.5]

10. Find the inverse Laplace transform of:

a) $\dfrac{s+3}{(s^2+6s+13)^2}$ b) $\dfrac{e^{-2s}}{(s+1)(s^2+2s+2)}$ [2+3]

11. Solve the differential equation $y''+2y'-3y=\sin t$ under the conditions $y(0)=y'(0)=0$ by using Laplace transform. [5]

12. Obtain the Fourier series to represent the function $f(x)=e^x$ for $-\pi \le x \le \pi$. [5]

13. Obtain the half range cosine series for the function $f(x)=x\sin x$ in the interval $(0, \pi)$. [5]

14. Use Simplex method to solve following LPP:

Maximize, $P = 30x_1 + x_2$

Subject to : $2x_1 + x_2 \le 10$

$x_1 + 3x_2 \le 10$

$x_1, x_2 \ge 0$ [7]

15. Use Big M method to solve following LPP:

16. Minimize, $Z = 4x_1 + 2x_2$

Subject to : $3x_1 + x_2 \ge 27$

$-x_1 - x_2 \le -21$

$x_1 + 2x_2 \ge 30$

$x_1, x_2 \ge 0$ [8]

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TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2076 Ashwin

Exam.	Back		
Level	BE	Full Marks	80
Programme	All except BAR	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Engineering Mathematics III *(SH 501)*

- ✓ 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. Prove that: $\begin{vmatrix} (b+c)^2 & c^2 & b^2 \\ c^2 & (c+a)^2 & a^2 \\ b^2 & a^2 & (a+b)^2 \end{vmatrix} = 2(ab+bc+ca)^2$ [5]

2. Prove that the necessary and sufficient condition for a square matrix A to possess an inverse is that $|A| \neq 0$. [5]

3. Find the rank of the matrix $\begin{bmatrix} 2 & -2 & 0 & 6 \\ 4 & 2 & 0 & 2 \\ 1 & -1 & 0 & 3 \\ 1 & -2 & 1 & 2 \end{bmatrix}$ by reducing it to normal form. [5]

4. State any two properties of eigen values of a matrix. Obtain eigen values and eigen vectors of the matrix $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$ [1+4]

5. Prove that the line integral $\int_A^B \vec{F}.d\vec{r}$ is independent of path joining any two points A and B in the region if and only if $\int_C \vec{F}.d\vec{r} = 0$ for any simple closed curve C in the region. [5]

6. State Green's Theorem and use it to find the area of the curve $\left(\frac{x}{a}\right)^{2/3} + \left(\frac{y}{b}\right)^{2/3} = 1$. [1+4]

7. Use Gauss' divergence theorem to evaluate $\iint_S \vec{F}.\vec{n}ds$ where $\vec{F} = (2xy+z)\vec{i} + y^2\vec{j} - (x+3y)\vec{k}$ and S is the surface bounded by the plane $2x+3y+z=6$, $x=0$, $y=0$, $z=0$. [5]

8. Verify Stoke's Theorem for the vector field $\vec{F} = (2x-y)\vec{i} - yz^2\vec{j} - y^2z\vec{k}$ over the upper half of the sphere $x^2+y^2+z^2=1$ bounded by its projection on xy-plane. [5]

9. Find the Laplace transform of: [2+3]

   i) $t^2\cos at$

   ii) $\frac{1-\cosh(at)}{t}$

10. Find the inverse Laplace transform of : [2+3]

i) $\frac{e^{-\pi s}(s+1)}{s^2+2s+2}$

ii) $\tan^{-1}\frac{2}{s}$

11. Solve the differential equation $y''+3y'+2y=e^{-t}$, $y(0)=y'(0)=0$ by applying Laplace transform. [5]

12. Find the Fourier Series of the function $f(x)=|\sin x|$ for $-\pi \le x \le \pi$. [5]

13. If $f(x) = lx-x^2$ in $(0,1)$, show that the half range sine series for $f(x)$ is $\frac{8l^2}{\pi^3}\sum_{n=0}^{\infty}\frac{1}{(2n+1)^3}\sin(2n+1)\frac{\pi x}{l}$. [5]

14. Find the maximum and minimum values of the function $z=20x+10y$ subject to: $x+2y\le 40$, $3x+y\ge 30$, $4x+3y \ge 60$, $x,y\ge 0$ by graphical method. [5]

15. Solve the following linear programming problem using big M method:

Maximize $P=2x_1+5x_2$

subject to : $x_1+2x_2 \le 18$

$2x_1+x_2 \ge 21$ [10]

$x_1, x_2 \ge 0$.

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Chaitra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	All except BAR	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Engineering Math III *(SH 501)*

- ✓ 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. If $\begin{vmatrix} a & a^2 & a^3-1 \\ b & b^2 & b^3-1 \\ c & c^2 & c^3-1 \end{vmatrix} = 0$, where $a \neq b \neq c$ show that $abc=1$. [5]
2. If A is a square matrix of order n, prove that $A(\text{adj. }A) = (\text{adj. }A)A = |A|I_n$, where I_n is a unit matrix having same order as A. [5]
3. Test the consistency of the system by matrix rank method and solve completely if found consistent: $x+2y-z=3$, $2x+3y+z=10$, $3x-y-7z=1$ [5]
4. State Cayley-Hemilton Thorem and verify it for the matrix $A=\begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$ [1+4]
5. A vector field is given by $\vec{F} = \sin y\vec{i} + x(1+\cos y)\vec{j}$. Evaluate the line integral $\int_c \vec{F}.d\vec{r}$ over the circular path c given by $x^2+y^2=a^2$, $z=0$. [5]
6. State and prove Green's Theorem in plane. [1+4]
7. Evaluate $\iint_S \vec{F}.\vec{n}\,ds$ for $\vec{F} = yz\vec{i} + zx\vec{j} + xy\vec{k}$ where S is the surface of the sphere $x^2+y^2+z^2=1$ in the first octant. [5]
8. State Stoke's theorem. Evaluate $\oint_c (xydx + xy^2dy)$ by Stoke's theorem taking c to be a square in the xy-plane with vertices (1,0),(-1,0),(0,1) and (0,-1). [1+4]
9. Find the Laplace transform of: [2+3]
   i) $te^{-t}\sin t$
   ii) $\dfrac{\cos 2t - \cos 3t}{t}$
10. Find the inverse Laplace transform of: [2+3]
    i) $\dfrac{s+2}{(s+1)^4}$
    ii) $\cot^{-1}(s+1)$
11. Solve the differential equation $y''+y=\sin 3t$, $y(0)=y'(0)=0$ by using Laplace transform. [5]
12. Define Fourier Series for a function f(x). Obtain Fourier series for $f(x)=x^3$; $-\pi \leq x \leq \pi$. [5]
13. Express $f(x)=e^x$ as the half range Fourier Sine series in $0<x<1$. [5]
14. Find the maximum and minimum values of the function $z = 50x_1 + 80x_2$ subject to: $x_1 + 2x_2 \leq 32$, $3x_1 + 4x_2 \leq 84$, $x_1x_2 \geq 0$; by graphical method. [5]
15. Solve the following Linear Programming problem using big M method: [10]
    Maximize $P= 2x_1+x_2$
    Subject to : $x_1+x_2 \leq 10$
    $-x_1+x_2 \geq 2$
    $x_1,x_2 \geq 0$

02 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Ashwin

Exam.	Back		
Level	BE	Full Marks	80
Programme	All (Except B.Arch.)	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: **- Engineering Mathematics III** ***(SH501)***

- ✓ 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 the determinant as a function and using its properties. Show that [5]

$$\begin{vmatrix} b+c & c+a & a+b \\ q+r & r+p & p+q \\ y+z & z+x & x+y \end{vmatrix} = 2\begin{vmatrix} a & p & x \\ b & q & y \\ c & r & z \end{vmatrix}$$

2. If A and B are orthogonal matrices of same order, prove that the product AB is also orthogonal. [5]

3. Test the consistency of the system $x-2y+2z=4$, $3x+y+4z=6$ and $x+y+z=1$ and solve completely if found consistent. [5]

4. For a matrix $A=\begin{pmatrix} 5 & 4 \\ 1 & 2 \end{pmatrix}$, find the modal matrix and the corresponding diagonal matrix. [5]

5. Prove that line integral $\int_A^B \vec{F}.d\vec{r}$ is independent of path joining any two points A and B in the region if and only if $\int_C \vec{F}.d\vec{r}=0$ for any simple closed curve C in the region. [5]

6. Verify Green's theorem in the plane for $\int_C [(3x^2-8y^2)dx+(4y-6xy)dy]$ where C is region bounded by $y=x^2$ and $x=y^2$. [5]

7. Evaluate $\iint_S \vec{F}.\vec{n}\,ds$ where $\vec{F}=6z\vec{i}-4\vec{j}+y\vec{k}$ and S is the region of the plane $2x+3y+6z=12$ bounded in the first octant. [5]

8. Evaluate using Gauss divergence theorem, $\iint_S \vec{F}.\vec{n}\,ds$ where $\vec{F}=x^2y\vec{i}+xy^2\vec{j}+2xyz\vec{k}$ and S is the surface bounded by the planes $x=0, y=0, z=0, x+2y+z=2$. [5]

9. Obtain the Fourier Series to represent $f(x)=x-x^2$ from $x=-\pi$ to $x=\pi$ and deduce that [5]

$$\frac{\pi^2}{12}=\frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}+\dots\dots\dots$$

10. Obtain the half range Fourier Sine Series for $f(x)=\pi - x$ in the range $0<x<\pi$. [5]

11. State the conditions for existence of Laplace transform. Obtain the Laplace transform of: [1+2+2]

(i) $e^{2t}\cos^3 2t$ (ii) $\dfrac{\cos 2t-\cos 3t}{t}$

12. Find the inverse Laplace transform of:

(i) $\dfrac{1}{(S-2)(S^2+1)}$ (ii) $\cot^{-1}(S+1)$ [2.5+2.5]

13. Solve the following intial value problem by using Laplace transform:

$y'' + 4y' + 3y = e^t$, $y(0)=0; y'(0)=2$ [5]

14. Graphically maximize $Z = 7x_1 + 10x_2$

Subject to constraints:

$$3x_1 + x_2 \le 9$$
$$x_1 + 2x_2 \le 8$$
$$x_1, x_2 \ge 0.$$

[5]

15. Solve the following linear Programming Problem by simple method:

Maximize: $Z = 3x_1 + 5x_2$

Subject to:

$$3x_1 + 2x_2 \le 18$$
$$x_1 \le 4,\ x_2 \le 6$$
$$x_1, x_2 \ge 0.$$

[10]

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01 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2074 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	All (Except B.Arch.)	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Engineering Mathematics III *(SH501)*

- ✓ 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. If $\begin{vmatrix} a & a^2 & a^3-1 \\ b & b^2 & b^3-1 \\ c & c^2 & c^3-1 \end{vmatrix} = 0$ where $a \neq b \neq c$; apply properties of determinant to show $abc = 1$. [5]

2. If A be an $n \times n$ matrix, prove that

   $\text{Adj}(A) . A = A . (\text{Adj}A) = |A| I$ where I is an $n \times n$ unit matrix. [5]

3. Find the rank of the following matrix by reducing it into normal form:

   $$\begin{pmatrix} 3 & 1 & 4 \\ 0 & 5 & 8 \\ -3 & 4 & 4 \\ 1 & 2 & 4 \end{pmatrix}$$ [5]

4. Find the modal matrix for the matrix

   $$A = \begin{pmatrix} 2 & 1 & 1 \\ -2 & 1 & 3 \\ 2 & 1 & -1 \end{pmatrix}$$ [5]

5. State and prove Green's theorem in plane. [5]

6. Find the total work done in moving the particle in a force field given by $\vec{F} = \text{Sin}y\,\vec{i} + x(1+\cos y)\,\vec{j}$ over the circular path $x^2+y^2 = a^2$, $z = 0$. [5]

7. Evaluate $\iint_S \vec{F}.d\vec{s}$ where $\vec{F} = x\vec{i} - y\vec{j} + z\vec{k}$ and s is the surface of the cylinder $x^2+y^2=a^2, 0<z<b$. [5]

8. Verify Stoke's theorem for $\vec{F} = (x^2+y^2)\vec{i} - 2xy\vec{j}$ taken round the rectangle bounded by the lines $x = \pm a, y = 0, y = b$. [5]

9. Obtain Fourier series for $f(x) = x^3$ in the interval $-\pi \leq x \leq \pi$. [5]

10. Express $f(x) = e^x$ as a half range Fourier Cosine Series in $0 < x < 1$. [5]

11. State existence theorem for Laplace Transform. Obtain the Laplace transform of

    a) $te^{-t}\sin t$ b) $\dfrac{e^{-at}-e^{-bt}}{t}$ 1+2+2]

12. Find the inverse Laplace transform of:

a) $\dfrac{1}{s^2-5s+6}$ b) $\tan^{-1}\dfrac{2}{s}$ [2+5.+2.5]

13. By using Laplace transform, solve the initial value problem:

$y'' + 2y = r(t)$, $y(0) = y'(0) = 0$
Where $r(t) = 1, 0 < t < 1$
$= 0$, otherwise [5]

14. Graphically maximize $Z = 5x_1 + 3x_2$ Subject to constraints

$x_1 + 2x_2 \leq 50$
$2x_1 + x_2 \leq 40.$ [5]
$x_1, x_2 \geq 0$

15. Solve the following Linear Programming Problem by simple method:

Maximize : $Z = 4x + 3y$

Subject to : $2x + 3y \leq 6$
$-x + 2y \leq 3$
$2y \leq 5$
$2x + y \leq 4$
$x, y \geq 0.$ [10]

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01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Ashwin

Exam.	Back		
Level	BE	Full Marks	80
Programme	ALL (Except B. Arch)	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Engineering Mathematics III *(SH501)*

- ✓ 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. Use properties of determinant to show [5]

$$\begin{vmatrix} x^2 & x^2-(y-z)^2 & yz \\ y^2 & y^2-(z-x)^2 & zx \\ z^2 & z^2-(x-y)^2 & xy \end{vmatrix} = (x-y)(y-z)(z-x)(x+y+z)(x^2+y^2+z^2)$$

2. Prove that every square matrix can be uniquely expressed as the sum of symmetric and a skew symmetric matrix. [5]

3. Define eigen values and eigen vectors in terms of linear transformation with matrices as operator. Find eigen values of the matrix. [2+3]

$$\begin{pmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{pmatrix}$$

4. Test the consistency of the system $x+y+z=3,\ x+2y+3z=4,\ 2x+3y+4z=7$ by using rank of matrix method and solve if consistent. [5]

5. If $\vec{F}$ is the gradient of some scalar point functions ϕ i.e $\vec{F}=\nabla\phi$, prove that the line integral is independent of the path joining any two points in the region and conversely. [5]

6. Evaluate $\iint_S \vec{F}.\vec{n}\,ds$, where $\vec{F}=xy\,\vec{i}-x^2\,\vec{j}+(x+z)\vec{K}$ and S is the region of the plane $2x+2y+z=6$ bounded in the first quadrant. [5]

7. State and prove Green's theorem in plane. [5]

8. Apply Gauss' divergence theorem to evaluate $\iint_S \left[\left(x^3-yz\right)\vec{i}-2x^2y\,\vec{j}+2\vec{K}\right].\vec{n}\,ds$, where S is the surface of the cube bounded by the planes x = 0, x = a, y = 0, y = a, z = 0, z = a. [5]

9. Expand f(x) = x sinx as a Fourier series in $-\pi \le x \le \pi$. [5]

10. Obtain half range cosine series for f(x) = x in the interval $0 \le x \le \pi$. [5]

11. Find the Laplace transform of: [3+2]

   i) $t^2 \cos at$

   ii) $\dfrac{\sin t}{t}$

12. State convolution theorem for inverse Laplace transform and use it to find the inverse Laplace transform of $\frac{S}{(S^2+4)(S^2+9)}$ [1+4]

13. Solve the following initial value problem by using Laplace transform: [5]

$y''+2y'-3y=\sin t,\ y(0)=y'(0)=0$

14. Graphically maximize [5]

$Z=7x_1+10x_2$

Subject to constraints,

$3x_1+x_2\le 9$

$x_1+2x_2\le 8$

$x_1,x_2\ge 0$

15. Solve the following LPP by simplex method using duality of: [10]

Minimize $Z=20x+50y$

Subject to:

$2x+5y\ge 12$

$3x+7y\ge 17$

$x,y\ge 0$

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01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	All (Except B. Arch)	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Engineering Mathematics III *(SH501)*

- ✓ 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. Distinguish a matrix and a determinant. Use property of determinant to prove: [5]

$$\begin{vmatrix} a+b+2c & a & b \\ c & b+c+2a & b \\ c & a & c+a+2b \end{vmatrix} = 2(a+b+c)^3$$

2. Prove that the necessary and sufficient condition for a square matrix to posses an inverse is that it is non singular. [5]
3. Find the rank of the matrix: [5]

$$\begin{pmatrix} 1 & 0 & -5 & 6 \\ 3 & -2 & 1 & 2 \\ 3 & -2 & -9 & 14 \\ 4 & -2 & -4 & 8 \end{pmatrix}$$ by reducing it to normal form.

4. State Cayley-Hamilton theorem and use it to find inverse of the matrix $\begin{pmatrix} 4 & 3 & 1 \\ 2 & 1 & -2 \\ 1 & 2 & 1 \end{pmatrix}$ [5]
5. Find the work done by the force $\vec{F} = yz\vec{i} + zx\vec{j} + xy\vec{k}$ in displacement of a particle along the straight segment C from point (1,1,1) to the point (3,3,2). [5]
6. State Gauss divergence theorem and apply it to evaluate $\iint_S \vec{F}.\vec{n}\, ds$, where $\vec{F} = x\vec{i} + y\vec{j} + z\vec{k}$ and S is the surface of the cube bounded by the planes x = 0, x = a, y = 0, y = a, z = 0, z = a. [5]
7. State and prove Green's theorem in plane. [5]
8. Verify stokes theorem for the vector field $\vec{F} = (2x-y)\vec{i} - yz^2\vec{j} - y^2z\vec{k}$ over the upper half of the surface of $x^2+y^2+z^2=1$ bounded by its projection the xy-plane. [5]
9. Find the Fourier series to represent $f(x) = x - x^2$ from $-\pi$ to π. [5]
10. Find the half range Fourier sine series for $f(x) = e^{2x}$ in $0 < x < \pi$. [5]
11. Define Laplace transform of a function and state criteria of existence of a Laplace transform of a function. Find the Laplace transform of $f(t) = \frac{1-\cos 2t}{t}$ [1+1+3]

12. Find inverse Laplace transform of [2+3]

(i) $\frac{1}{s(s+2)}$ (ii) $\tan^{-1}\left(\frac{1}{s}\right)$

13. Solve the following initial value problem using Laplace transform: [5]

$y''+4y'+3y=0,\ y(0)=3,\ y'(0)=1$

14. Use simplex method to solve the following LPP: [10]

Maximum $z=50x_1+80x_2$

Subject to,

$$x_1+2x_2 \le 32$$
$$3x_1+4x_2 \le 84$$

15. Graphically maximize [5]

$z=7x_1+10x_2$

Subject to,

$$3x_1+x_2 \le 9$$
$$x_1+2x_2 \le 8$$
$$x_1,x_2 \ge 0$$

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01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Shrawan

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	ALL (Except B. Arch)	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Engineering Mathematics II *(SH501)*

- ✓ 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. Use properties of determinants to prove: $\begin{vmatrix} a^2 & bc & ac+c^2 \\ a^2+ab & b^2 & ac \\ ab & b^2+bc & c^2 \end{vmatrix} = 4a^2b^2c^2$ [5]

2. Prove that the necessary and sufficient condition for a square matrix A to posses an inverse is that the matrix A should be non singular. [5]

3. Find the rank of the matrix $\begin{pmatrix} 1 & 3 & -2 & 1 \\ 1 & 1 & 1 & 1 \\ 2 & 0 & -3 & 2 \\ 3 & 3 & -3 & 3 \end{pmatrix}$ [5]

   by reducing it into normal form.

4. Find the eigenvalues and eigenvectors of the matrix $\begin{pmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{pmatrix}$ [4+1]

   Give an example showing importance of eigenvectors.

5. Show that $\vec{F} = (2x+z^2)\vec{i} + Z\vec{j} + (y+2xz)\vec{K}$ is irrotational and find its scalar potential. [5]

6. State and prove Green's Theorem in plane. [5]

7. Evaluate $\iint_S \vec{F}.\vec{n}\, ds$, where $\vec{F} = yz\vec{i} + zx\vec{j} + xy\vec{k}$ and S is the surface of the sphere $x^2+y^2+z^2=1$ in the first octant. [5]

8. Evaluate $\int_c xydx + xy^2dy$ by applying stokes theorem where C is the square in xy-plane with vertices (1,0), (-1,0), (0,1), (0,-1) [5]

9. Find the Laplace transform of : [2+3]

   i) $te^{2t}\sin 3t$

   ii) $\dfrac{e^{-t}\sin t}{t}$

10. Find the inverse Laplace transform of: [2+3]

i) $\dfrac{s+2}{s^2-4s+13}$

ii) $\log\left(\dfrac{s+a}{s-a}\right)$

11. Solve the following initial value problem using Laplace transform: [5]

$x''+4x'+4x=6e^{-t}, \quad x(0)=-2, \quad x'(0)=-8$

12. Find the Fourier series representation of $f(x)=|x|$ in $[-\pi, \pi]$ [5]

13. Obtain the half range Fourier Sine Series for the function $f(x) = x^2$ in the interval (0, 3). [5]

14. Apply Graphical method to maximize, [5]

$Z=5x_1+3x_2$

Subject to the constraints:

$x_1+2x_2 \le 50$

$2x_1+x_2 \le 40$

$x_1 \ge 0,\ x_2 \ge 0$

15. Solve the following Linear Programming Problem by Simplex method: [10]

Maximize: $Z=15x_1+10x_2$

Subject to: $x_1+3x_2 \le 10$

$2x_1+x_2 \le 10$

$x_1 \ge 0,\ x_2 \ge 0$

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01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	All (Except B. Arch)	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Engineering Mathematics III *(SH501)*

- ✓ 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. Use properties of determinants to prove: [5]

$$\begin{vmatrix} a^2+1 & ba & ca & da \\ ab & b^2+1 & cb & db \\ ac & bc & c^2+1 & dc \\ ad & bd & cd & d^2+1 \end{vmatrix} = 1+a^2+b^2+c^2+d^2$$

2. Show that every square matrix can be uniquely expressed as the sum of symmetric and Skew-Symmetric matrices. [5]

3. Test the consistency of the system $x+y+z=3, x+2y+3z=4$ and $2x+3y+4z=7$ and solve completely if found consistent. [5]

4. State Cayley-Hamilton theorem and verify it for the matrix; $A=\begin{pmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{pmatrix}$ [1+4]

5. Prove that " The line integral $\int_c \vec{F}.d\vec{r}$ of a continuous function $\vec{F}$ defined in a region R is independent of path C joining any two points in R if and only if there exists a single valued scalar function ϕ having first order partial derivatives such that $\vec{F}=\nabla\phi$". [5]

6. State Green's theorem and use it to find the area of astroid $x^{2/3}+y^{2/3}=a^{2/3}$ [5]

7. Evaluate $\iint_s \vec{F}.\vec{n}\, ds$, where $\vec{F}=x^2\vec{i}+y^2\vec{j}+z^2\vec{k}$ and 's' is the surface of the plane $x+y+z=1$ between the co-ordinate planes. [5]

8. Apply Gauss' divergence theorem to evaluate $\iint_s \vec{F}.\vec{n}\, ds$ where

$\vec{F}=(x^3-yz)\vec{i}-2x^2y\,\vec{j}+2\vec{k}$ and 's' is the surface the cube bounded by the planes $x=0, x=a, y=0, y=a, z=0, z=a$. [5]

9. Find the Laplace transform of: [2+3]

i) $t\sin^2 3t$

ii) $\frac{\sin 2t}{t}$

10. Find the inverse Laplace transform of: [2+3]

i) $\frac{1}{s^2 - 3s + 2}$

ii) $\frac{1}{s(s+1)^3}$

11. Apply Laplace transform to solve the differential equation: [5]

$y'' + 2y' + 5y = e^{-t}\sin t, \quad x(0) = 0, x'(0) = 1$

12. Find a Fourier series to represent $f(x) = x - x^2$ from $x = -\pi$ to $x = \pi$. Hence show that

$\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots\ldots = \frac{\pi^2}{12}$ [5]

13. Develop $f(x) = \sin\left(\frac{\pi x}{l}\right)$ in half range Cosine Series in the range $0 < x < l$. [5]

14. Graphically maximize, [5]

$Z = 7x_1 + 10x_2$

Subject to constraints,

$3x_1 + x_2 \le 9$

$x_1 + 2x_2 \le 8$

$x_1 \ge 0, x_2 \ge 0$

15. Solve the following LPP using simplex method. [10]

Maximize: $P = 50x_1 + 80x_2$

Subject to: $x_1 + 2x_2 \le 32$

$3x_1 + 4x_2 \le 84$

$x_1 \ge 0, x_2 \ge 0$

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01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Kartik

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	All (Except B.Arch)	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Engineering Mathematics III *(SH501)*

- ✓ 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. Prove that $\begin{vmatrix} (a+b)^2 & ca & bc \\ ca & (b+c)^2 & ab \\ bc & ab & (c+a)^2 \end{vmatrix} = 2abc(a+b+c)^3$ [5]

2. If A and B are two non singular matrices, then prove that $(AB)^{-1} = B^{-1}A^{-1}$ [5]

3. Find the rank of the matrix: [5]

$$\begin{pmatrix} 1 & -1 & -2 & -4 \\ 2 & 3 & -1 & -1 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{pmatrix}$$

4. Find the eigen values and eigen vectors of the matrix. [5]

$$\begin{pmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{pmatrix}$$

5. Prove that the line integral $\int_A^B \vec{F}.d\vec{r}$ is independent of path joining any two points A and B in the region R, if and only if, $\int_C \vec{F}.d\vec{r} = 0$ for any simple closed path C in R. [5]

6. Evaluate $\iint_S \vec{F}.\vec{n}\, ds$ where $\vec{F} = yz\,\vec{i} + zx\,\vec{j} + xy\,\vec{k}$ where S is the surface of the sphere $x^2 + y^2 + z^2 = 1$ in the first octant. [5]

OR

Apply Stoke's theorem to evaluate $\int_C (x+y)dx + (2x-z)dy + (y+z)\,dz$ where C is the boundary of the triangle with vertices (2,0,0), (0,3,0) and (0,0,6). [5]

7. State Green's theorem in plane and hence apply it to compute the area of the curve $x^{2/3} + y^{2/3} = a^{2/3}$. [5]

8. Apply Gauss divergence theorem to evaluate $\iint_S \vec{F}.\vec{n}\,ds$ where $\vec{F}=x^2\vec{i}+z\vec{j}+yz\vec{k}$ taken over the cube bounded by $x=0, x=1, y=0, y=1, z=0, z=1$. [5]

9. Find the Laplace transform of the following: [2.5×2]

   a) $\frac{\cos 2t-\cos 3t}{t}$

   b) $\sin^3 2t$

10. Find the inverse Laplace transform of the following: [2+3]

    a) $\frac{1}{s^2-5s+6}$

    b) $\frac{s+2}{(s^2+4s+5)^2}$

11. Solve the initial value problem by using Laplace transform: [5]

    $x''+2x'+5x=e^{-t}\sin t;\ x(0)=0,\ x'(0)=1$

12. Obtain Fourier Series for the function $f(x)=x-x^2$ from $-\pi$ to π and hence show that: [5]

    $$\frac{\pi^2}{12}=\frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}+\text{..........}$$

13. Obtain the half range sine series for the function $f(x)=x^2$ in the interval (0,3). [5]

14. Graphically maximize and minimize [5]

    $Z=5x_1+3x_2$ Subjected to constraints

    $3x_1+5x_2\le 15$

    $5x_1+2x_2\le 10, x_1, x_2\ge 0$

15. Use simplex method to solve the Linear Programming problem: [10]

    Maximize $Z=15x_1+10x_2$

    Subject to $2x_1+2x_2\le 10$

    $x_1+3x_2\le 10$

    and $x_1, x_2\ge 0$

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01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	All (Except B.Arch.)	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Engineering Mathematics III *(SH501)*

- ✓ 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. Using the properties, evaluate the determinant: [5]

$$\begin{vmatrix} 1 & a & a^2 & a^3+bcd \\ 1 & b & b^2 & b^3+cda \\ 1 & c & c^2 & c^3+abd \\ 1 & d & d^2 & d^3+abc \end{vmatrix}$$

2. Prove that every square matrix can uniquely be expressed as the sum of a symmetric and a skew symmetric matrix. [5]

3. Test the consistency of the system: [5]

$x-6y-z=10,\ 2x-2y+3z=10,\ 3x-8y+2z=20$

And solve completely, if found consistent.

4. Find the eigen values and eigenvecters of the matrix $\begin{pmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{pmatrix}$. [5]

5. Using the line integral, compute the workdone by the force [5]

$\vec{F}=(2x-y+2z)\vec{i}+(x+y-z)\vec{j}+(3x-2y-5z)\vec{k}$

when it moves once around a circle $x^2+y^2=4; z=0$

6. State and prove Green's Theorem in plane. [5]

7. Verify Stoke's theorem for $\vec{F}=(x^2+y^2)\vec{i}-2xy\vec{j}$ taken around the rectangle bounded by the lines $x=\pm a$, $y=0$, $y=b$. [5]

8. Evaluate $\iint_S \vec{F}.\vec{n}\ ds$ where $\vec{F}=(2xy+z)\vec{i}+y^2\vec{j}-(x+3y)\vec{K}$ by Gauss divergence theorem; where S is surface of the plane $2x+2y+z=6$ in the first octant bounding the volume V. [5]

9. Find the Laplace transform of the following: [2.5×2]

   a) $te^{-2t}\cos t$

   b) $\sinh at.\cos t$

10. Find the inverse Laplace transform of : [2.5×2]

a) $\dfrac{1}{S(S+1)}$

b) $\dfrac{S^2}{(S^2+b^2)^2}$

11. Solve the differential equation $y''+2y'+5y = e^{-t}\sin t, y(0)=0, y'(0)=1,$ by using Laplace transform. [5]

12. Expand the function $f(x) = x \sin x$ as a Fourier series in the interval $-\pi \le x \le \pi$. [5]

13. Obtain half range sine series for the function $f(x) = x - x^2$ for $0 < x < 1$. [5]

14. Graphically maximize and minimize [5]

$z = 9x + 40y$ subjected to the constraints

$y - x \ge 1, y - x \le 3, 2 \le x \le 5$

15. Solve the following Linear Programming Problem by Simplex method: [10]

Maximize, $P = 20x_2 - 5x_1$

Subjected to, $10x_2 - 2x_1 \le 5$

$2x_1 + 5x_2 \le 10$ and $x_1, x_2 \ge 0$

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B.C.E. II/I

01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Shawan

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	All (Except B.Arch)	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Mathematics III *(SH501)*

- ✓ 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. Show that: $\begin{vmatrix} (b+c)^2 & b^2 & c^2 \\ a^2 & (c+a)^2 & c^2 \\ a^2 & b^2 & (a+b)^2 \end{vmatrix} = 2abc(a+b+c)^3$ [5]

2. Prove that every square matrix can be uniquely written as a sum of Hermitian and Skew-Hermitian matrices. [5]

3. Find the rank of the matrix by changing it into normal form: $\begin{pmatrix} 3 & 1 & 4 \\ 0 & 5 & 8 \\ -3 & 4 & 4 \\ 1 & 2 & 4 \end{pmatrix}$ [5]

4. Find the eigen value and eigen vector of the matrix: $\begin{pmatrix} 2 & 1 & 1 \\ -2 & 1 & 3 \\ 2 & 1 & -1 \end{pmatrix}$ [5]

5. Using Green's theorem, evaluate $\int_C (y^3dx - x^3dy)$ where C is the boundary of the circle $x^2 + y^2 = 4$. [5]

6. Show that $\vec{F}(x,y,z) = y^3\,\vec{i} + (3xy^2 + e^{2z})\,\vec{j} + 2ye^{2z}\,\vec{k}$ is conservative vector field and find its scalar potential function. [5]

7. Find the surface integral $\iint_S \vec{F}.\hat{n}\,ds$ where $\vec{F} = x\,\vec{i} + y\,\vec{j} + z\,\vec{k}$ and S is the upper half of the sphere $x^2 + y^2 + z^2 = 1$. [5]

8. Verify Stoke's theorem for $\vec{F}(x,y,z) = (2x-y)\,\vec{i} - yz^2\,\vec{j} - y^2z\,\vec{k}$ where S is the upper half of the sphere $x^2 + y^2 + z^2 = 4$ and C is its boundary. [5]

   OR

   Evaluate using Gauss divergence theorem,
   $\iint_S \vec{F}.\hat{n}\,ds$ where $\vec{F}(x,y,z) = x^2y\,\vec{i} + xy^2\,\vec{j} + 2xyz\,\vec{k}$ and S is the surface bounded by the planes x = 0, y = 0, z = 0 and x+2y+z = 2

9. Find the Laplace transform of (i) $\sin 2t \cosh 4t$ (ii) $te^{2t} \sin 4t$. [5]

10. Using the Convolution theorem, find the inverse Laplace transform of $\frac{3s}{(s^2+4)(s^2+1)}$ [5]

11. Solve the following initial value problem using Laplace transform: [5]

$$y''+4y'+3y=e^t, y(0)=00, y'(0)=2$$

12. Obtain the half range Fourier sine series of $f(x)=\pi-x$ in the range $0<x<\pi$. [5]

13. Obtain the Fourier series of $f(x)=e^{3x}$ in $0<x<2\pi$. [5]

14. Graphically maximum $Z=5x_1+3x_2$ subject to constraints [5]

$$x_1+2x_2\le 50, 2x_1+x_2\le 40 \text{ and } x_1\ge 0, x_2\ge 0$$

15. Solve the following linear programming problem by simplex method constructing the duality: [10]

Minimize: $P=21x_1+50x_2$

Subject to $3x_1+7x_2\ge 17$

$2x_1+5x_2\ge 12$

$x_1, x_2\ge 0$

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04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING

Examination Control Division

2070 Chaitra

Exam.	Old Back (2065 & Earlier Batch)		
Level	BE	Full Marks	80
Programme	All (Except B. Arch)	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Mathematics III *(EG501SH)*

- ✓ 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. Using the properties of the determinant prove that: $\begin{vmatrix} x & a & a & a \\ a & x & a & a \\ a & a & x & a \\ a & a & a & x \end{vmatrix} = (x+3a)(x-a)^3$.

2. If A and B are square matrices of same order n, then show that B^TAB is symmetric or skew-symmetric according as A is symmetric or skew-symmetric.

3. Solve the following system of equation by Gauss elimination method:

$$2x + 3y + 4z = 20$$
$$3x + 4y + 5z = 26$$
$$3x + 5y + 6z = 31$$

4. State prove Cayley - Hamilton theorem.

5. Find the Laplace transforms of the following functions: (i) $\frac{\sin^2 2t}{t}$ (ii) tsin2tcos3t.

6. Find the inverse Laplace transforms of the following functions:

   (i) $\frac{4s+15}{s^2-25}$ (ii) $\frac{1}{s^2-5s+6}$

7. Prove the second shifting theorem. If $L[f(t)] = F(s)$, then $L[f(t-a)\,u(t-a)] = e^{-as}F(s)$.

8. Solve the following differential equation using Laplace transform:

   $\frac{d^2y}{dt^2} + y = \sin 3t; y(0) = 0, y'(0) = 0.$

9. Find the velocity and acceleration of a particle which moves along the curve $x = 2\sin 3t$, $y = 2\cos 3t$, $z = 8t$ at any time $t=\pi/3$. And hence find their magnitudes.

10. If $\vec{V} = \text{grad}\,(x^3+y^3+z^3-3xyz)$, find div $\vec{V}$ and curl $\vec{V}$.

11. Evaluate $\int_C \vec{F} \cdot d\vec{r}$ if $\vec{F} = x^2\hat{i} + y^3\hat{j}$ and C is the arc of the parabola $y = x^2$ in the xy-plane from (0,0) to (1,1).

12. Verify Green's theorem in the plane for $\int_C (xy+y^2)dx + x^2dy$ where C is the closed curve of the region bounded by the straight line $y = x$ and parabola $y = x^2$.

13. Evaluate $\iint_S \vec{F}.\vec{n}\,ds$ where $\vec{F} = yz\hat{i} + zx\hat{j} + xy\hat{k}$ and S is the surface of the sphere $x^2+y^2+z^2=1$ in the first octant.

14. Evaluate $\iiint_V (\nabla.\ \vec{F})dv$ where $\vec{F} = x\hat{i} - y\hat{j} + (z^2-1)\hat{k}$ for the square region in the xy plane bounded by the lines $x = 0$, $y = 0$, $x = a$ and $y = a$.

OR

Verify Stokes theorem for $\vec{F} = (2x-y)\hat{i} - yz^2\hat{j} - y^2z\hat{k}$ where S is the upper part of the sphere $x^2+y^2+z^2=a^2$ and C is its boundary.

15. Obtain the Fourier series to represent $f(x) = \dfrac{\pi - x}{2}$ in the interval $0 \le x \le 2\pi$.

16. Obtain the half range sine series for the function $f(x) = x^2$ in the interval $0 \le x \le \pi$.

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01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	All (Except B.Arch)	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Mathematics III *(SH501)*

- ✓ 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. Using the properties of determinant prove [5]

$$\begin{vmatrix} (b+c)^2 & a^2 & a^2 \\ b^2 & (c+a)^2 & b^2 \\ c^2 & c^2 & (a+b)^2 \end{vmatrix} = 2abc(a+b+c)^3$$

2. Prove that $(AB)^T = B^T A^T$ where A is the matrix of size m×p and B is the matrix of size p×n [5]

3. Find the rank of the following matrix by reducing normal form. $\begin{bmatrix} 1 & 3 & -2 & 1 \\ 1 & 1 & 1 & 1 \\ 2 & 0 & -3 & 2 \\ 3 & 3 & -3 & 3 \end{bmatrix}$ [5]

4. Find the eigen values and eigen vectors of the following matrix. $\begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & -1 \\ 0 & 0 & 2 \end{bmatrix}$ [5]

5. Prove that the line intergral $\int_A^B \vec{F}.d\vec{r}$ is independent of the path joining any two points A and B in a region if $\int_C \vec{F}.d\vec{r} = 0$ for any simple closed curve C in the region. [5]

6. Evaluate $\iint_S \vec{F}.\hat{n}\ ds$ where $\vec{F} = x^2\vec{i} + y^2\vec{j} + z^2\vec{k}$ and S is the finite plane $x + y + z = 1$ between the coordinate planes. [5]

OR

Evaluate $\iint_S \vec{F}.\hat{n}\, ds$ for $\vec{F} = yz\,\vec{i} + zx\,\vec{j} + xy\,\vec{k}$ where S is the surface of sphere $x^2 + y^2 + z^2 = 1$ in the first octant.

7. Evaluate, $\iint \vec{F}.\hat{n}\, ds$ for $\vec{F} = x\,\vec{i} - y\,\vec{j} + (z^2 - 1)\vec{k}$ where S is the surface bounded by the cylinder $x^2 + y^2 = 4$ and the planes $z = 0$ and $z = 1$ [5]

8. Verify the stoke's theorem for $\vec{F} = (2x - y)\vec{i} - yz^2\vec{j} - y^2 z\vec{k}$ where S is the upper part of the sphere $x^2 + y^2 + z^2 = a^2$ C is its boundary. [5]

9. Find the Laplace transform of (a) $t^2 \sin zt$ and (b) $\frac{1-e^t}{t}$ [2.5×2]

10. Find the inverse Laplace transform of (a) $\frac{2s+3}{s^2+5s-6}$ (b) $\frac{s^3}{s^4-a^4}$ [2.5×2]

11. Solve the following differential equation by using Laplace transform [5]

$y'' + y' - 2y = x$, $y(0) = 1$, $y'(0) = 0$

12. Obtain the Fourior series for $f(x) = x^2$ in the interval $-\pi < x < \pi$ and hence prove that

$$\sum \frac{1}{x^2} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} \ldots\ldots = \frac{\pi^2}{6}$$ [5]

13. Obtain half range sine series for $f(x) = \pi x - x^2$ in $(0, \pi)$ [5]

14. Graphically minimize $z = 4x_1 + 3x_2 + x_3$ [5]

Subject to $x_1 + 2x_2 + 4x_3 \geq 12$

$3x_1 + 2x_2 + x_3 \geq 8$ and $x_1, x_2, x_3 \geq 0$

15. Minimize $z = 8x_1 + 9x_2$ [10]

Subject to $x_1 + 3x_2 \geq 4$

$2x_1 + x_2 \geq 5$ with $x_1, x_2 \geq 0$

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02 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Ashad

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	All (Except B. Arch)	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Engineering Mathematics III *(SH501)*

- ✓ 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. Prove that: $\begin{vmatrix} a & b & b & b \\ a & b & a & a \\ a & a & b & a \\ b & b & b & a \end{vmatrix} = -(b-a)^4$ [5]

2. Prove that every matrix A can uniquely be expressed as a sum of a symmetric and a skew symmetric matrix. [5]

3. Test the consistency of the system x+y+z = 3, x+2y+3z = 4 and 2x+3y+4z = 7 and solve if consistent. [5]

4. Verify Cayley-Hamilton theorem for matrix A and find the inverse of $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ [5]

5. State and prove Green's theorem in the plane. [5]

OR

Verify Stroke's theorem for $\vec{F} = (x^2+y^2)\vec{i} - 2xy\,\vec{j}$ taken round the rectangle in the xy-plane bounded by x = 0, x = a, y = 0, y = b

6. Find the work done in moving particle once round the circle $x^2+y^2=9,\ z=0$ under the force field $\vec{F}$ given by $\vec{F} = (2x-y+z)\vec{i} + (x+y-z^2)\vec{j} + (3x-2y+4z)\vec{k}$ [5]

7. Evaluate $\iint_S \vec{F}.\vec{n}\, ds$ where $\vec{F} = xy\,\vec{i} - x^2\vec{j} + (x+z)\vec{k}$, s is the portion of the plane 2x+2y+z = 6 included in the first octant. [5]

8. Show that $\iint_S \left[(x^3-yz)\vec{i} - 2x^2y\,\vec{j} + 2\vec{k}\right].\vec{n}\, ds = \frac{a^5}{3}$ where s is the surface of the cube bounded by the planes x = 0, x = a, y = 0, y = a, z = 0, z = a [5]

9. Find the Laplace transform of (i) $f(t) = \frac{1-\cos t}{t}$ (ii) $f(t) = te^{-t}\sin t$ [5]

10. Find the inverse Laplace transform of (i) $\frac{(s+2)^3}{s^4}$ (ii) $\frac{1}{s^2(s^2+a^2)}$ [5]

11. Using Laplace Transform to solve: $y''+4y = \sin t$; $y(0) = 0 = y'(0)$ [5]

12. Find a fourier series to represent $f(x) = x - x^2$ from $x = -\Pi$ to $x = \Pi$ [5]

13. Find a fourier series to represent $f(x) = 2x - x^2$ in the range $(0,3)$ [5]

OR

Express $f(x) = x$ as a half range sine series in $0 < x < \Pi$

14. Use simplex method to, Maximize $p = 15x_1 + 10x_2$ [7]

$$\text{Subject to } 2x_1 + x_2 \leq 10$$
$$x_1 + 3x_2 \leq 10, \quad x_1, x_2 \geq 0$$

15. Find the dual of following Linear programming problem and solve by simplex method [8]

$$\begin{aligned} &\text{Minimize} && C = 16x_1 + 45x_2 \\ &\text{Subject to} && 2x_1 + 5x_2 \geq 50 \\ & && x_1 + 3x_2 \geq 27, \quad x_1, x_2 \geq 0 \end{aligned}$$

OR

Use Big M-method to solve the following linear programming problem.

$$\begin{aligned} &\text{Maximize } p = 2x_1 + x_2 \\ &\text{Subject to} \quad x_1 + x_2 \leq 10 \\ &\qquad -x_1 + x_2 \geq 2, \quad x_1, x_2 \geq 0 \end{aligned}$$

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02 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	All (Except B.Arch)	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Engineering Mathematics III *(SH501)*

- ✓ 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. Find the value of the determinant $\begin{vmatrix} a^2 & a^2-(b-c)^2 & bc \\ b^2 & b^2-(c-a)^2 & ca \\ c^2 & c^2-(a-b)^2 & ab \end{vmatrix}$ [5]

2. Show that the matrix $B^\theta AB$ is Hermitian or skew-Hermittian according as A is Hermitian and skew- Hermitian. [5]

3. Find the rank of the matrix $\begin{bmatrix} 6 & 1 & 3 & 8 \\ 4 & 2 & 6 & -1 \\ 10 & 3 & 9 & 7 \\ 16 & 4 & 12 & 15 \end{bmatrix}$ reducing this into the triangular form. [5]

4. Obtain the characteristic equation of the matrix $A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$ and verify that it is satisfied by A. [5]

5. Evaluate $\int_C \vec{F}.\vec{dr}$, where $\vec{F} = (x-y)\vec{i} + (x+y)\vec{j}$ along the closed curve C bounded by $y^2 = x$ and $x^2 = y$ [5]

6. Find the value of the normal surface integral $\iint_S \vec{F}.\vec{n}\,ds$ for $\vec{F} = x\vec{i} - y\vec{j} + (z^2-1)\vec{k}$, where S is the surface bounded by the cylinder $x^2+y^2=4$ between the planes $Z=0$ and $Z=1$. [5]

7. Using Green's theorem, find the area of the astroid $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$ [5]

8. Verify stoke's theorem for $\vec{F} = 2y\vec{i} + 3x\vec{j} - z^2\vec{k}$ where S is the upper half of the sphere $x^2+y^2+z^2=9$ and C is its boundary. [5]

OR

Evaluate the volume intergral $\iiint_V \vec{F}\,dv$, where V is the region bounded by the surface $x=0, y=0, y=6, z=x^2, z=4$ and $\vec{F} = 2xz\,\vec{i} - x\,\vec{j} + y^2\,\vec{k}$

9. Find the Laplace transforms of the following functions [2.5×2]
a) $te^{-4t}\sin 3t$
b) [illegible]

10. State and prove the second shifting theorem of the Laplace transform. [5]

11. Solve the following differential equation using Laplace transform. [5]

$$\frac{d^2y}{dx^2}+\frac{dy}{dx}-2y=x \text{ given } y(0)=1,\ y'(0)=0$$

12. Obtain the Fourier series for $f(x) = x^2$ in the interval $-\pi < x < \pi$ and hence show that

$$\sum\frac{1}{n^2}=\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+\ldots\ldots=\frac{\pi^2}{6}$$ [5]

13. Express $f(x)=x$ as a half-range sine series in $0<x<2$ [5]

14. Maximize $Z=4x_1+5x_2$ subject to constraints [5]

$2x_1+5x_2\leq 25$
$6x_1+5x_2\leq 45$
$x_1\geq 0$ and $x_2\geq 0$

graphically

15. Solve the following linear programming problem using the simplex method. [10]

Maximize $P=50x_1+80x_2$
Subject to $x_1+2x_2\leq 32$
$3x_1+4x_2\leq 84$
$x_1, x_2\geq 0$

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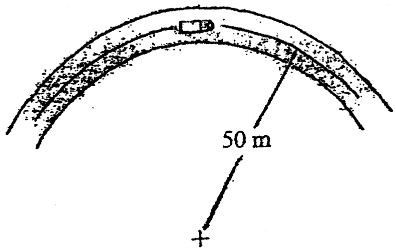
TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Bhadra

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

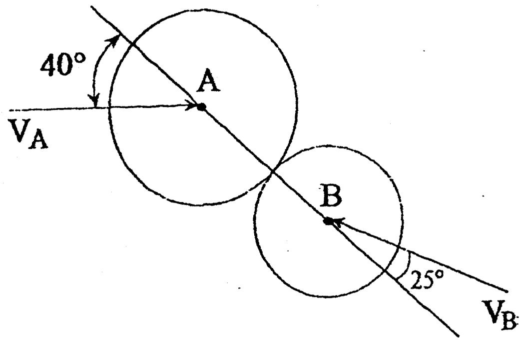
Subject: - Applied Mechanics (Dynamics) *(CE 501)*

- ✓ 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.*

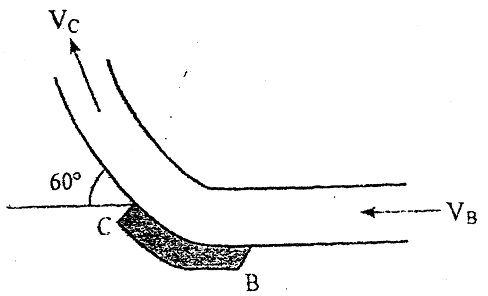
1. The truck travels along a circular road that has a radius of 50 m at a speed of 4 m/s. For a short distance when t = 0, its speed is then increased by $a_t = (0.4t)\ m/s^2$, where t is the seconds. Determine the speed and the magnitude of the truck's acceleration when t = 4s. [4]



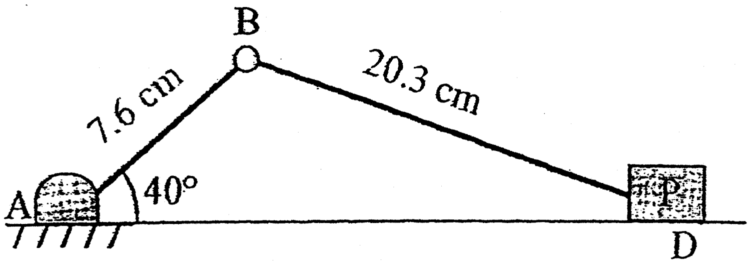
2. Two frictionless balls ($m_A = 6$ kg, $m_B = 3$ kg) strike each other as shown in figure. The coefficient of restitution between the balls is e = 0.67. Find the velocities of A and B after the impact if initial velocity are $v_A = 3$ m/s and $v_B = 4.5$ m/s. Explain the principle of work and energy with governing equation. [6+2]



3. Define linear and angular momentum of system of particles. A nozzle discharges a stream of water of cross-sectional area A = 100 mm² with a speed of v = 60 m/s and the stream is deflected by a fixed vane as shown in figure. The mass density of water ρ = 1000 kg/m³. Determine the resultant force $\vec{F}$ exerted on the stream by fixed vane. [2+6]

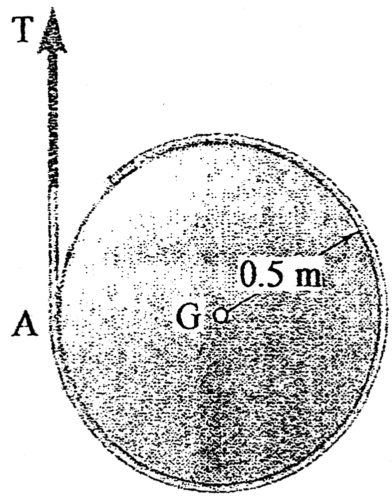


4. Define Instantaneous centre of rotation (ICR) with examples. Crank AB of the engine system has a constant clockwise angular velocity of 2000 rpm. For the crank position shown, calculate angular acceleration of rod BD and acceleration of piston P (point D). [Take $\omega_{BD} = 61.87$ rad/s (ccw) and $v_D = 13.2558$ m/s ($\rightarrow$) (if necessary)] [2+8]



5. Explain the principle of impulse and momentum for the plane motion of rigid body. A cord is wrapped around a homogeneous disk of radius r = 0.5 m and mass m = 15 kg. If the cord is pulled upward with a force $\vec{T}$ of magnitude 200 N, determine [4+6]

   a) the acceleration of the center of the disk.
   b) the angular acceleration of the disk.
   c) the acceleration of the cord.



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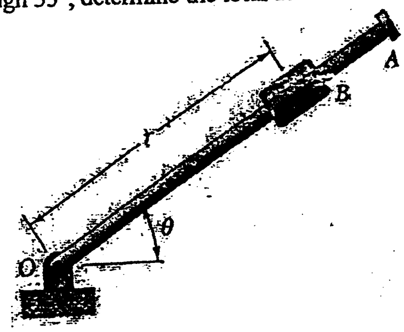
TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Baishakh

Exam.	Back		
Level	BE	Full Marks	40
Programme	BCE, BGE	Pass Marks	16
Year / Part	II / I	Time	$1\frac{1}{2}$ hrs.

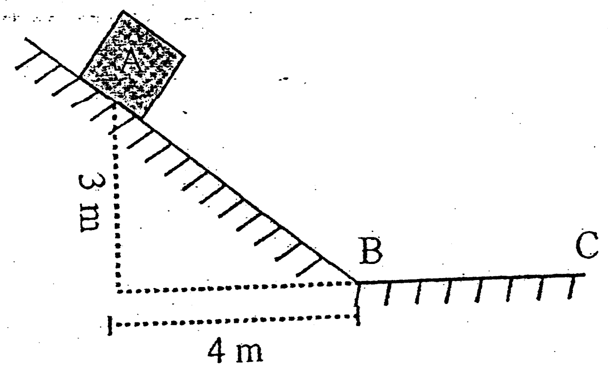
Subject: - Applied Mechanics (Dynamics) (*CE 501*)

- ✓ 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.*

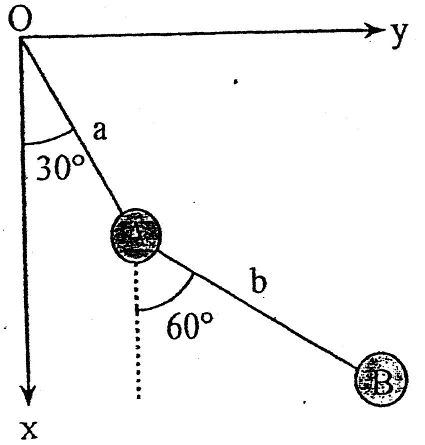
1. Rotation of the arm about O is defined by $\theta = 0.23t^2$ where θ is in radians and t in seconds. Collar B slides along the ram such that $r = 0.9\text{-}0.12t^2$ where r is in meters. After the arm has rotated through 35°, determine the total acceleration of the collar. [4]



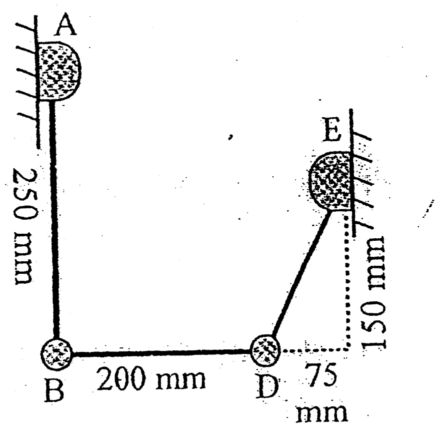
2. What is the principle of conservation of energy of a system? Illustrate it with suitable example. A small block starts from rest at point A and slides down the inclined plane as shown. What distance along the horizontal plane will it travel before coming to rest? The coefficient of static and kinetic friction between the block and either plane are 0.35 and 0.3 respectively. Assume that the initial velocity with which it starts to move along BC is of the same magnitude as that gained sliding from A to B. [2+6]



3. A double pendulum shown in figure oscillates in the xy plane. At the instant shown ω_1 = 2 rad/s ccw and ω_2 =3 rad/s ccw. Take a = 0.5 m and b = 0.7 m. What is the angular momentum (Ho) at this instant of $m_1 = m_2$ = 1kg? It is given that the lower pendulum is connected to mass m by pin joint and is free to rotate about this point. [8]



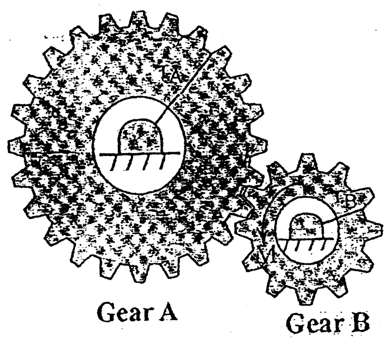
4. Define instantaneous center of rotation with an example. In the position shown, bar AB has an angular velocity of 6 rad/s clockwise. Determine the angular velocity of bars BD and DE. [2+6]



5. Explain D' Alemberts principle with necessary equations. Gear A has a mass of 10 kg and a radius of gyration of 80 mm. The system is at rest when a couple M of magnitude 8 Nm is applied to gear B. Neglecting friction. Take r_A= 250 mm and r_B =100 mm. Determine:

   a) The time required for the angular velocity of gear C to reach 600 rpm.

   b) The tangential force which gear B exerts on gear A. [4+8]



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TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

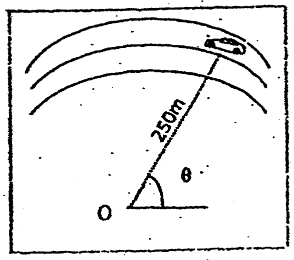
2078 Bhadra

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

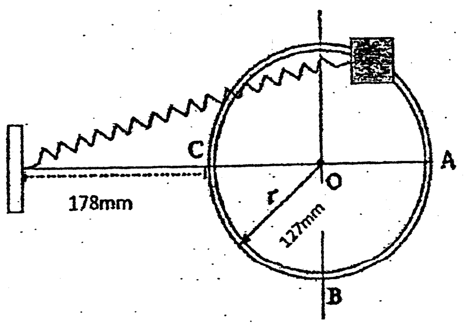
Subject: - Applied Mechanics (Dynamics) *(CE 501)*

- ✓ 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.*

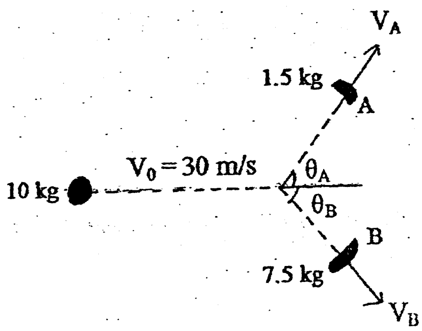
1. A radar gun at 'O' rotates with the angular velocity of $(d\theta/dt) = 0.15$ rad/sec and angular acceleration of $(d^2\theta/dt^2) = 0.025$ rad/sec^2 at the instant $\theta = 40°$, as it follows the motion of the car travelling along the circular road having radius of $r = 250$ m. Determine the magnitude of velocity and acceleration of the car at this instant. [4]



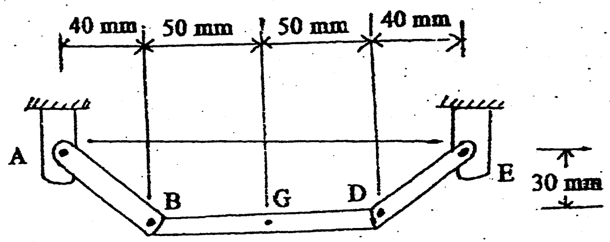
2. A 0.45 kg collar is attached to a spring and slides without friction along a circular rod in a vertical plane. The spring has an undeformed length of 127 mm and a constant K = 146 N/m. Knowing that the collar is released from being held at A, determine the speed of the collar and the normal force between the collar and the rod as the collar passes through B. [8]



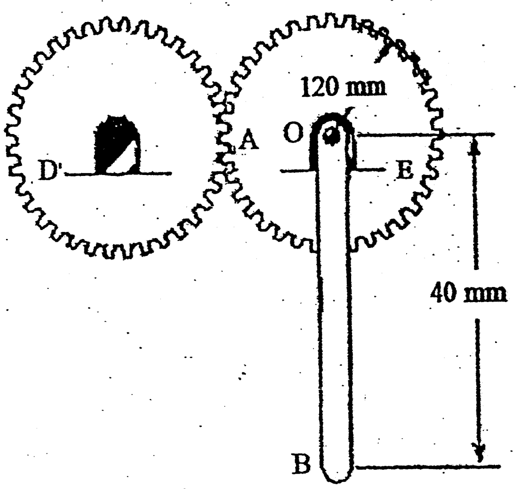
3. Define angular momentum for a system particle. A 10 kg projectile is moving with a velocity of 30 m/s when it explodes into two fragments A and B weighing 2.5 kg and 7.5 kg respectively, knowing that immediately after the explosion, fragments a and B travel in the directions defined respectively by $\theta_A = 45°$ and $\theta_B = 30°$, determine the velocity of each fragment. [2+4]



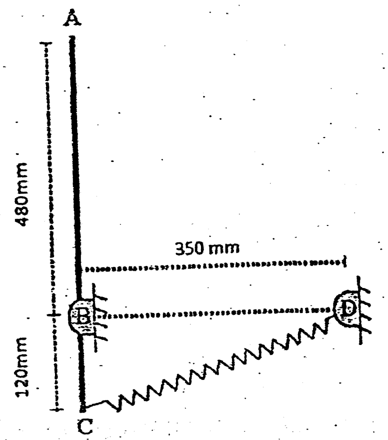
4. Define General plain motion with suitable example. Knowing that at the instant shown rod AB has zero angular acceleration and an angular velocity of 15 rad/s counter clockwise. Determine [2+6]
   a) angular acceleration of arm DE
   b) the acceleration of Point D.



5. The portion AOB of the mechanism is actuated by gear D and at the instant shown has a clockwise angular velocity of 8 rad/s and a counter clockwise aqngular acceleration of 40 rad/s^2. Determine tangential force exerted by gear D. Take $m_E = 4$ kg, $\bar{k}_E = 85$ mm and $m_{OB} = 3$ kg [8]



6. A slender 4 kg rod can rotate in a vertical plane about a pivot at B. A spring of constant k = 400 N/m and of unstretched length 150 mm is attached to the rod as shown. Knowing that the rod is released from rest in the position shown, determine its angular velocity after it has rotated through 90°. [6]



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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Kartik

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

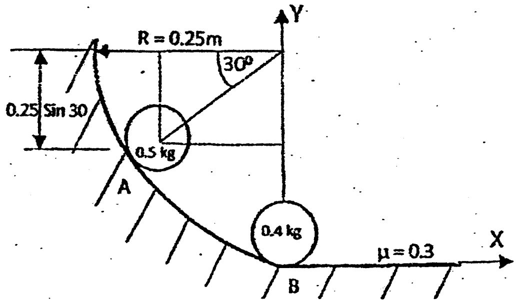
Subject: - Applied Mechanics (Dynamics) *(CE 501)*

- ✓ 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.*

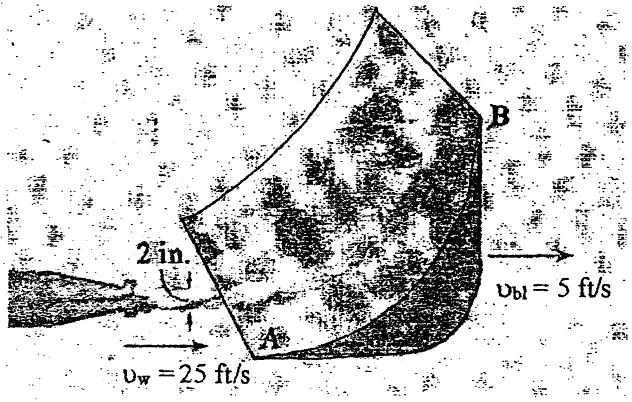
1. A bullet is fired into a viscous medium with an initial velocity of 80 m/s. The resistance of the medium produces a resistance equal of $a = (-0.5\ v^3)$ m/s^2, where v is in m/s. Calculate the bullet's velocity and position 3 sec after it is fired. [4]

2. a) Differentiate the concept of "work-energy" and "impulse-momentum" principles for study of kinetics of particle. [2]

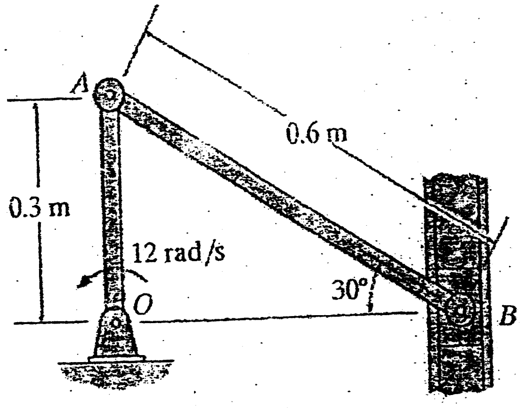
   b) A particle having mass 0.5 kg is released from rest and strikes the stationary particle of mass 0.4 kg as shown in figure. Assume the impact is direct and elastic. If the horizontal surface has a kinetic coefficient of friction $\mu = 0.3$. Locate the final position of each mass from the origin of x-axis. [6]



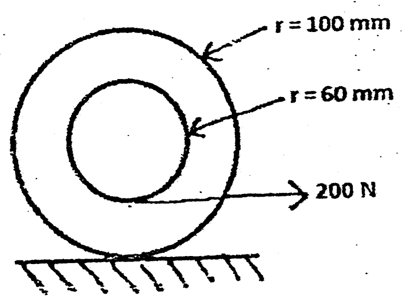
3. A 2-in -diameter water jet having a velocity of 25 ft/s impinges upon a single moving blade as shown in figure. If the blade moves with a constant velocity of 5 ft/s away from the jet, determine the horizontal and vertical components of force which the blade is exerting on the water. What power does the water generate on the blade? Water has a specific weight of 62.4 lb/ft^3. [6]



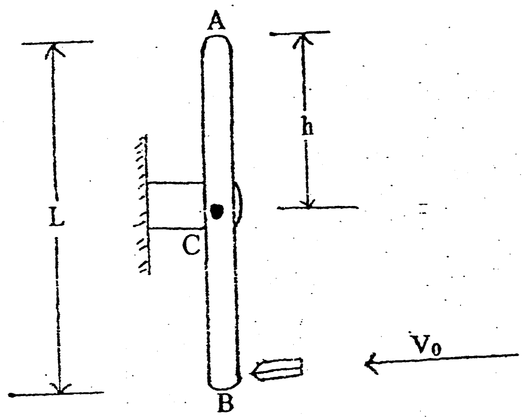
4. If crank OA rotates with an angular velocity 12 rad/s, determine the velocity of piston B, velocity of midpoint of AB and the angular velocity of rod AB at the instant shown. Define constrained motion with examples. [6+2]



5. A wheel is wrapped around the inner drum of a wheel and pulled horizontally with a force of 200 N. The wheel has a mass of 45 kg and radius of gyration of 70 mm. Knowing that $\mu_s = 0.2$ and $\mu_k = 0.15$, determine the acceleration of G and angular acceleration of wheel. [8]



6. A bullet weighing 40 gm is fired with horizontal velocity of 600 m/s into the lower end of a slender 7 kg bar of length L = 600 mm. Knowing that h = 260 mm and that the bar is initially at rest, determine (a) the angular velocity of bar immediately after the bullet becomes embedded, (b) the impulsive reaction at C, assuming that the bullet becomes embedded in 0.001 s. [6]



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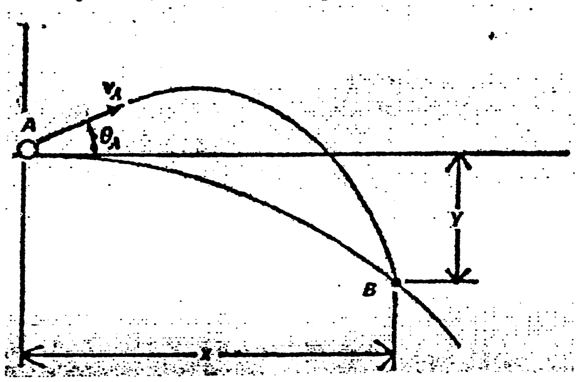
TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Ashwin

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

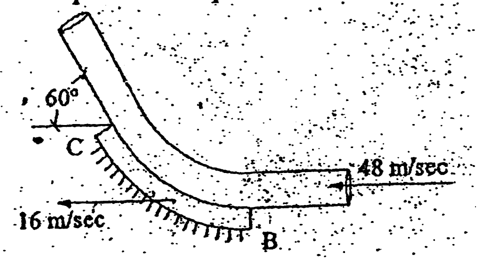
Subject: - Applied Mechanics (Dynamics) *(CE 501)*

- ✓ 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. The ball at A is kicked such that θ_A=30°. If it is strikes the ground at B having co-ordinates x=15 ft and y=-9 ft, determine the speed at which it is kicked. [4]

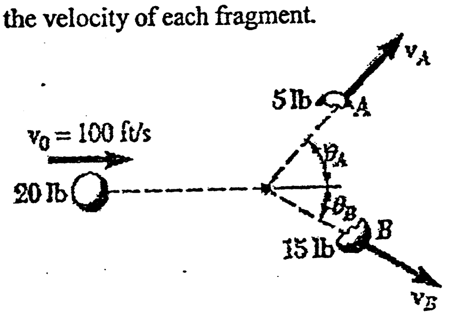


2. A nozzle discharges a stream of water of cross sectional area A = 4000 mm^2 with a speed v = 48m/sec, and the stream is deflected by a fixed vane which is moving in the same direction of water flow with constant speed of 16 m/sec as shown in figure. The mass density of water ρ=1000 kg/m^3. Determine the resultant force exerted on the stream by the fixed vane and maximum power developed. [5+3]

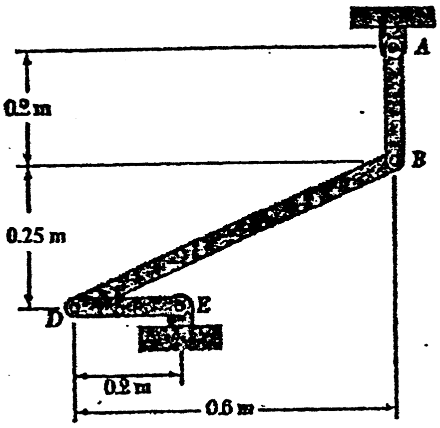


3. Define angular momentum for a rigid body in plane motion with examples. [4]

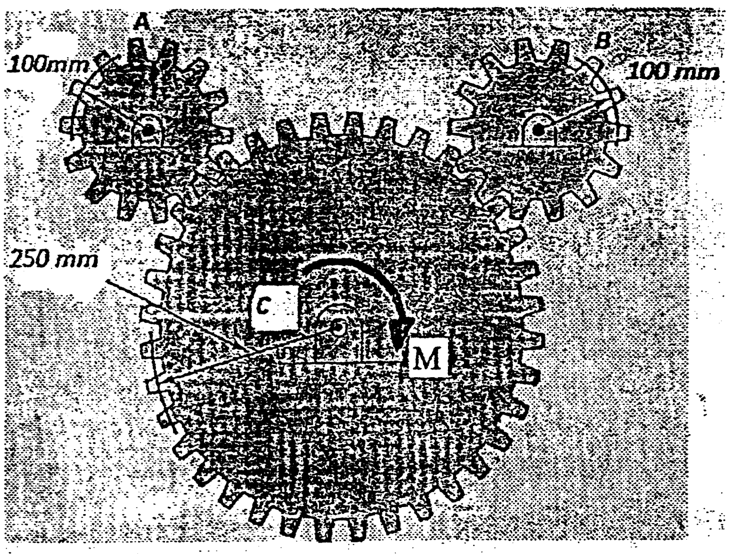
4. A 20-lb projectile is moving with a velocity of 100 ft/s when it explodes into two fragments A and B, weighing 5 lb and 15 lb, respectively. Knowing that immediately after the explosion, fragments A and B travel in directions defined respectively by θ_A=45° and θ_B=30°, determine the velocity of each fragment. [6]



5. Define Coriolis acceleration of a rigid body in general plane motion. For the figure shown knowing that at the instant shown the velocity of point D is 2.4 m/s upward, determine (a) the angular velocity of rod AB, (b) the velocity of the midpoint of rod BD. [2+8]



6. Each of gear A and B has a weight of 2.5 Kg and radius of gyration of 100 mm inch while gear C has a weight of 12.5 kg and radius of gyration of 180 mm. A couple M of magnitude of 10 N-m is applied to gear C. Determine a) number of revolution of gear C required for its angular velocity to increase from 100 to 450 rpm a) the corresponding tangential force on gear A. [8]



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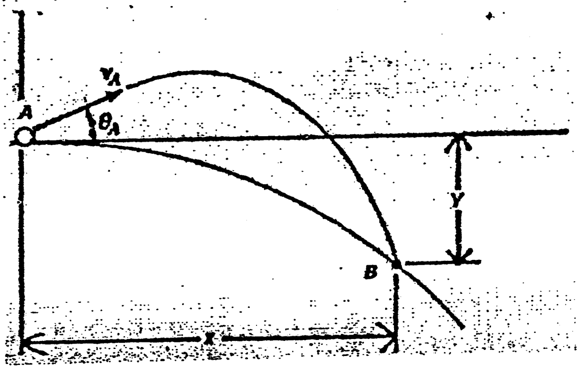
TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Ashwin

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

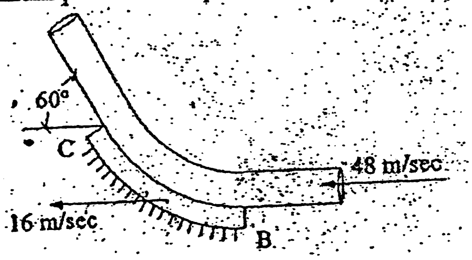
Subject: **- Applied Mechanics (Dynamics)** ***(CE 501)***

- ✓ 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. The ball at A is kicked such that θ_A=30°. If it is strikes the ground at B having co-ordinates x=15 ft and y=-9 ft, determine the speed at which it is kicked. [4]

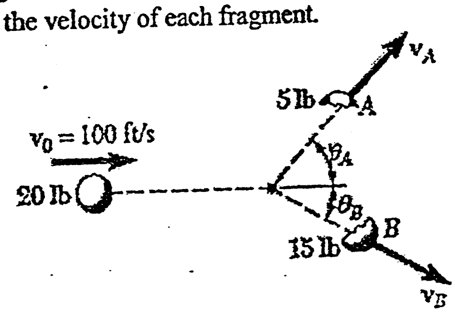


2. A nozzle discharges a stream of water of cross sectional area A = 4000 mm^2 with a speed v = 48m/sec, and the stream is deflected by a fixed vane which is moving in the same direction of water flow with constant speed of 16 m/sec as shown in figure. The mass density of water ρ=1000 kg/m^3. Determine the resultant force exerted on the stream by the fixed vane and maximum power developed. [5+3]

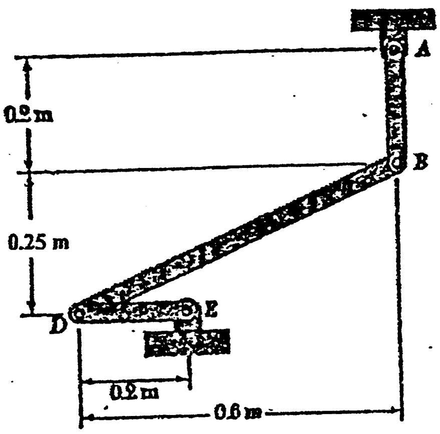


3. Define angular momentum for a rigid body in plane motion with examples. [4]

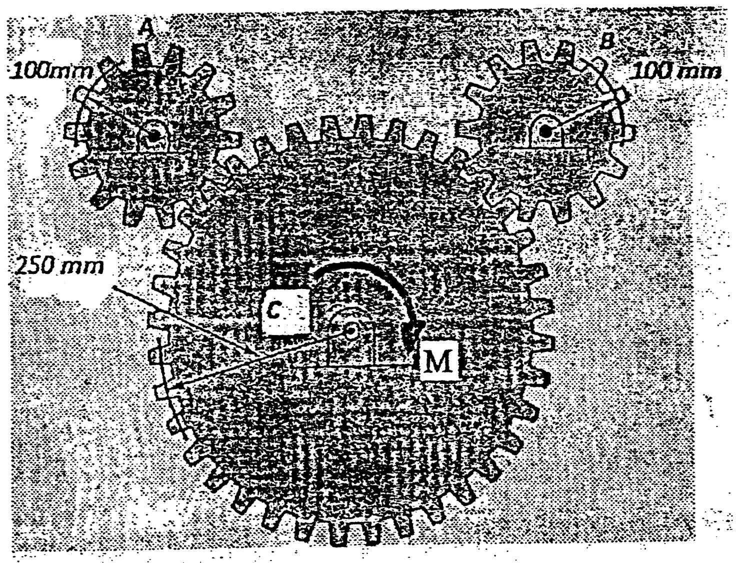
4. A 20-lb projectile is moving with a velocity of 100 ft/s when it explodes into two fragments A and B, weighing 5 lb and 15 lb, respectively. Knowing that immediately after the explosion, fragments A and B travel in directions defined respectively by θ_A=45° and θ_B=30°, determine the velocity of each fragment. [6]



5. Define Coriolis acceleration of a rigid body in general plane motion. For the figure shown knowing that at the instant shown the velocity of point D is 2.4 m/s upward, determine (a) the angular velocity of rod AB, (b) the velocity of the midpoint of rod BD. [2+8]



6. Each of gear A and B has a weight of 2.5 Kg and radius of gyration of 100 mm inch while gear C has a weight of 12.5 kg and radius of gyration of 180 mm. A couple M of magnitude of 10 N-m is applied to gear C. Determine a) number of revolution of gear C required for its angular velocity to increase from 100 to 450 rpm a) the corresponding tangential force on gear A. [8]



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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Chaitra

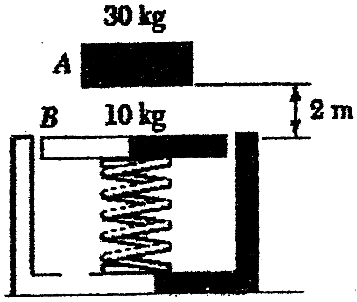
Exam.	Regular / Back		
Level	BE	Full Marks	40
Programme	BCE, BGE	Pass Marks	16
Year / Part	II / I	Time	1½ hrs.

Subject: - Applied Mechanics (Dynamics) *(CE 501)*

- ✓ 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 relative velocity and acceleration with suitable example. [2+2]

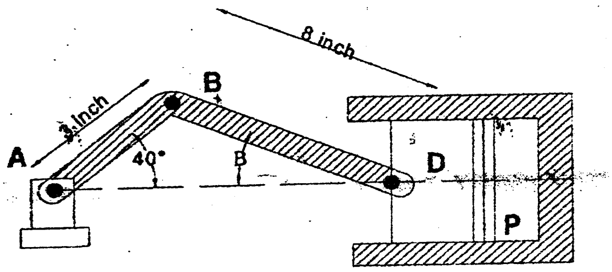
2. A 30-kg block is dropped from a height of 2m onto the 10-kg pan of a spring scale. Assuming the impact to be perfectly plastic, determine the maximum deflection of the pan. The constant of the spring is k=30 kN/m. [8]



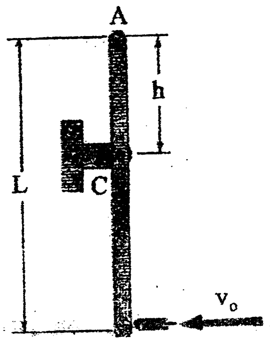
3. Explain general plane motion of rigid bodies with suitable example. [4]

4. Derive an expression for the force exerted on the system due to change in mass over time. Show that the final acceleration increases when system loses mass. [6]

5. Define centre of rotation. In an engine system as shown in the figure below, crank AB has a constant clockwise angular velocity of 1800 rpm. For the crank position as shown, determine (a) the angular velocity of the connecting rod BD and (b) the velocity of the piston P. [2+8]



6. A bullet weighting 40gm is fired with a horizontal velocity of 600m/s into the lower end of a slender 7 kg bar of length L=600mm. Knowing that h=240mm and that the bar is initially at rest, determine [8]
   a) the angular velocity of the bar immediately after the bullet becomes embedded.
   b) The impulsive reaction at C, assuming that the bullet becomes embedded in 0.001s.



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06 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

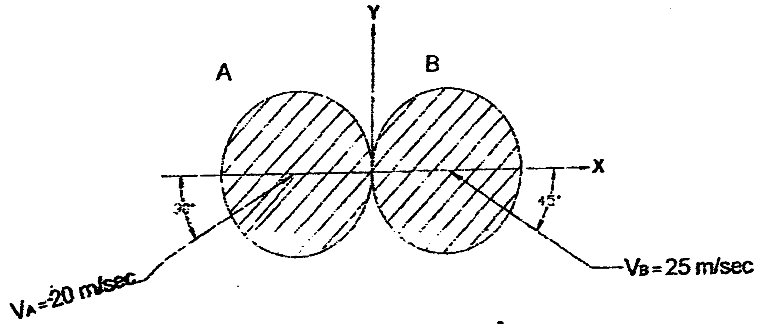
2075 Ashwin

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

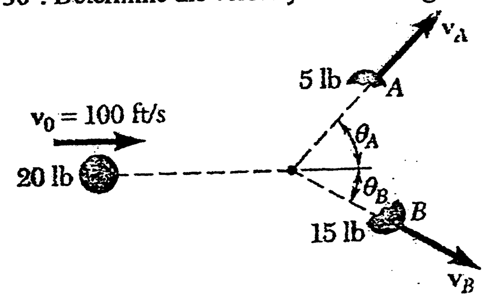
Subject: - Applied Mechanics (Dynamics) *(CE501)*

- ✓ 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.*

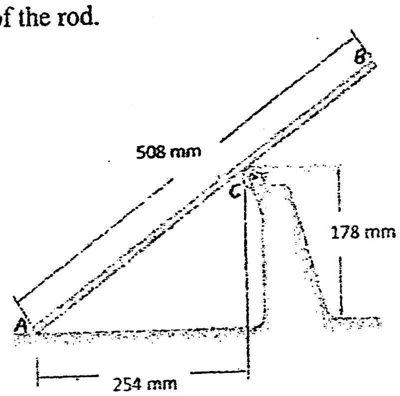
1. The magnitude and direction of the velocities of two balls A and B having masses 1.2kg and 1.8kg respectively before they strike each other are shown as in figure below. Assuming e = 0.84, determine the velocity of each ball after the impact. How much K.E. will be lost due to the impact? [8]



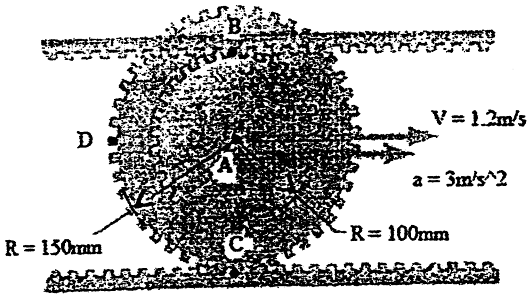
2. A 20-lb projectile is moving with a velocity of 100 ft/s when it explodes into 5 and 15-lb fragments. Immediately after the explosion, the fragments travel in the directions $\theta_A = 45°$ and $\theta_B = 30°$. Determine the velocity of each fragment. [8]



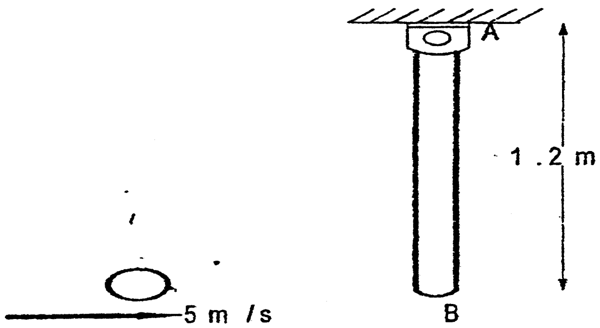
3. Rod AB moves over a small wheel at C while end A moves to the right with a constant velocity of 635 mm/s. At the instant shown, determine (a) the angular velocity of the rod, (b) the velocity of end B of the rod. [8]



4. The center of the double gear has a velocity and acceleration to the right of 1.2m/s and 3m/s2, respectively. The lower rack is stationary. Determine (a) the angular acceleration of the gear, and (b) the acceleration of points B, C and D. [8]



5. A 2.5-kg sphere moving horizontally to the right with an initial velocity of 7m/s strikes the lower end an 10-kg rod AB. The rod is suspended from a hinge at A and is initially at rest. Knowing that the co-efficient of restitution between the rod and the sphere is 0.890, determine the angular velocity of the rod and the velocity of the sphere immediately after the impact. [8]



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06 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Chaitra

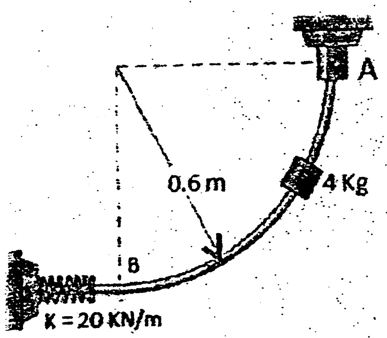
Exam.	Regular		
Level	BE	Full Marks	40
Programme	BCE, BGE	Pass Marks	16
Year / Part	II / I	Time	1 ½ hrs.

Subject: - Applied Mechanics (Dynamics) *(CE501)*

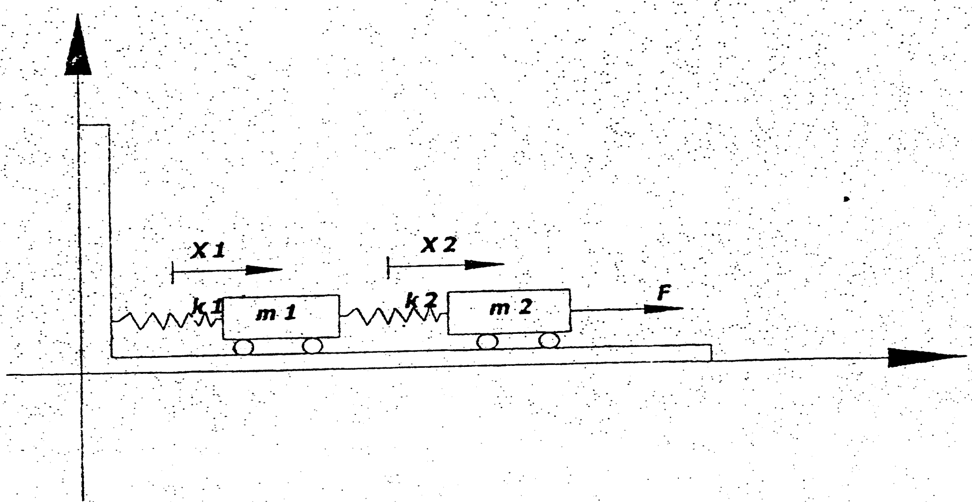
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Derive relations for the radial and transverse components of the acceleration when a particle is moving curvilinearly. [4]

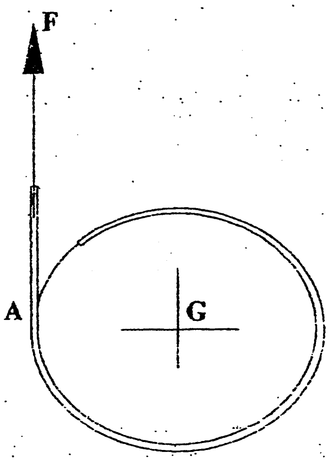
2. The 4 kg slider is released from rest from position A and slides down the frictionless rod in vertical plane. Determine a) the velocity 'v' of the slider as it strikes the spring b) maximum deflection of spring. [8]



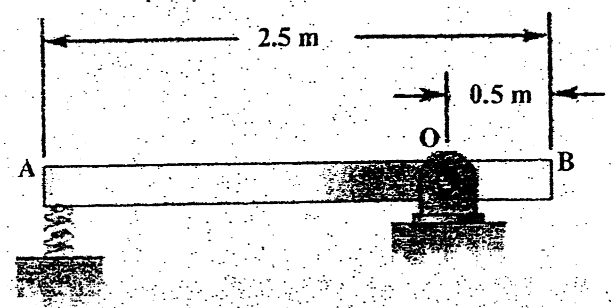
3. Two masses shown in figure oscillate on the smooth plane in the x-direction.
   a) Write the differential equation of motion for each mass
   b) Find the equation of motion for the center of the mass.
   c) Write the expression for kinetic and potential energy of the system of particles. [6]



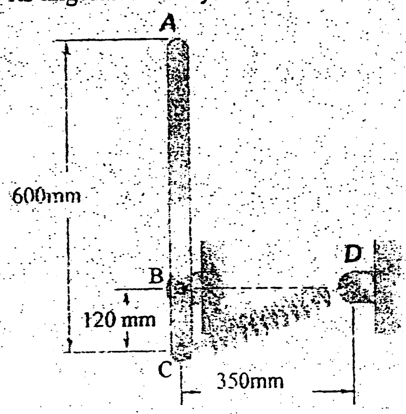
4. A cord is wrapped around a homogenous disk of radius r = 0.5 m and mass 20kg. If the cord is pulled upward with a force of magnitude F = 250N, determine (a) the angular acceleration of the disk, (b) the acceleration of the disk and (c) the acceleration of the cord. [6]



5. A 15 kg slender rod pivots about the point O. The other end is pressed against a spring (k = 300 kN/m) until the spring is compressed one inch and the rod is in a horizontal position. If the rod is released from this position, determine its angular velocity and the reaction at the pivot as the rod passes through a vertical position. [8]



6. Define impulsive motion and eccentric impact. A slender 4 kg rod can rotate in a vertical plane about a pivot at B. A spring of constant k = 400 N/m and of unstretched length 150 mm is attached to the rod as shown. Knowing that the rod is released from rest in the position shown, determine its angular velocity after it has rotated through 90°. [2+6]



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06 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING

Examination Control Division

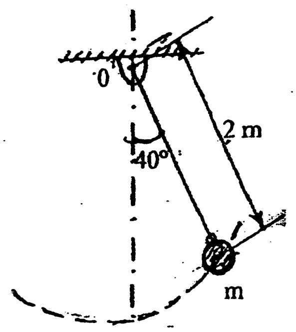
2074 Ashwin

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

Subject: - Applied Mechanics (Dynamics) *(CE501)*

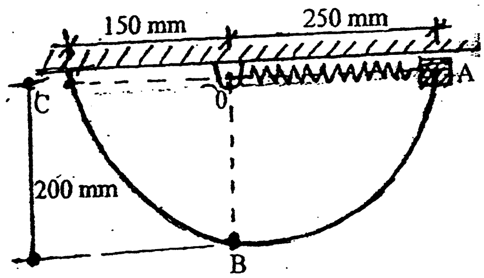
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt __All__ questions.*
- ✓ *The figures in the margin indicate __Full Marks__.*
- ✓ *Assume suitable data if necessary.*

1. The bob of a 2 m pendulum describes an arc of circle in a vertical plane. If the tension in the cord is 2.5 times the weight of the bob for the position shown. Find the velocity and acceleration of the bob in the given position. [4]

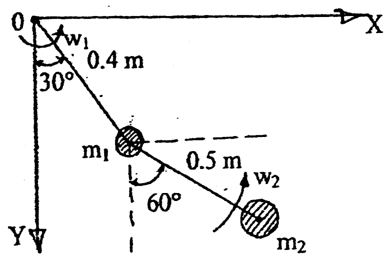


2. a) What is the principle of conservation of energy of a system? Illustrate it with suitable example. [3]

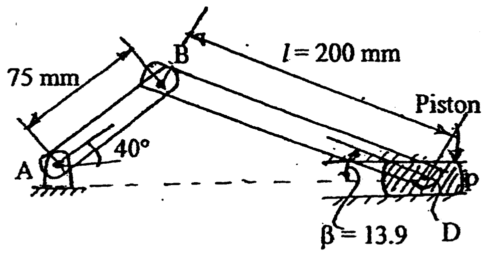
   b) 2 kg collar is attached to a spring and slides without friction in a vertical plane along the curved rod ABC. The spring is undeformed when its length is 100 mm and its constant is 800 N/m. If the collar is released at 'A' with no initial velocity, determine its velocity (a) as it passes through 'B' (b) as it reaches at 'C' [5]



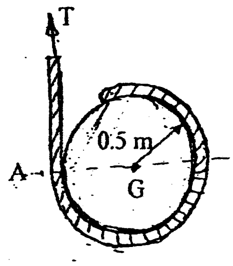
3. Derive the expression for resultant force for the system of variable mass. A double pendulum as shown in figure below oscillates in X-Y plane. At the instant shown, $w_1 = 4$ rad/sec CCW and $w_2 = 5$ rad/sec CCW. What will be the angular momentum about 'O' at this instant, if $m_1 = 3$ kg and $m_2 = 4$ kg? Note that the lower pendulum is connected to mass 'm_1' by a pin joint and is free to rotate about this point. [4+4]



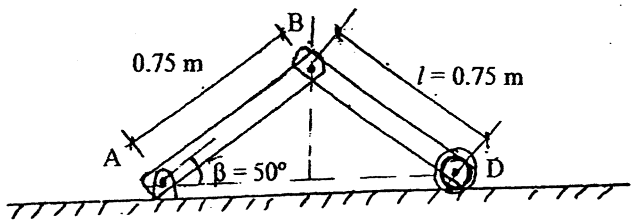
4. What is the meaning of corioli's acceleration in plane motion of Rigid body? Crank AB of the engine system shown in figure below, has a constant clockwise angular velocity of 2000 rev/min. For the crank position as shown in figure below, determine the angular acceleration the connecting rod 'BD' and the acceleration of point 'D'. Given that the value of w_{BD} = 61.9 rad/sec and the angle made by rod BD with horizontal β = 13.9. [8]



5. A cord is wrapped around a homogeneous disk of radius r = 0.5 m and mass m = 15 kg. If the cord is pulled upward with force $\vec{T}$ of magnitude 180 N, determine (a) the acceleration of the center of the disk (b) the angular acceleration of the disk (c) the acceleration of the cord. [4]



6. Differentiate the central and Eccentric impact of the body. Each of the two slender rods as shown in figure below is 0.75 m long and has a mass of 6 kg. If the system is released from rest when β = 50°, determine (a) the angular velocity of rod "AB" when 'β'' = 20° (b) the velocity of point 'D' at the same instant. [2+6]



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06 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Chaitra

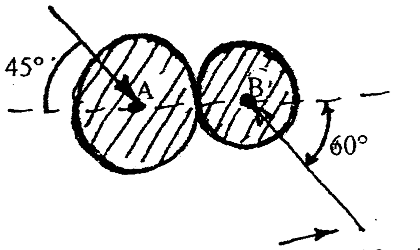
Exam.	Regular		
Level	BE	Full Marks	40
Programme	BCE, BGE	Pass Marks	16
Year / Part	II / I	Time	1 ½ hrs.

Subject: - Applied Mechanics (Dynamics) *(CE501)*

- ✓ 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. Derive the expression for radial and transverse components of acceleration when a particle moves in a curvilinear path. [4]

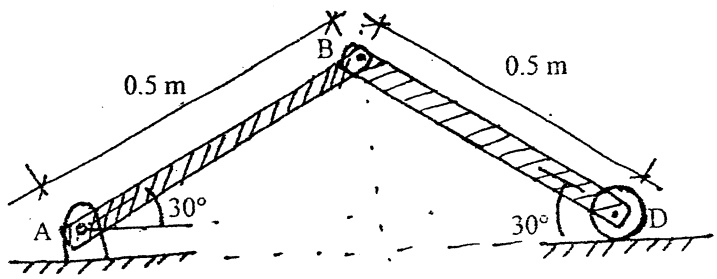
2. Two identical balls collides with the velocities of $V_A = 15$ m/s and $V_B = 15$ m/s as shown in figure. What are the final velocities after the impact? Given that the coefficient of restitution e = 0.8. [8]



3. Derive the expression for the resultant force exerted on the surface of pipe due to the steady stream of particles. [4]

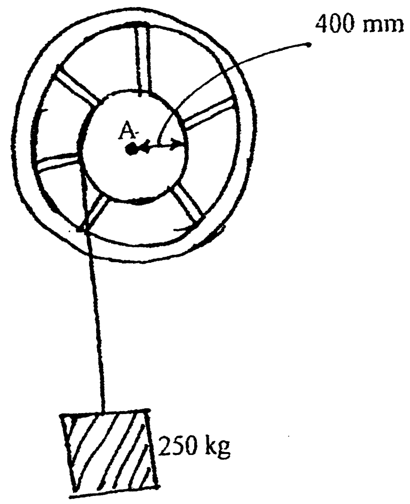
4. a) Describe about the types of rigid body motion with suitable sketches. [4]

   b) Determine the angular velocities of link BD and AB and also find the velocity of point B at the position shown in figure below. Provided that the block 'B' moves with a speed of 2 m/s. [8]



5. Describe about the constrained motion of rigid body in plane with suitable examples. [4]

6. A 250 kg block is suspended from a inextensible cable which is wrapped around a drum of 400 mm radius rigidly attached to the fly wheel as shown in figure below. The drum and flywheel have a combined centroidal moment of inertia $\bar{I} = 20\,\text{kg m}^2$. At the instant given in figure, the velocity of the block is 1.5 m/sec directed downward. Knowing that the bearing at 'A' is poorly lubricated and that the bearing friction is equivalent to a couple $\vec{M}$ of magnitude 80 N-m, Determine the velocity of the block after it has moved 1 m downward. [8]



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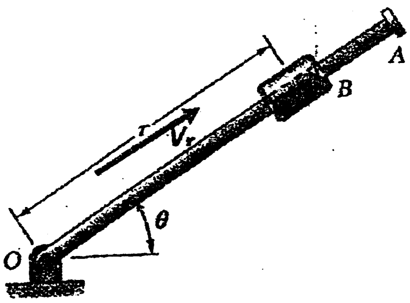
05 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Shrawan

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	40
Programme	BCE, BGE	Pass Marks	16
Year / Part	II / I	Time	1 ½ hrs.

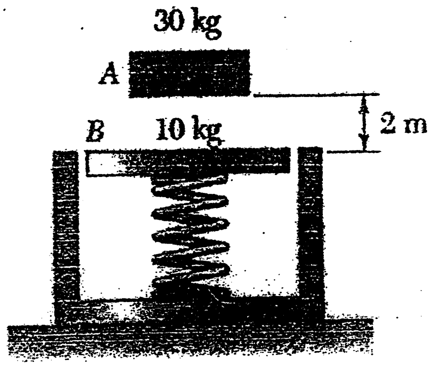
Subject: - Applied Mechanics (Dynamics) *(CE501)*

- ✓ 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.*

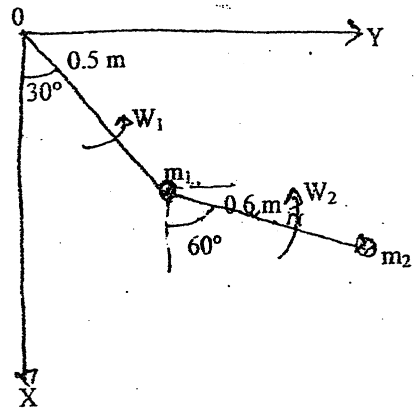
1. Rotation of the arm about O is defined by $\theta = 0.75t^2$ where θ is in radians and t in seconds. Collar B slides along the arm such that $r = 1\text{-}0.3t^2$ where r is in meters. After the arm has rotated through 45°, determine (a) the total velocity of the collar, (b) the total acceleration of the collar and (c) the relative acceleration of the collar with respect to the arm. [6]



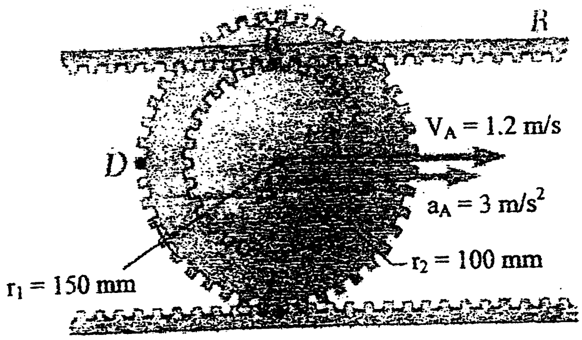
2. A 30 kg block is dropped from a height of 2 m onto the 10 kg pan of a spring scale. Assuming the impact to be perfectly plastic, determine the maximum deflection of the pan. The constant of the spring is k = 20 kN/m. [8]



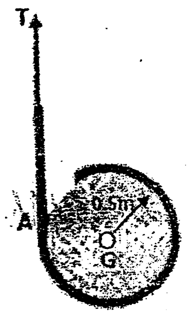
3. A double pendulum as shown in figure below oscillates in the X-Y plane. As shown in figure below, $W_1 = 2$ rad/sec. CCW and $W_2 = 4$ rad/sec CCW. What is $\vec{H}_0$ at this instant if $m_1 = 1$ kg and $m_2 = 2$ kg. The lower pendulum is connected to mass m_1, by a pin joint and is free to rotate about this point. [8]



4. The center of the double gear has a velocity and acceleration to the right of 1.2 m/s and 3 m/s^2, respectively. The lower rack is stationary. Determine (a) the angular acceleration of the gear and (b) the acceleration of points B, C and D. [8]



5. A chord is wrapped around a homogeneous disk of radius r = 0.5 m and mass m = 30 kg as shown in figure below. If the cord is pulled upward with a force T of magnitude 200N, determine (a) the acceleration of the center of the disk (b) the angular acceleration of the disk (c) the acceleration of the chord. [6]



6. Derive the expression for the resultant force on the system with variable mass. [4]

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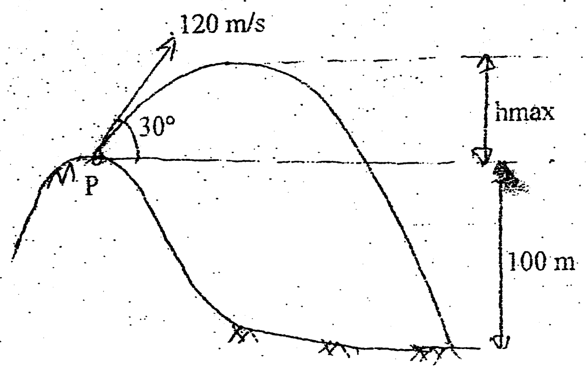
06 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Chaitra

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

Subject: - Applied Mechanics (Dynamics) *(CE501)*

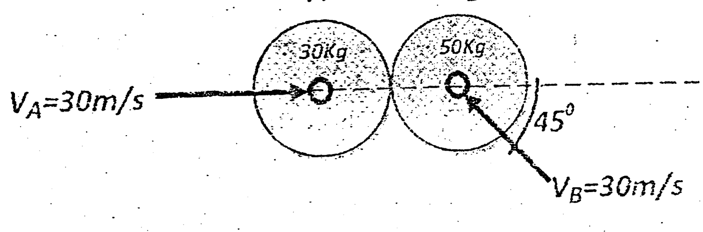
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. A bullet is fined at an angle of 30° to the horizontal from a point 'P' on a hill and it strikes a target which is 100m lower than the level of projection. The initial velocity of the bullet is 120 m/s. Neglecting the air resistance calculate: [6]



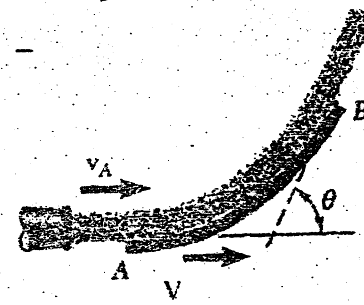
   i) The maximum height to which the bullet will rise above the horizontal
   ii) The actual velocity with which it will strike the target
   iii) The total time required for the flight of bullet

2. The magnitude and direction of the velocities of two frictionless balls with the mass m_A = 30 kg and m_B = 50kg before they strike each other are shown in figure below. Assume e = 0.9, determine the magnitude and direction of the velocity of each ball after the impact. [8]

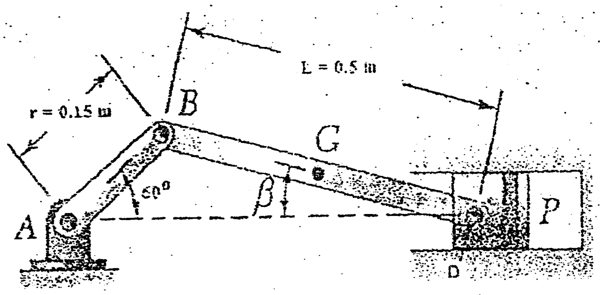


3. A nozzle discharges a stream of water of cross-sectional area "A" with a velocity V_A. The stream is deflected by single blade which moves to the right with a constant velocity V. Assuming that the water moves along the blade at a constant. Determine: [8]

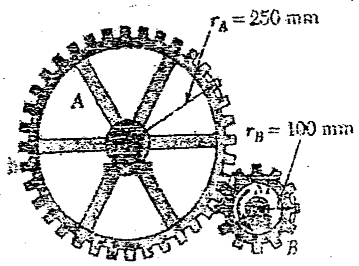
   i) The component of forces exerted by the blade on the stream.
   ii) The velocity V for which maximum power is developed.



4. Crank AB of the engine system has a constant clockwise angular velocity of 200 rpm, which makes the angle 60° with horizontal level. For the crank position shown in figure below. Determine the angular acceleration of the connecting rod BD and the acceleration of point D. [8]



5. The system is at rest when a moment of M = 8 N-m is applied to gear B. Neglecting friction (a) determine the number of revolutions of gear B before its angular velocity reaches 540 rpm and (b) tangential force exerted by gear B on gear A. [6]



$m_A = 10\text{kg}$ $\bar{k}_A = 200\text{mm}$
$m_B = 3\text{kg}$ $\bar{k}_B = 80\text{mm}$

6. Deduce an expression which shows the relation for the force exerted by the vane on the stream while you are dealing with the steady stream of particles. [4]

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06 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

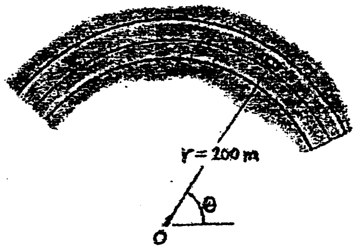
2072 Kartik

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	40
Programme	BCE, BGE	Pass Marks	16
Year / Part	II / I	Time	1 ½ hrs.

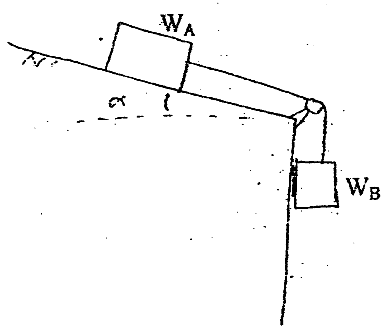
Subject: - Applied Mechanics (Dynamics) *(CE501)*

- ✓ 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.*

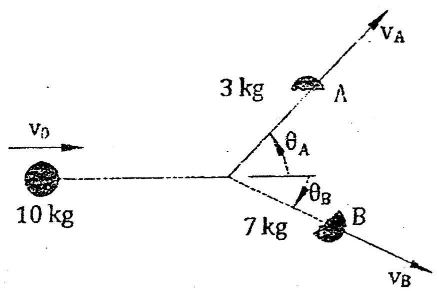
1. A radar gun at 0 rotates with the angular velocity of $\dot{\theta} = 0.1\,\text{rad/s}$ and angular acceleration of $\ddot{\theta} = 0.025\,\text{rad/s}^2$, at the instant $\theta = 45°$, as it follows the motion of the car travelling along the circular road having a radius of $r = 200$ m. Determine the magnitude of velocity and acceleration of the car at this instant. [4]



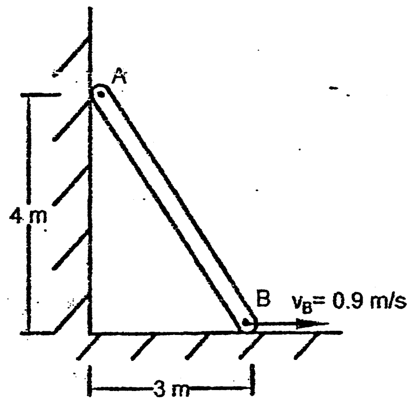
2. Tow block A and B are connected by means of an inextensible and weightless cord as shown in figure below. The bodies start to slide from rest. If the dynamic coefficient of friction is 'μd' for block A on the surface inclined at an angle α, compute the velocity of the object A at any time t, before the body A reaches the end of incline. [8]



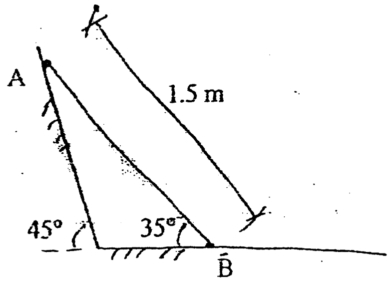
3. Derive equation for kinetic energy of a system of particles. A 10 kg projectile is moving with a velocity of 30 m/s when it explodes into two fragments A and B, weighing 3 kg and 7 kg respectively. Knowing that immediately after the explosion, fragments A and B travel in directions defined respectively by $\theta_A = 45°$ and $\theta_B = 30°$, determine the velocity of the each fragment. [4+4]



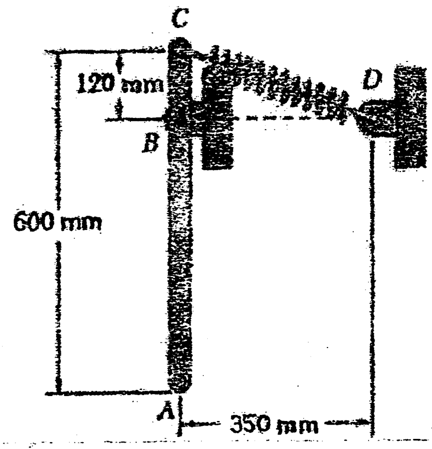
4. When does a general plane motion occur in a rigid body? Give some examples of GPM. The end B of the rod AB moves with a constant velocity $V_B = 0.9\,m/s$ (toward right). Determine velocity of end A and angular velocity of rod AB. [3+5]



5. The entremities of a 1.5 m rod of mass 30 kg may move freely and with no friction. If the rod is released initially from rest from the position shown, determine angular acceleration of the rod. [4]



6. Write the expression for kinetic energy of a rigid body in rotational motion with notations. A slender 4 kg rod AC can rotate in a vertical plane about a pivot at B. A spring of constant K = 400 N/m and of outstretched length 150 mm is attached to the rod as shown. Knowing that the rod is released from rest in the position shown, determine its angular velocity after it has rotated through 90°. [1+7]



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05 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

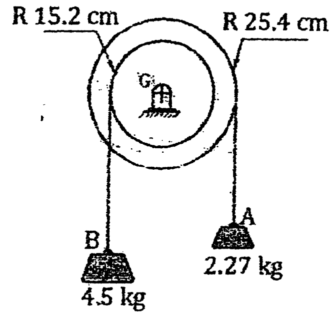
2071 Shawan

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

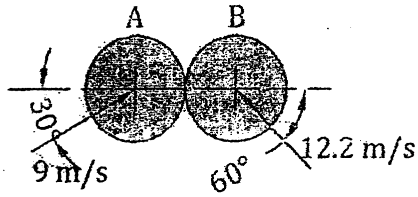
Subject: - Applied Mechanics *(Dynamics) (CE501)*

- ✓ 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. Derive expression for tangential and normal components of acceleration while the particle moves in a curve path. A pulley weighing 5.44 kg and having a radius of gyration of 20.3 cm is connected to two blocks as shown in figure below. Assuming no axel friction, determine the angular acceleration of the pulley. [4+4]



2. Illustrate "Principle of conservation of energy" with an appropriate example. The magnitude and direction of the velocities of two identical frictionless balls before they strike each other are as shown in figure below. Assuming e = 0.9, determine the magnitude and direction of the velocity of each ball after the impact. [3+5]



3. A system of particles has masses $m_1 = 5$ kg, $m_2 = 2$ kg and $m_3 = 6$ kg and their locations and velocities at time t_1 and time t_2 are shown in figure (a) and (b) respectively. What is the total linear impulse on the system during this time interval? Also determine the total angular impulse of the system during this time interval about the origin. [8]

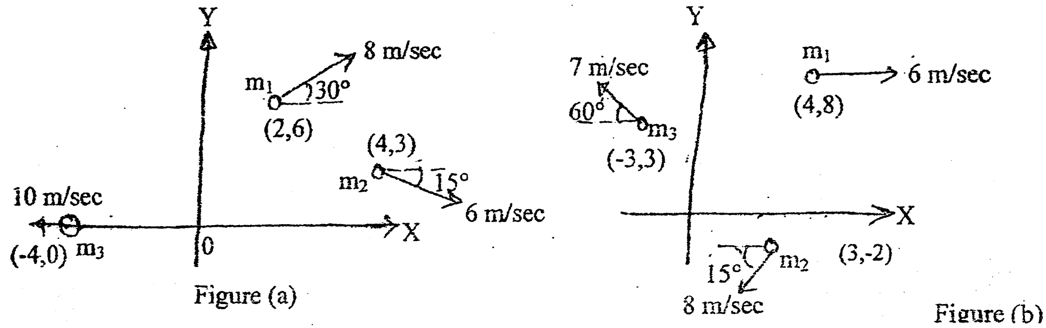
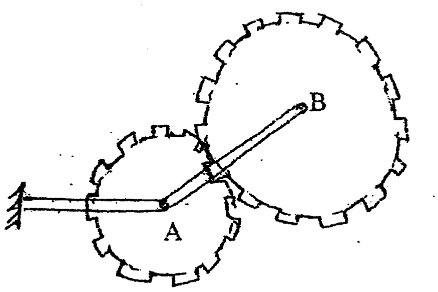
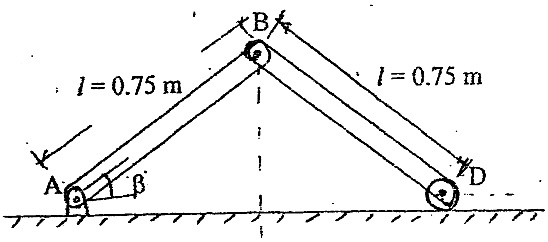


Figure (a) Figure (b)

4. Gear A rotates with an angular velocity of 120 rpm clockwise and angular velocity of arm AB is 90 rpm. Determine the corresponding angular velocity of Gear B. [8]



5. Each of the two slender rods shown in figure below is 0.75 m long and has a mass of 5 kg. If the system is released from rest when β=50°, determine: (a) the angular velocity of rod AB, when β = 30° (b) the velocity of point D at the same instant. [8]



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P.7

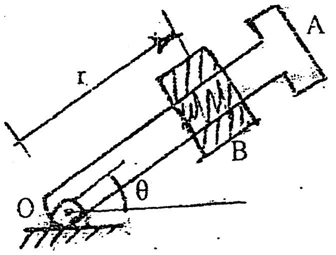
05 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Chaitra

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

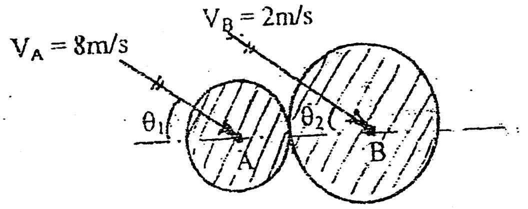
Subject: **- Applied Mechanics (Dynamics) (*CE501*)**

- ✓ 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. Rotation of the arm about 'O' is defined by $\theta = 0.45t^2$, where 'θ' is in radian and 't' is in seconds. Collar 'B' slides along the arm such that $r = 1\text{-}0.4t^2$, where 'r' is in meter. After the arm has rotated through 60°; determine: (a) the total velocity of the collar (b) the total acceleration of the collar (c) the relative acceleration of the collar with respect to the arm. [4]

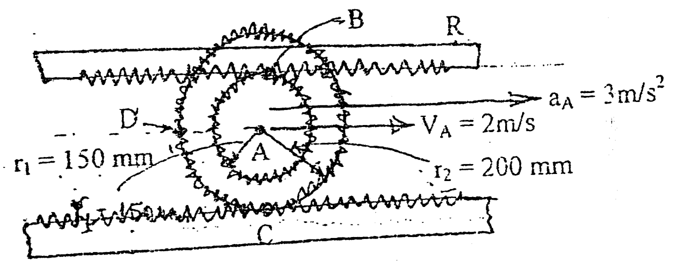


2. The two balls of masses 2 kg and 4 kg with a velocities 8m/s and 2m/s respectively; collides to each other. At the instant of impact, the velocities of the two bodies are parallel and inclined at 30° to the line of impact. Determine the magnitude and directions of the velocities after the impact if the coefficient of restitution, ρ =0.6. [8]



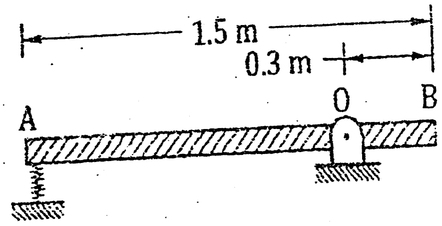
3. Show that the moment due to force resultant force about the fixed point O of the external forces is equal to the rate of change of angular momentum about O of the system of particles. While crushing in level flight at a speed of 913.3 km/hr a jet airplane scoops in air at a rate of 108.86 kg/s and discharges it with a velocity of 670.56 m/s relative to the airplane. Determine the total power developed by the engine. [2+6]

4. Define the instantaneous center of rotation with examples. The center of double gear has a velocity of 2m/s to the right and the acceleration of 3 m/s² to the right. If the lower rack is stationary; determine: (a) The angular acceleration of the gear (b) The acceleration of the points B, C and D of the gear. [4+4]



5. Explain De'Alembert's principle in relation to Newton's 2nd Law of motion. [4]

6. Define conservative and non conservative system with two examples for each. A 13.6 kg slender rod AB is 1.5 m long and is pivoted about a point O which is 0.3 m from end B. The other end is pressed against a spring of constant k = 315 kN/m until the spring is compressed 2.54 cm. The rod is then in a horizontal position. If the rod is released from this position, determine its angular velocity and the reaction at the pivot O as rod passes through a vertical position. [2+6]



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2070-03-

03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Ashad

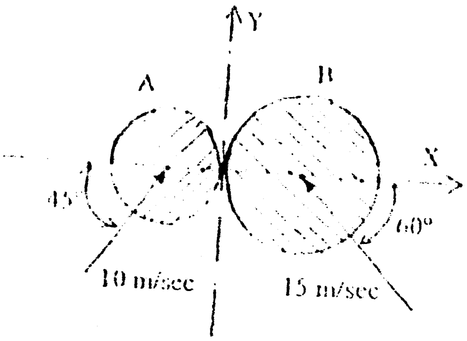
Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	40
Programme	BCE	Pass Marks	16
Year / Part	II / I	Time	1½ hrs.

Subject: - Applied Mechanics (Dynamics) *(CE501)*

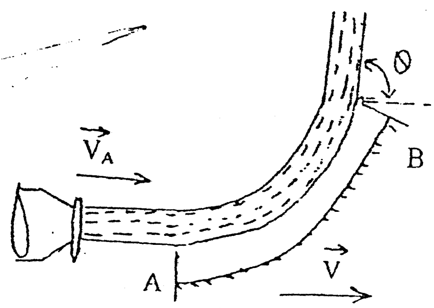
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. What do you understand by Radial and Transverse components of acceleration? Derive an expression for the same. [4]

2. Two balls A and B having mass 5 kg and 8 kg respectively collide as shown in figure below. Determine their velocity immediately after the impact if the coefficient of restitution is 0.80. How much K.E will be lost due to the impact? [8]

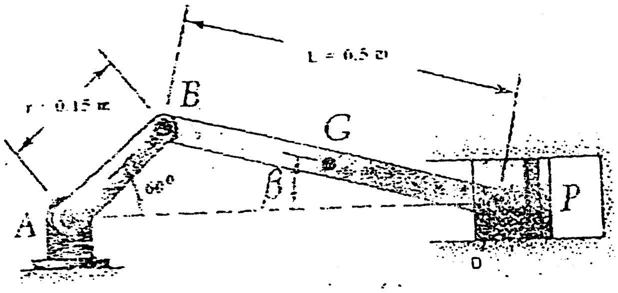


3. A nozzle discharges a stream of water of cross sectional area A with a velocity $\vec{V}_A$. The stream is deflected by a single blade which moves to the right with a constant velocity $\vec{V}$. Assuming that water moves along the blade at constant speed, determine the components of the force $\vec{F}$ exerted by the blade on the stream and velocity $\vec{V}$ for which maximum power is developed. (see figure below). [8]



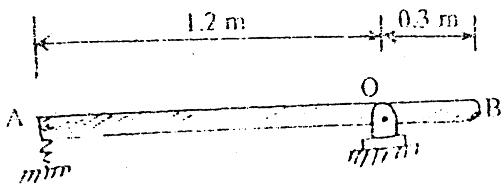
Moving blade

4. Crank AB of the engine system has a constant clockwise angular velocity of 200 rpm, which makes the angle 60° with horizontal level. For the crank position shown in figure below. Determine the angular acceleration of the connecting rod BD and the acceleration of point D. [8]



5. Define the term rigid body. Describe, with an example, how you would apply D' Alemberts principle in plane motion of rigid body. [4]

6. A 20 kg slender rod AB is 1.5 m long and is pivoted about a point 'O' which is 0.3 m from end 'B'. The other end is pressed against a spring of constant K = 400 KN/m until the spring is compressed 20 mm. The rod is then in horizontal position. If the rod is released from this position, determine it's angular velocity and reaction at the pivot 'O' as the rod passes through a vertical position. (see figure below) [8]



03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Chaitra

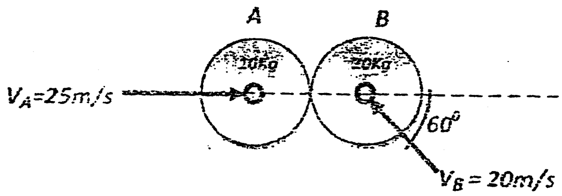
Exam.	Regular		
Level	BE	Full Marks	40
Programme	BCE	Pass Marks	16
Year / Part	II / I	Time	1½ hrs.

Subject: - Applied Mechanics (Dynamics) *(CE501)*

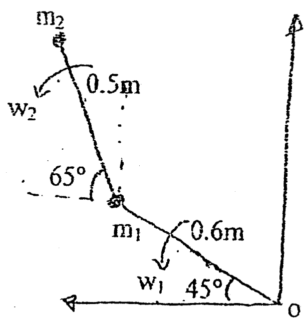
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. Derive an expression for tangential and normal components of a acceleration for a particle moving along a curve path. [4]

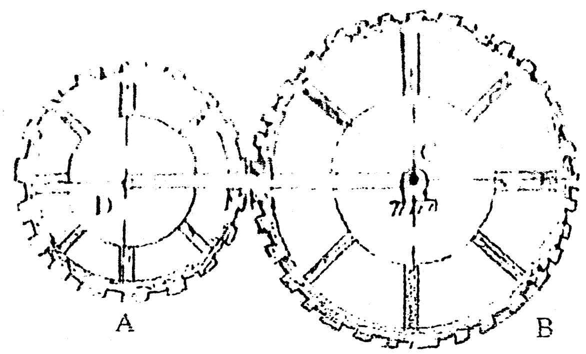
2. The magnitude and direction of the velocities of two frictionless balls with the mass m_A = 100kg and m_B = 20kg before they strike each other are shown in figure below. Assume e = 0.7, determine the magnitude and direction of the velocity of each ball after the impact. How much K.E will be lost due to the impact? [8]



3. Mass m_2 rotates about mass m_1 with angular velocity w_2 and mass m_1 rotates about 0 with angular velocity w_1. Calculate the angular momentum of the system about origin.
w_1 = 5 rad/s ccw m_1 = 2.2 kg w_2 = 4 rad/s ccw m_2 = 1.6 kg [8]

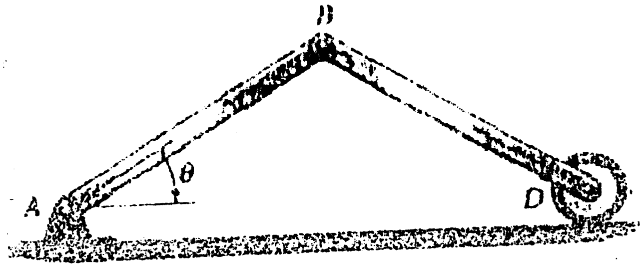


4. The gear A of the system as shown in figure below rotates with angular velocity w_A = 200rpm (↻) and connecting arm CD rotates with w_{CD} = 70rmp (↺). Determine the angular velocity of gear B. Radius of gear A and B are 100 and 150 mm respectively. [8]



5. State De' Alembert's principle and show that the external force acting on the body are equivalent to a force-couple system consisting of a vector force attached to the mass center and a couple about the mass center. [4]

6. Each of two slender rods AB and BD has length 1.5m and has the same mass of 12kg as shown in figure below. If the system is released from rest with $\theta = 50°$, determine (a) the angular velocity of rod AB when $\theta = 10°$ (b) the velocity of point D at the same instant. [8]



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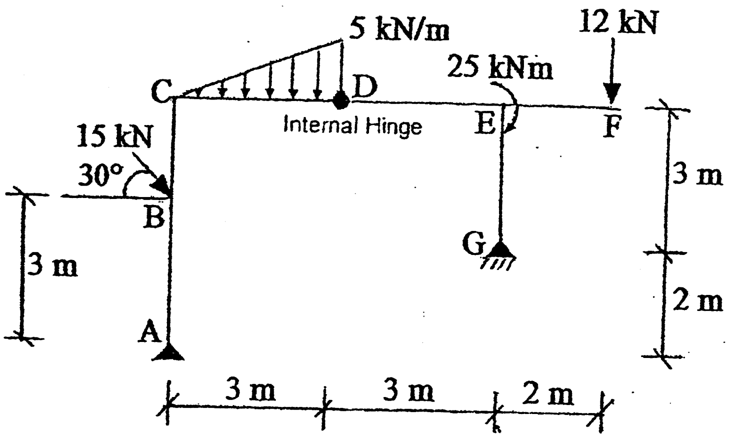
TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Bhadra

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

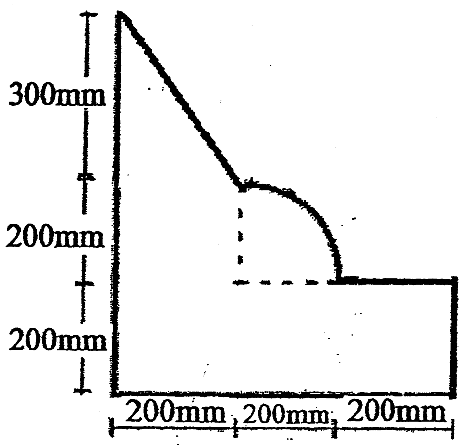
Subject: - Strength of Materials *(CE 502)*

- ✓ 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. Draw axial force, shear force and bending moment diagrams for the frame shown in the figure below. Also indicate the salient features. [16]

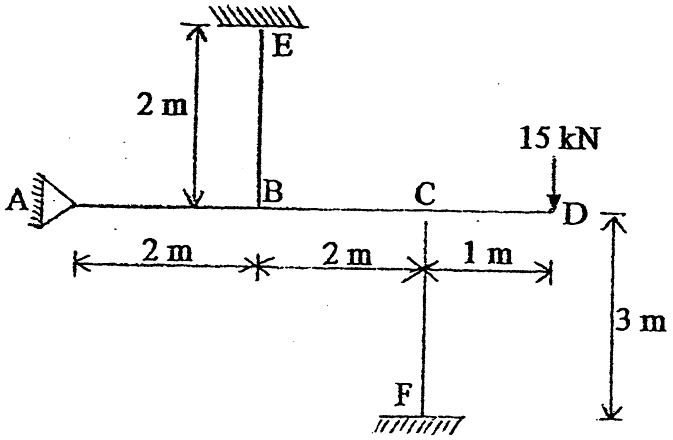


2. Find out the principle axis and principle moment of inertia for the given section and verify using Mohr's circle. [12]



3. a) Derive the expression for the elongation of a circular bar of tapering section due to axial load. [6]

b) A rigid bar 'ABCD' is supported at 'A' and connected with a brass rod BE and a steel rod CF at 'B' and 'C' respectively as shown in the figure. A load of 15 kN is applied at 'D'. Find the magnitude of stress in the brass rod and the steel rod. Take $A_b = 1000\ mm^2$, $A_s = 600\ mm^2$, $E_b = 100\ kN/mm^2$ and $E_s = 200\ kN/mm^2$. [8]



4. a) The tensile stress at a point on two perpendicular planes along X-axis and Y-axis are 120 MN/m^2 and 60 MN/m^2 respectively. Find principle stresses and their direction. Based on obtained data, verify stress invariant concept. What will be the intensity of stress which acting alone can produce same maximum strain? Take poisson's ratio = ¼. [10]

b) A cylindrical vessel 3 m long and 600 mm diameter with 10 mm thick plates is subjected to an internal pressure of 3 MPa. Calculate the change in volume of the vessel. Take E = 200 GPa and Poisson's ratio = 0.3 for the vessel material. [4]

5. a) A solid shaft is to transmit 300 kW at 120 rpm. Determine the diameter if the allowable shear stress is 100 N/mm^2 and the allowable angle of twist is 30° per diameter length of the shaft. Assume that the maximum torque is 1.3 times the mean torque. Take $G = 10^5 MPa$. [8]

b) What is pure bending? Explain with suitable example. Determine the maximum deflection in a simply supported beam AB of length L, carrying uniformly distributed load of intensity w kN/m over whole span. [8]

6. A round bar fixed at bottom and free at top has a length of 3 m. Determine the buckling load for the bar if the load is applied axially on top. If a horizontal force of 15 kN at top can produces a horizontal deflection of 35 mm. [8]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Baishakh

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

Subject: - Strength of Materials (*CE 502*)

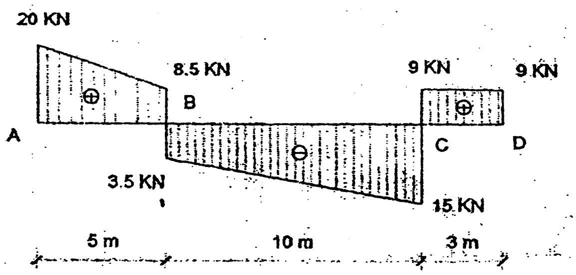
✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt All questions.*
✓ *The figures in the margin indicate Full Marks.*
✓ *Assume suitable data if necessary.*

1. a) Define geometrical stability of the structure. "A structure which is statically determinate or indeterminate may be geometrically unstable". Give example to support the statement. [4]

   b) The shear force diagram (SFD) of an overhanging beam AD with support at A and C is shown in figure. Using it, determine

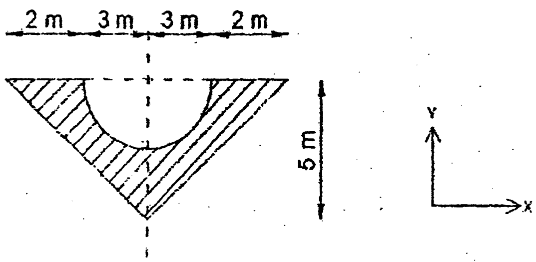
   i) Bending moment at critical location and bending moment diagram.

   ii) Loading on the beam. [12]



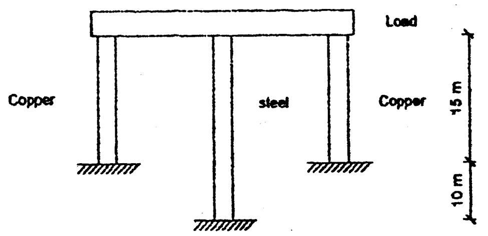
2. a) Find from first principle the product of inertia about centroidal axis of a quarter circle lying in first quadrant. [4]

   b) Determine moments and product of inertia about centroidal axes for a shaded area shown. What will be the change in these values about an axis inclined at 30° counterclockwise to the centroidal X and Y-axis? From the data obtained, show that the polar moment of inertia is invariant under rotation transformation. [8]

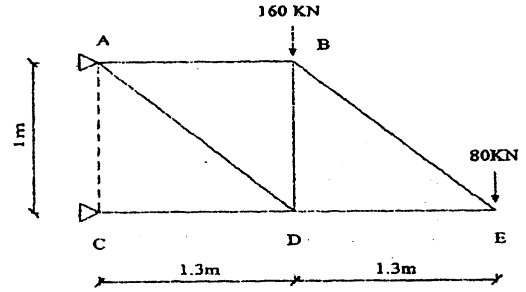


3. a) What is the significance of upper yield point as seen in ductile material like mild steel? Also explain how to specify the strength of materials which do not have distinct yield point. [4]

b) Two cooper rods and one steel rod together support a load as shown in figure. If the stress in copper and steel are not to exceed 550 kg/cm^2 and 1000 kg/cm^2 respectively. Determine the safe load that can be applied. The cross section of copper is 3×3 cm^2 and that of steel is 4×4 cm^2. Take Es=2Ec. [7]



c) A steel truss is acted upon by the force as shown. It is found that a 20 mm diameter steel rod is capable of taking an ultimate load of 150 kN. If factor of safety is to taken as 3; determine the required diameter of rod BE. [5]

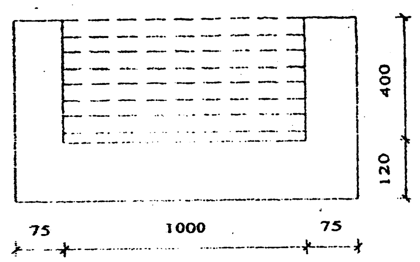


4. What is Mohr's stress circle? Write step wise step procedure for Mohr's circle construction to determine stress on an inclined plane, the plane acting with "like normal stresses". Verify it with the expression obtained analytically. [8]

5. Compare thin and thick walled vessel. A thin cylindrical shell is made of steel plates. It has hemispherical ends having diameter 300 mm and wall thickness 2 mm. Determine the thickness of cylindrical portion if there is no distortion of the junction under pressure. Take Es = 200 GPa and poisson's ratio = 0.3. [2+4]

6. Discuss shaft in series and parallel on the basis of total angle of twist and torsion. A hollow steel shaft 20 cm in internal diameter and 30 cm external diameter is to be replaced by a solid alloy shaft. If the tensional rigidity is same for both the shafts, determine the ratio of polar moduli. G for steel is equal to 2.5 times G for alloy. [8]

7. An 8 m long reinforced concrete channel section as shown is carrying water. Calculate maximum tensile and compressive bending stresses. $r^c = 25 kN/m^3, r^w = 10 kN/m^3$. [8]



8. Write an empirical formula for calculating critical load for intermediate column. Calculate the maximum value of slenderness ratio of steel column for which Euler's formulas is valid. Take $\sigma c = 330\ MN/m^2$ and $E = 210\ GN/m^2$. [6]

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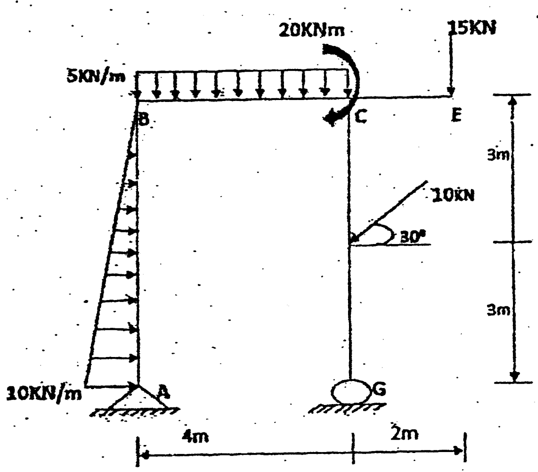
TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Bhadra

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

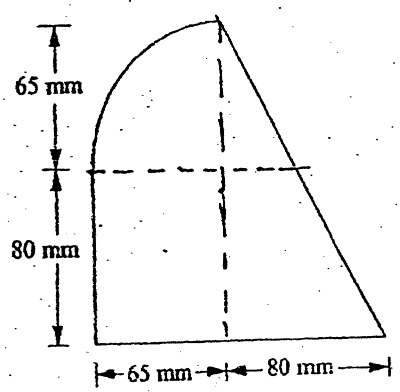
Subject: - Strength of Materials *(CE 502)*

- ✓ 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. Draw axial force, shear force and bending moment diagram of given loaded frame. Also show the salient feature. [16]



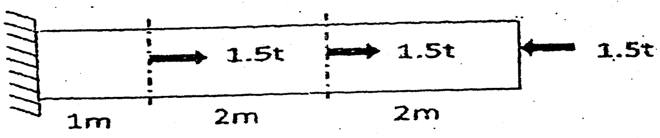
2. a) Calculate the principal moment of inertia about the centroid and locate the principal axes for the figure as shown below. [12]



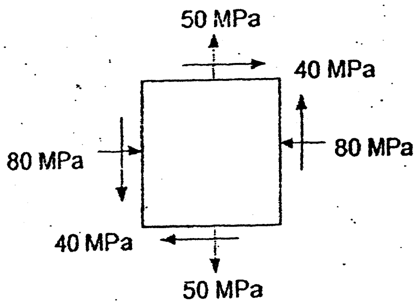
b) A seamless spherical vessel of 1.9 m internal diameter and 6 mm thick is filled with a fluid under pressure until its volume increases by 400 cm^2. Calculate the pressure exerted by the fluid in the vessel. Take 2×10^5 N/mm^2 and Poisson's ratio = 0.25. [6]

3. a) Derive relationship between young's modulus and bulk modulus. [6]

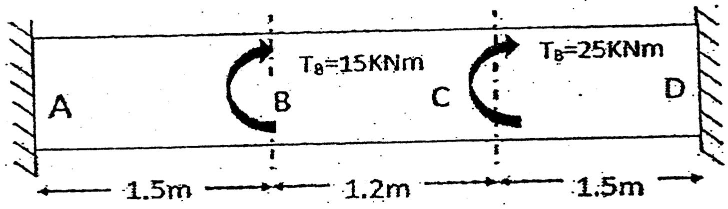
b) At what distance 'x' from the fixed end of the uniform bar should the '2t' force be applied in order that the net overall change in length of the bar will be zero? [8]



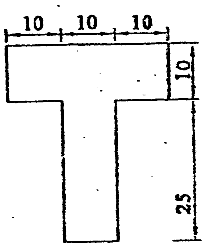
4. a) For an infinitesimal element normal and shearing stresses in the two mutually perpendicular planes are given below. Determine the normal and shearing stresses on the inclined plane at an angle of 20° with vertical. Also calculate principal stresses, their planes, maximum shear stresses and their planes. [8]



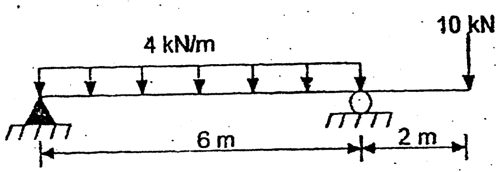
b) Determine the end fixing couples, diameter of the shaft if the maximum shearing stress is not to exceed 50 MN/m^2 and the position of the section where the shaft suffers no angular twist. [8]



5. a) Determine the maximum bending stress in the beam shown in figure below. [10]



All dimensions are in cm



b) A hollow mild steel tube is 5 m long and 4 cm internal diameter. Thickness of tube is 8 mm and it is used as a strut with both ends hinged. Determine critical load and safe load on the strut. Take $E = 2.1\times10^5$ N/mm^2 F.O.S = 3 [6]

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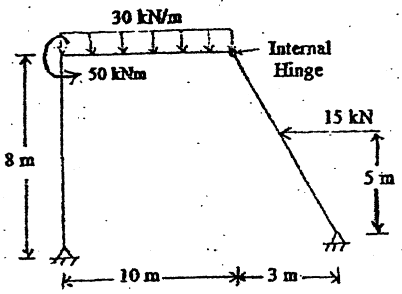
TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Kartik

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

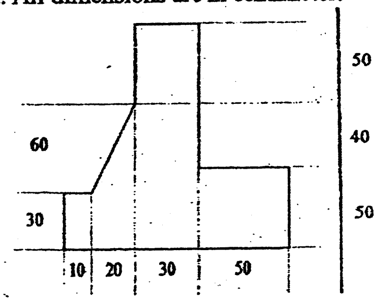
Subject: - Strength of Materials *(CE 502)*

- ✓ 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. Draw axial force diagram, shear force diagram and bending moment diagram for the frame shown, indicating the salient features. [16]



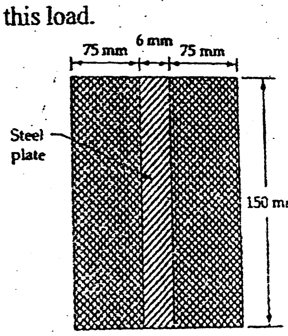
2. a) Determine principal moment of inertia and orientation of principal axes passing through the centroid. All dimensions are in centimeter. [12]



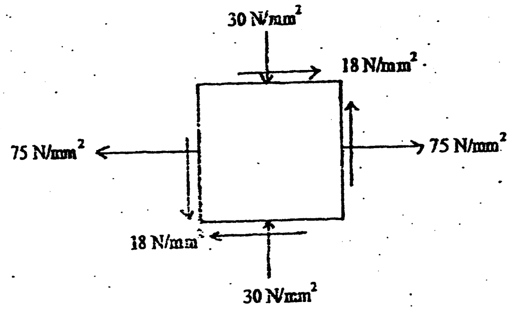
b) In a thin walled cylindrical vessel show that the volumetric strain is equal to two times circumferential strain plus longitudinal strain. [6]

3. a) Derive a relation between Young's modulus of elasticity, Shear modulus and bulk modulus. [6]

b) Two 150 mm × 75 mm × 4 m long timber members are reinforced with a steel plate 150 mm × 6 mm × 4 m long as shown in figure. The three members are adequately bolted together. The permissible stresses for the timber and the steel members are 6 N/mm^2 and 130 N/mm^2 respectively. E for timber is 8.4 GN/m^2 and for steel is 210 GN/m^2. Calculate the permissible tensile load for the composite member and the amount of elongation due to this load. [8]



4. a) Determine the principal stresses, orientation of principal planes, maximum shearing and normal stress on the plane of maximum shear stress. Verify the results by drawing Mohr's Circle. [8]



b) A steel shaft transmits 200 horse power at 150 rpm. If the shaft is 110 mm in diameter, find the torque in the shaft and the maximum shear stress developed. Also, determine the angle of twist for the shaft in the length 5 m. Take G = 90 GN/m^2. (1 hp = 746 watt) [8]

5. a) A simply supported timber joist of 6 m span has to carry uniformly distributed load 5 kN/m over its entire length and a point load of 15 kN at its center. Determine the dimensions of the rectangular joist if the maximum permissible stress in bending is 12 N/mm^2. [8]

b) Derive an expression for Euler's formula for crippling load of a column of length 'L' with one end fixed and other hinged condition. [8]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Chaitra

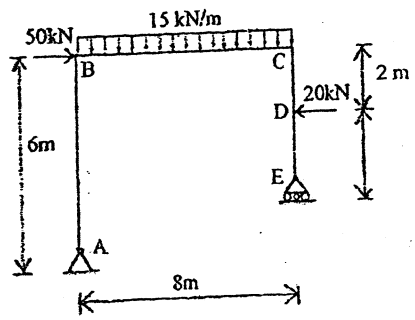
Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Strength of Materials *(CE 502)*

- ✓ 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.*

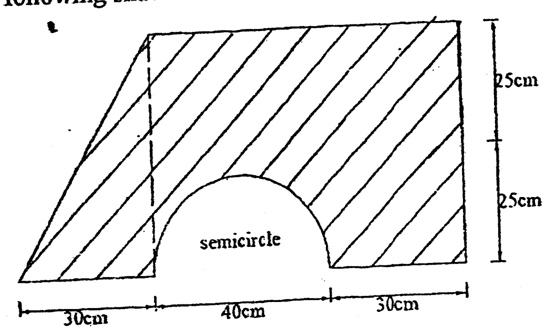
1. a) Define point of contraflexure. Derive the relationship between rate of loading, Shear force and Bending moment. [2+4]

   b) Draw axial force shear force and bending moment diagram for a given loaded frame. Also write the salient features. [10]

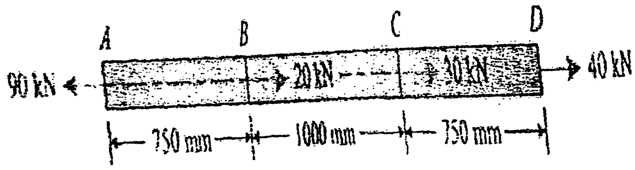


2. a) Define principal moment of inertias and principal axes. [2]

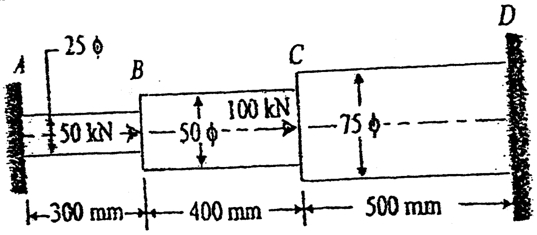
   b) Determine principal moment of inertias and principal axes passing through the centroid for the following shaded area. [10]



3. a) Find the total elongation in the bar. Take E for the material as the 200Gpa. A Steel bar of 600 mm^2 cross-sectional area is carrying loads as shown in the figure given below. [6]



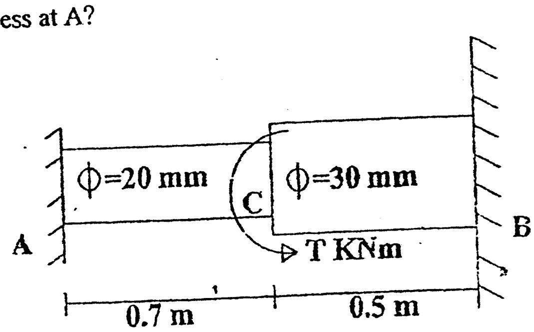
b) A Circular bar ABCD, rigidly fixed at A and D is subjected to axial loads of 50 KN and 100 KN at B and C as shown in the figure. Find the loads shared by each part of the bar and displacements of the points B and C. Take E for the steel as 200Gpa. [10]



4. Direct stresses of 100 MPa in tension and 60 MPa in compression are applied to an elastic material at a certain point on planes right angles to each other. If the maximum stress in not to exceed 150 MPa, to what shearing stress can the material be subjected at the point? What is then the maximum shearing stress in the material? Also find the magnitude of the principal stresses and its planes. [8]

5. A thin cylindrical shell is 5m long and has 1m internal diameter and 20mm metal thickness. Calculate the maximum intensity of shear stress, longitudinal stress and circumferential stress induced, if subjected to an internal pressure of 5 N/mm2. Also calculate change in diameter, length and volume of the shell. Take E = 200 GPa and poisons ratio = 0.3. [6]

6. A steel shaft is connected to fixed supports as shown in figure. Limiting shear stress in the material is 50 MPa. Determine the maximum torque that can be applied at joint C. What is the shear stress at A? [8]



7. A simply supported beam of span 10m is to carry uniformly distributed load 20 KN/m over the entire span and a point load 50 KN at its center. Determine the dimension of beam, if the beam is rectangular in cross section and the maximum permissible stress in bending tension and compression are 120 N/mm^2 and 100 N/mm^2 respectively. Take depth of beam two times its breadth. [8]

8. Derive the Eulers formula for critical load for a strut with both end hinged. [6]

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TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2076 Ashwin

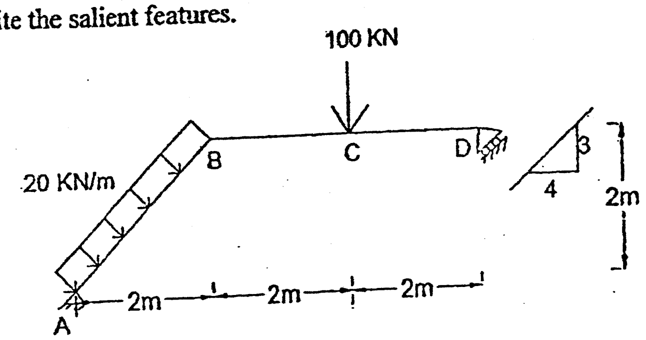
Exam.		Back	
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Strength of Material *(CE 502)*

- ✓ 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.*

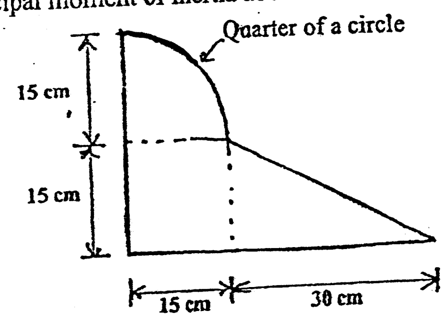
1. a) State the principle of Superposition. Explain the stepwise procedure for the determination of bending moment of the beam using the principle of superposition. [2+2]

   b) Draw axial force, shear force and bending moment diagram for a given loaded frame. Also write the salient features. [12]



2. a) What is radius of gyration? [2]

   b) Determine principal moment of inertia about the centroidal axis of following figure. [10]



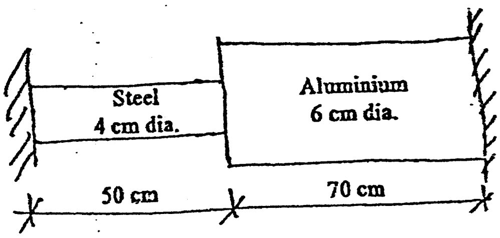
3. a) In an experiment, a bar of 30mm diameter is subjected to a pull of 60 KN. The measured extension on guage length of 200 mm is 0.09 mm and the change in the diameter is 0.0039mm. Calculate the values of Poisson's ratio and three elastic moduli. [6]

   b) A composite bar made up of steel and aluminum is rigidly fixed between two supports as shown in figure. The two bars are free of stress at initial temperature of 25°C. Find the stresses in the two bars when the temperature increases to 50°C if,

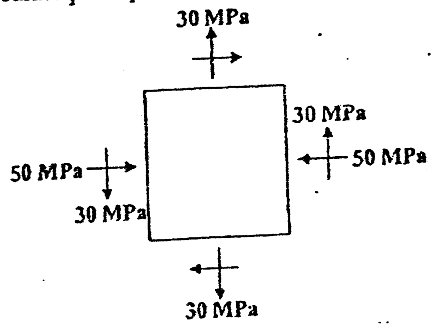
   i) The support are unyielding

   ii) The supports move away from each other by 0.1 mm.

   [Given: E_s=200 GPa, E_A=70 GPa, $\alpha_S=13\times10^{-6}$/°C, $\alpha_A=23.1\times10^{-6}$/°C] [10]



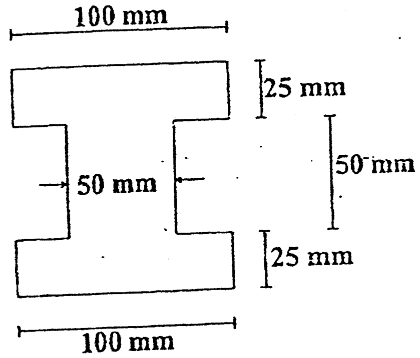
4. a) Determine the normal and shearing stress on the inclined plane at the angle of 40° to the vertical. Also calculate principal stresses and their planes. [8]



b) A 1 m long hollow cylindrical shaft is to be designed to transmit a power of 1670 KW at a rotational speed of 4500 rpm. The outer diameter is to be 1.75 times the inner diameter. The maximum shear stress of the material is to be limited to 210 MPa and the angle of twist is not to exceed 0.5 degrees. Determine the size of the shaft. Assume maximum torque is 30% greater than the average torque. shear modulus of material is 25.5 GPa. [8]

5. a) Derive the Euler's formula for critical load for a strut with one end fixed another hinged. Also mention the limitation for using this formula. [6]

b) A simply supported beam of span 10 m, subjected to UDL w throughout the length. If permissible bending stress in tension and compression are 150 MPa and 180 MPa respectively. Calculate Moment of resistance and value of UDL by assuming the I-section as shown in figure. [8]



6. A cylindrical shell of length 4m internal diameter 300mm and wall thickness of 12mm is initially filled with water at atmospheric pressure. Find the increase in volume if the water is pumped to increase the internal pressure to $6 N/mm^2$. Take $E=2.10\times10^5 N/mm^2$, $v=0.3$ and $K=2100\ N/mm^2$. [6]

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TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2075 Chaitra

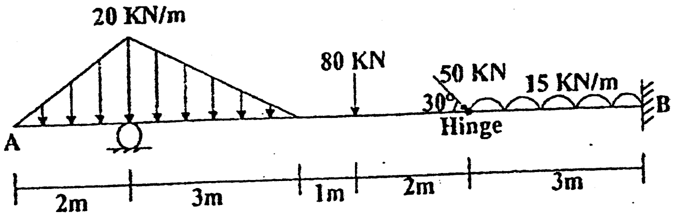
Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Strength of Materials *(CE 502)*

- ✓ 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.*

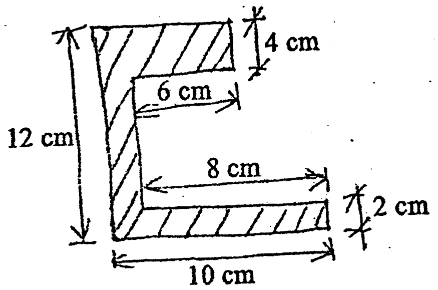
1. a) Briefly explain the properties of internal hinge. What do you understand by point of contraflexure? [2+2]

   b) Draw AFD, SFD and BMD for following beam. Also indicate the silent features. [12]



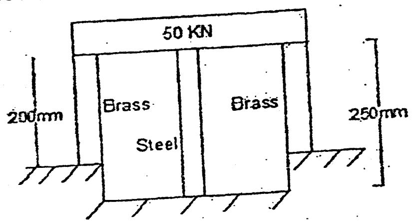
2. a) Define product moment of inertia. [2]

   b) Calculate the principal moments of inertia of the section given in figure and their orientation. Assume horizontal and vertical axes to be the given x and y axes and the bottom left corner of the section to be the origin for the purpose of your calculation. [10]

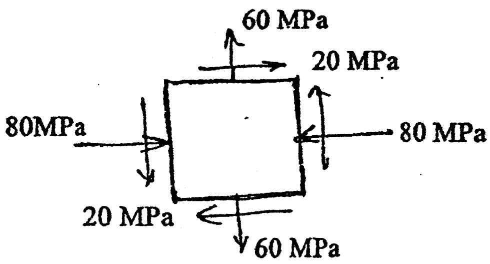


3. a) Determine the expression for elongation in bar having uniformly tapering circular section subjected to tensile load P. [6]

   b) A steel rod of cross sectional area $1000 mm^2$ and two brass rod each of cross sectional area $800 mm^2$ together support the load of 50KN. Calculate the stresses in the rod. Take E for steel as 200GPa and E for brass as 100 GPa. [10]



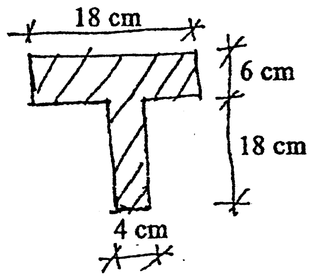
4. a) The state of stress in a two dimensional stress system is shown in figure. Determine the principal stresses and their direction, maximum shear and associated normal stress. [8]



b) Prove that the hollow shaft of same material, same weight and same length is more stronger than the solid shaft in case of torque transmission. [8]

5. a) Derive Euler critical buckling load formula for a column having one end fixed and the other end free. Discuss the limitations of Euler buckling formula. [6]

b) A 3.0m long cantilever beam having self-weight 1.5 kN/m is subjected to a downwards point load of 'P' kN at the free end. Determine the value of 'P' and the moment of resistance of the beam. Take permissible bending stress in tension and compression as 150MPa. The cross section is shown in figure. [8]



6. A cylindrical shell of 260mm external diameter 2.5 m length and 5mm wall thickness is subjected to internal pressure of 1.60 MPa. Calculate the change in diameter, length and volume of the cylinder if the cylinder has a longitudinal joint (85% efficiency) and circumferential joint (65% efficiency). Take Young's modulus = 200GPa and Poisson's ratio = 0.3 [6]

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07 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

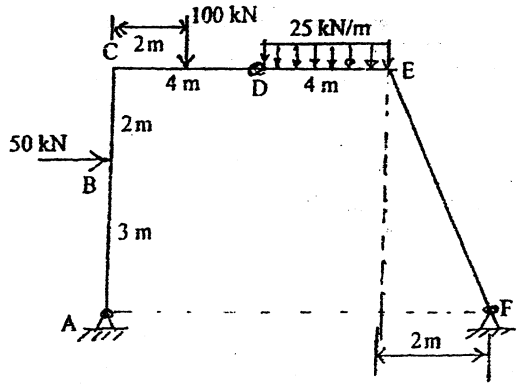
2075 Ashwin

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

Subject: - Strength of Materials *(CE502)*

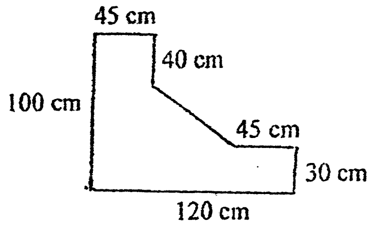
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt __All__ questions.*
- ✓ *The figures in the margin indicate __Full Marks__.*
- ✓ *Assume suitable data if necessary.*

1. Draw axial force, shear force and bending moment diagrams for the frame. Indicate numerical values at salient points. [16]



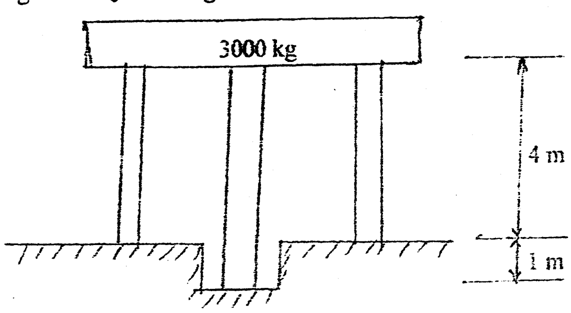
2. a) What is product of inertia? [2]

   b) Determine principal moment of inertia of the given figure below about the axes passing through the centroid. [10]



3. a) Derive the expression for the total elongation of a uniform bar of length L and cross section area A under its self weight. [5]

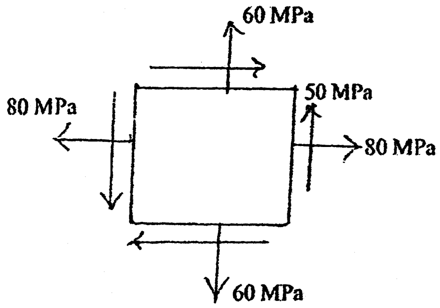
   b) Two copper rods and one steel rod are having diameter 4 cm, together support a load 3000 kg as shown in figure below. Determine the stresses in each rod. Take $E_s = 2 \times 10^6$ kg/cm^2 $E_c = 10^6$ kg/cm^2 [8]



4. a) For the state of plane stress shown in figure below determine. [8]

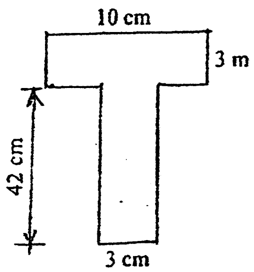
i) principal stresses ii) orientation of principal planes

iii) maximum shearing stress iv) normal stress on the plane of maximum shear stress



b) Derive torsional equation. $\frac{T}{J} = \frac{\tau_s}{R} = \frac{G\varphi}{L}$ [8]

5. a) A simply supported beam of span 5m loaded with udl 4 kN/m. Determine the maximum value of bending stress 15 cm above the base of the cross section. The cross section is T-section as shown in figure. [8]



b) Derive an expression for the Euler's formula for crippling load on a column with both ends fixed. [8]

6. Derive an expression for the volumetric strain of a thin walled cylindrical vessel with its length 'L' internal diameter 'd' and thickness 't'. [7]

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07 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

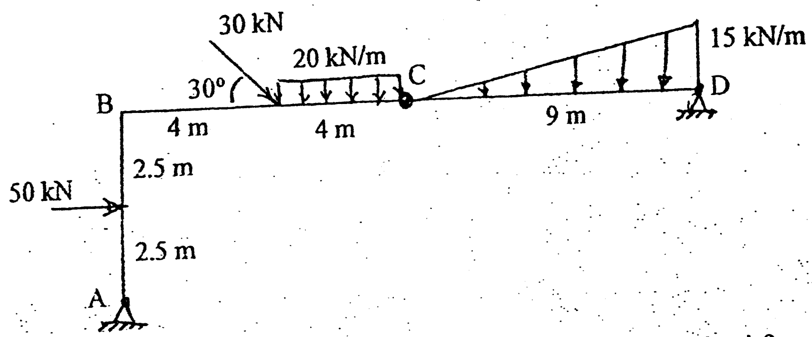
2074 Chaitra

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

Subject: - Strength of Materials *(CE502)*

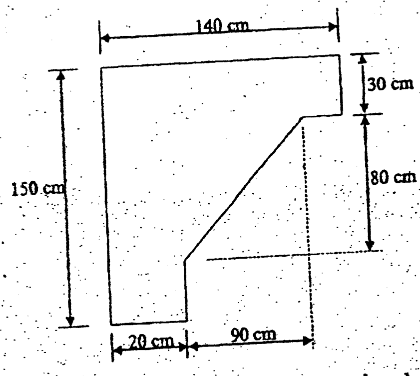
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt __All__ questions.*
- ✓ *The figures in the margin indicate __Full Marks__.*
- ✓ *Assume suitable data if necessary.*

1. Draw axial force, shear force and bending moment diagram for the given frame. Indicate numerical values at salient points. [16]

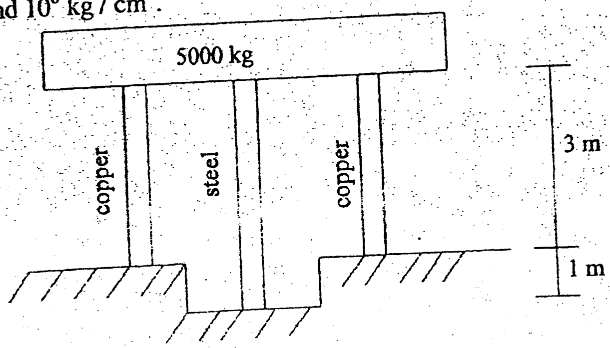


2. a) What do you understand by principle moment of inertia and principal axis? [4]

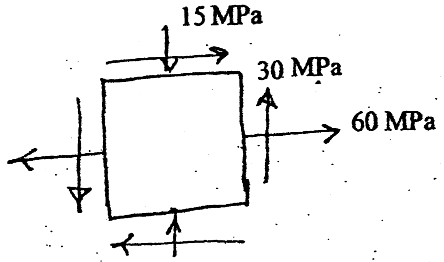
   b) Determine the principle moment of inertia of the given figure. [10]



3. Derive the expression for the total elongation due to the circular tapered bar. Two copper rods and one steel rod is of 3 cm diameter, together support a load of 5000 kg as shown in figure below. Find the stresses in each rod. Take 'E' for steel and copper as 2×10^6 kg/cm^2 and 10^6 kg / cm^2. [6+6]



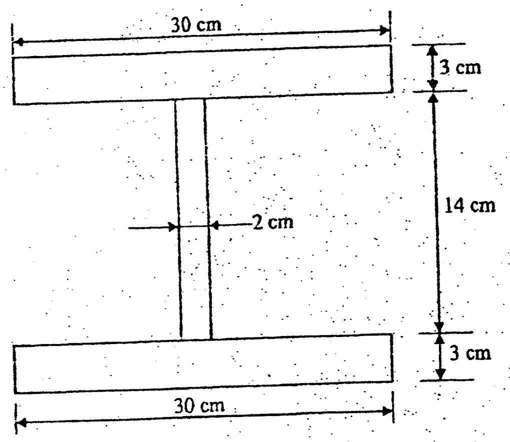
4. a) For the state of plane stress shown in figure below determine (i) the principal planes (ii) principal stresses (iii) the maximum shearing stress and the corresponding normal stress. [8]



b) Show that hollow shaft is more strong than solid shaft when material, weight and length are same. [8]

5. a) Derive the expression for the Euler's formula for crippling load on a column with both ends hinged condition. Explain the limitation of Euler's Formula also. [8]

b) For the simply supported beam of 4m span loaded with UDL of 3 kN/m, determine the value of bending stress 80 mm above the base of the cross section. The cross section of the beam is I section and the dimensions are shown below. [8]



6. Explain the different types of stresses in thin walled cylinders. [6]

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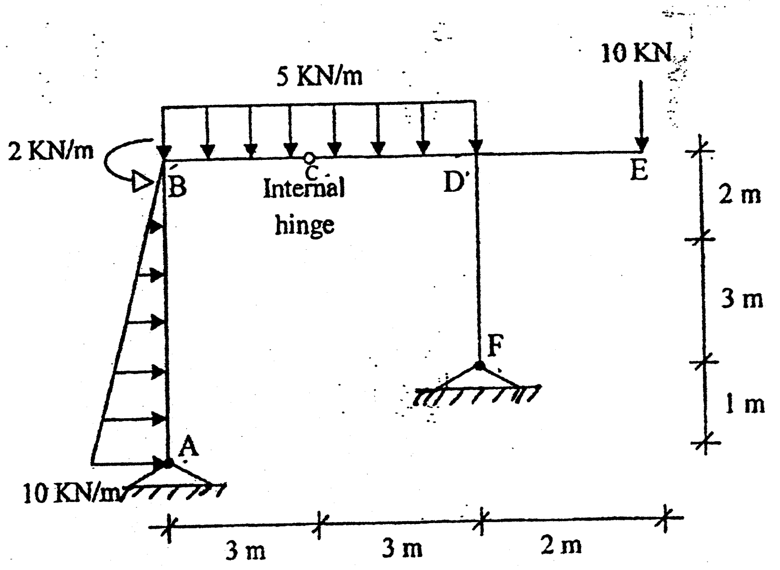
07 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Ashwin

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

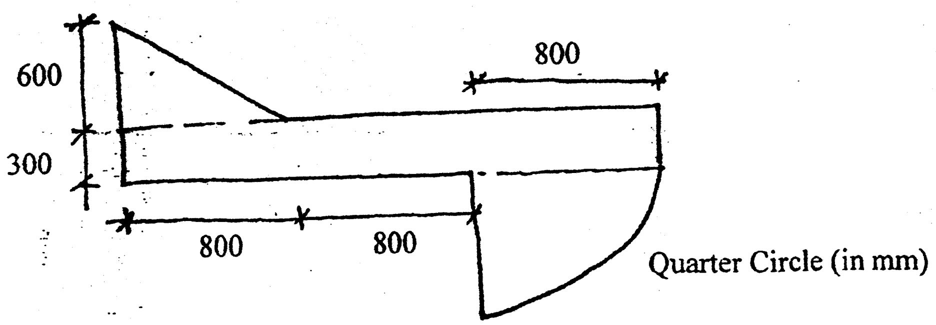
Subject: - Strength of Materials *(CE502)*

- ✓ 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.*

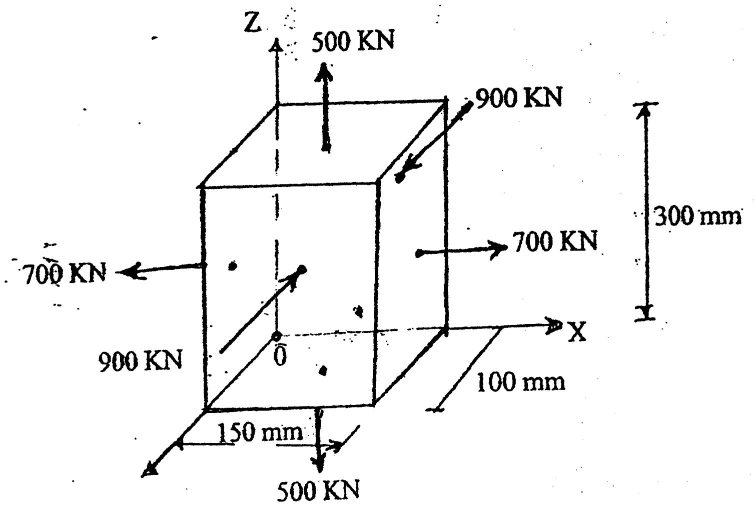
1. Draw axial force, shear force and bending moment diagrams for the frame shown in figure below, indicating the principal numerical values at salient points. [16]



2. Find the principal moments of inertia and directions of principal axes for the section as shown in figure below. [12]

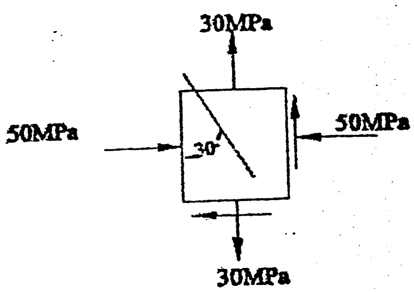


3. a) A block of steel 300 mm×150 mm× 100 mm is subjected to axial loads as shown in figure below. Find the change in the dimensions of the bar and change in volume for the material of the block. Take $E_S = 200\ GN/m^2$ and poisson's ratio (σ) = 0.30. [8]



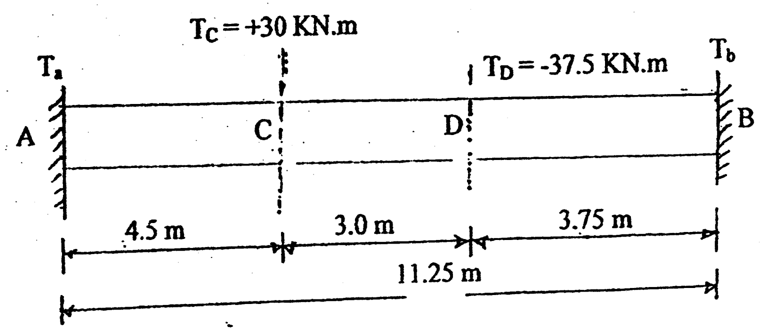
b) What is the stress concentration? What effect is produced in brittle material due to stress concentration? [4]

4. a) For an infinitesimal element normal and shearing stress in the two mutually perpendicular planes are shown in figure below. Determine the normal and shearing stress on the inclined plane at an angle of 30° with vertical. Also calculate principal stresses their planes, maximum shear stress and their planes. Verify your result using Mohr's circle. [12]



b) Prove that longitudinal stress is half of the circumferential stress for the thin cylinder with neat sketch. [4]

5. a) A horizontal shaft securely fixed at each ends has a free length of 11.25 m. Viewed from end "A" of the shaft, axial couples of 30 KN.m clockwise and 37.5 KN.m counter clockwise act on the shaft at a distance 4.5 m and 7.5 m from left respectively. Determine the end fixing couples in magnitude and direction and find the diameter of shaft (solid) for a maximum shearing stress of 60 N/mm^2. [10]



b) Derive the bending equation $\left[\frac{\sigma}{y}=\frac{M}{I}=\frac{E}{R}\right]$ [6]

6. Derive Euler's formula of critical load for a steel column with both ends fixed. Also explain the limitations to the use of this formula. [6+2]

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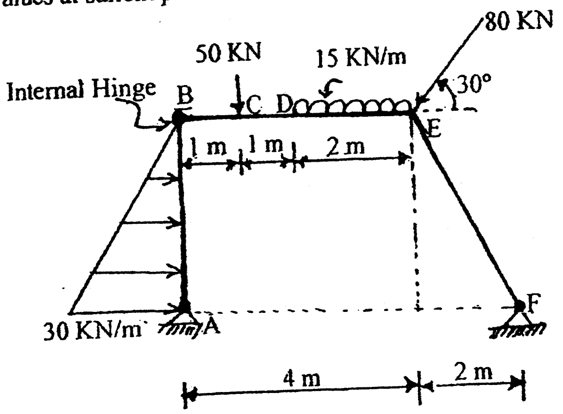
07 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Chaitra

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

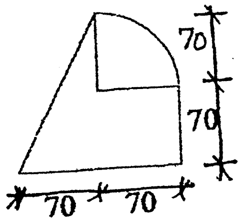
Subject: - Strength of Materials *(CE502)*

- ✓ 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.*

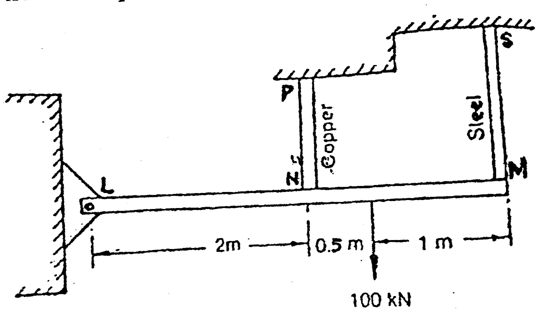
1. Draw axial force, shear force and bending moment diagrams for the given frame. Indicate numerical values at salient points. [16]



2. Define principal moment of inertia and principal axes. Determine the principal axes and principal moment of inertia of the given section. [2+10]

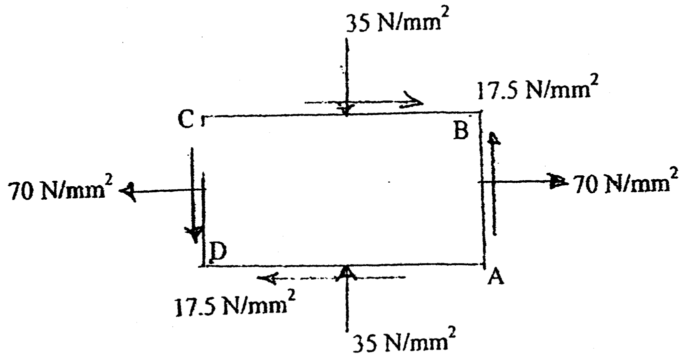


3. a) A rigid bar 3.5 m in length is hinged at L and is supported by steel rod SM and copper rod PN as shown in figure below. If the length of SM and PN are 1 m and 0.75 m and cross-sectional area 2 cm^2 and 4 cm^2 respectively, determine stress in each of the rods and elongation of the steel rod if a load of 100 KN is applied on the bar at a distance of 2.5 meters from the hinge. [8]
Take $E_C = 1.2\times10^8$ KN/m^2 and $E_S = 2\times10^8$ KN/m^2
The bar is horizontal prior to the application of the load.



b) Sketch the stress and strain diagram for mild steel as per tensile test and describe the characteristics points. [4]

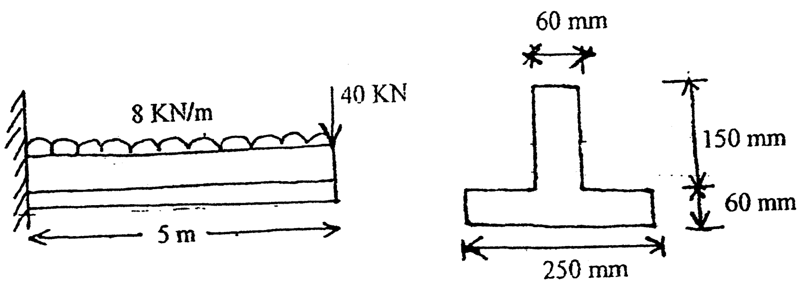
4\. a) Two planes AB and BC which are at right angles, carry shear stresses of intensity 17.5 N/mm^2 while these planes also carry a tensile stress 70 N/mm^2 and compressive stress of 35 N/mm^2 respectively. Determine the principles planes and principal stresses and also determine maximum shear stress and the plane at which it acts. [8]



b) A copper plate vessel in the shape of thin spherical shell 50 cm radius and 1 cm shell thickness is completely filled with a fluid at atmospheric pressure. Additional fluid is then pumped till the pressure increase by 10 MN/m^2. Find the volume of this additional fluid, given that the poisson's ratio is 0.26 and modulus of elasticity 100 GN/m^2 for the shell material. [8]

5\. a) A hollow cylinder shaft is required to transfer 500 KW at 120 rpm. The maximum torque is likely to exceed the mean torque by 25%. If the shear is not to exceed 60 MN/m^2 and the twist not to exceed 2° for a length of 4 m, find the minimum external diameter of the shaft to satisfy above conditions. Take diameter ratio to be 2/5 and G = 80 GN/m^2. [8]

b) A Cantilever beam 5 m in length is subjected to load as shown in figure below. Determine the value of bending stress 30 mm below from the top surface of the beam. [8]



6\. Classify the column based on their nature of failure pattern. Derive the expression for the Euler's formula for crippling load on a column of length l with both ends hinged condition. [3+5]

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04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Shrawan

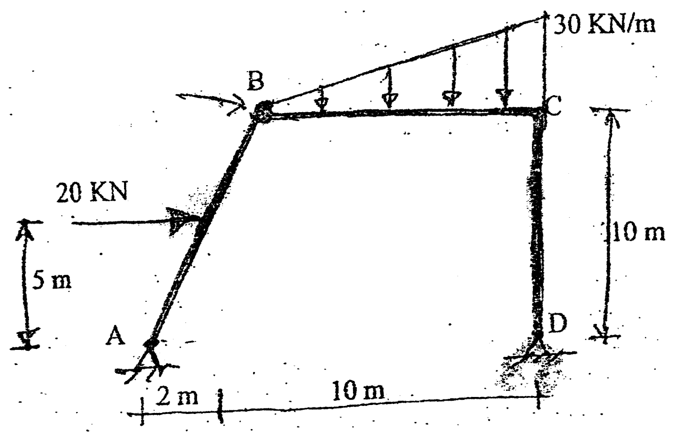
Exam.	New Back (2066 & Later Batch)		
Level	BE	**Full Marks**	80
Programme	BCE	**Pass Marks**	32
Year / Part	II / I	**Time**	3 hrs.

Subject: - Strength of Materials *(CE502)*

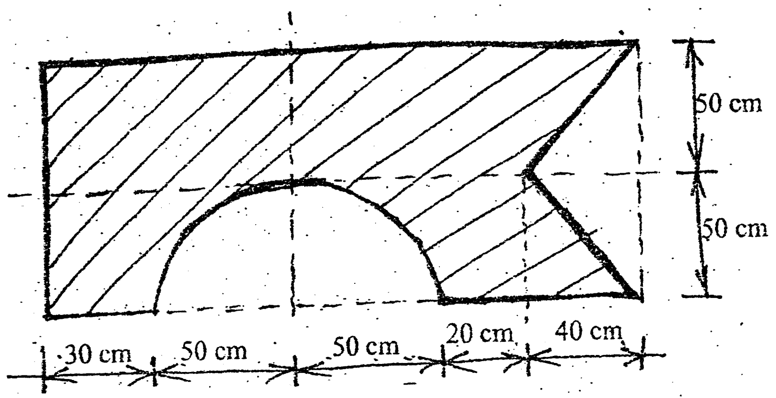
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) Define shear force and bending moment at a section of beam. [4]

   b) Draw axial force, shear force and bending moment diagram of the frame shown in figure below. [12]

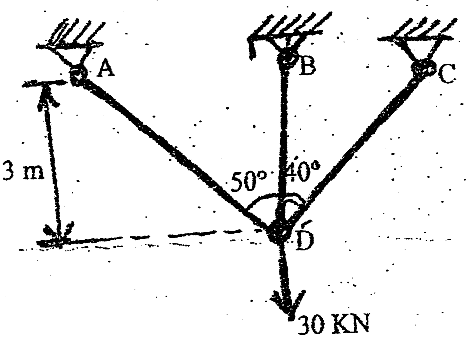


2. a) Obtain the principle moment of inertia and draw principle axes for the plane figure given below. [8]



   b) Derive the relation $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$ [8]

3. a) Find the forces in each members of the bar system shown in figure below. Take cross sectional area of each bar as 6 cm^2 and modulus of elasticity E as $2\times10^5 N/mm^2$. [8]



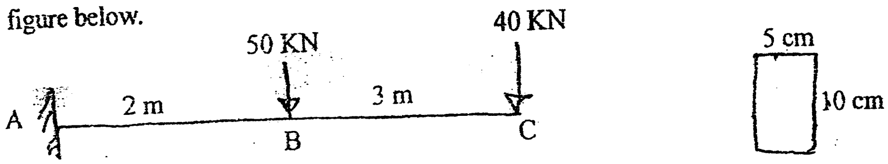
b) The principle stresses at a point in a bar are 100 MPa tensile and 40 MPa compressive. Find the normal stress shears and resultant stress on a plane inclined at 60° to the axis of major principal stress. [8]

4. a) A water pipe 500 mm internal diameter contains water at a pressure head 100 m. If the unit weight of water is 10 KN/m^3 and allowable stress of pipe material is 20 N/mm^2. Calculate the thickness of the pipe. [8]

b) A solid circular shaft is subjected to a torque 120 Nm. Determine the diameter if the allowable shear stress is 100 N/mm^2 and the allowable angle of twist is 30° per 10 diameter length of the shaft. $G = 10^5\ N/mm^2$. [8]

5. a) Derive euler's column formula for critical load of a column with both ends hinged. [8]

b) Determine the slope and deflection at the free end of the cantilever beam shown in figure below. [8]



$E = 200\ KN/mm^2$

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07 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2072 Chaitra

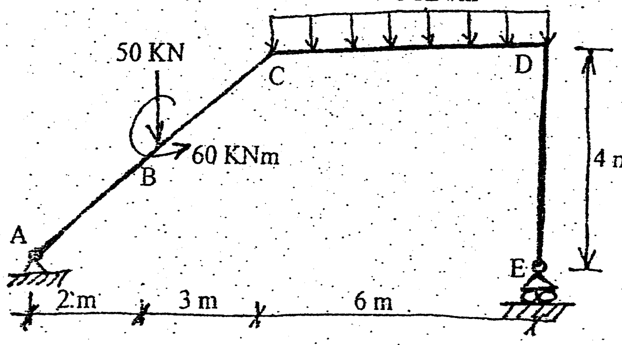
Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Strength of Materials *(CE502)*

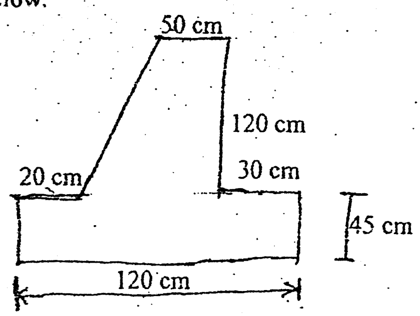
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. a) Explain shear force and bending moments. [4]

   b) Draw axial force, shear force and bending moment diagrams for the frame given in figure below. [12]

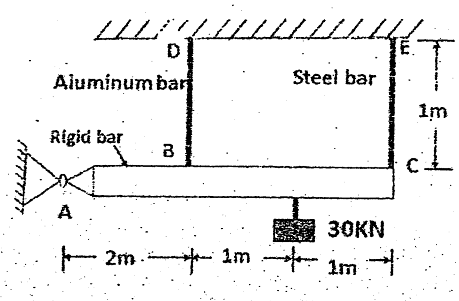


2. a) Determine principal moment of inertia and draw orientation of principal axes of the figure shown in figure below. [12]



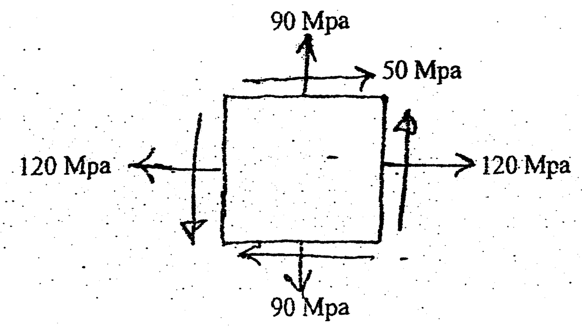
   b) Define principle moment inertia. [4]

3. a) ABC is a rigid bar, wire BD is made of aluminum and EC is made of steel. Determine the stresses in rods and reactions at A. Take A_{al} = 4 mm^2, A_{st} = 2 mm^2, E_{al}= 72 KN/m^2, E_{st} = 210 KN/m^2. [8]



   b) Derive a relation between Young's modulus of elasticity, Shear modulus and bulk modulus. [8]

4. a) The state of stress in a two dimensional stress system is as shown in figure below. Determine the principal stresses and orientation of principal planes. [8]



b) Prove that the longitudinal stress at thin cylinders is equal to the half of circumferential stress at that thin cylinders. [8]

5. a) A solid circular shaft is subjected to a torque 120 Nm. Determine the diameter if the allowable shear stress is 100 N/mm^2 and the allowable angle of twist is 3° per 10 diameter length of the shaft. $G = 10^5$ N/mm^2. [8]

b) Prove that the torque transmitted by the hollow shaft is greater than the solid shaft of same weight, material and length. [8]

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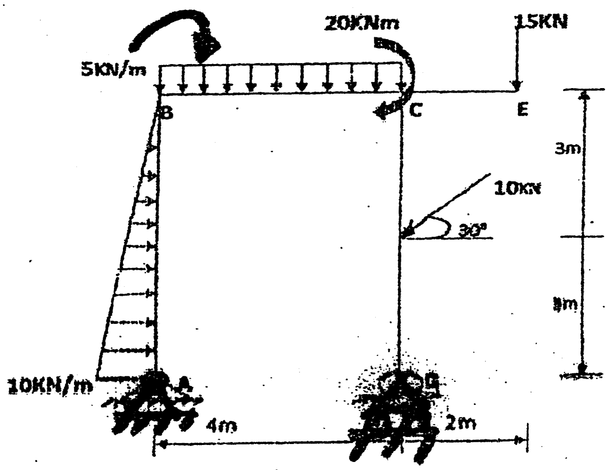
07 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Kartik

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

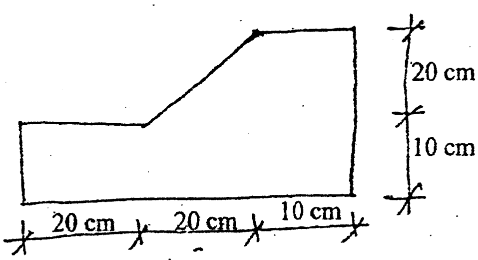
Subject: - Strength of Materials *(CE502)*

- ✓ 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.*

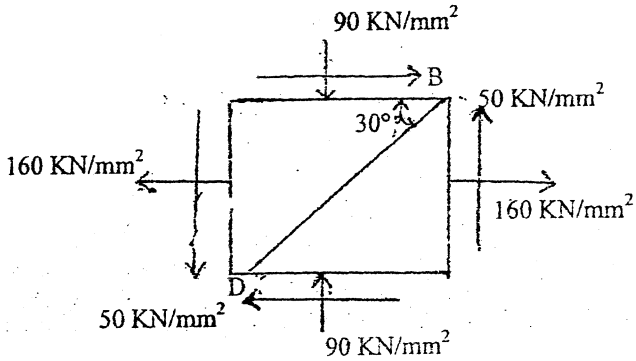
1. Draw axial force, shear force and bending moment diagram of given loaded frame. Also show the salient feature. [16]



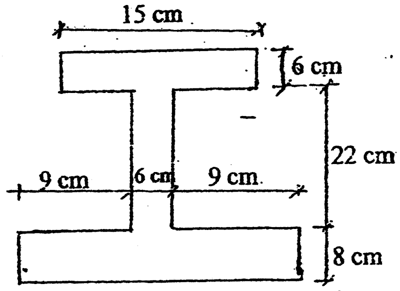
2. Obtain the principle moment of inertia and draw the orientation of principal axes in a sketch. [12]



3. The state of the stress in a two dimensional stress system as shown in figure below. Find the principal planes and maximum shear stress. Determine also the normal and tangential stress on plane BD. Verify the results by drawing Mohr's circle. [8]



4. A horizontal beam 4 m long is simply supported at ends carries a UDL of 40 KN/m over the whole span along with a concentrated load of 40 KN at its mid span. The Beam is of I-section of overall depth 36cm. Find the maximum Tensile and Compressive stress. [8]

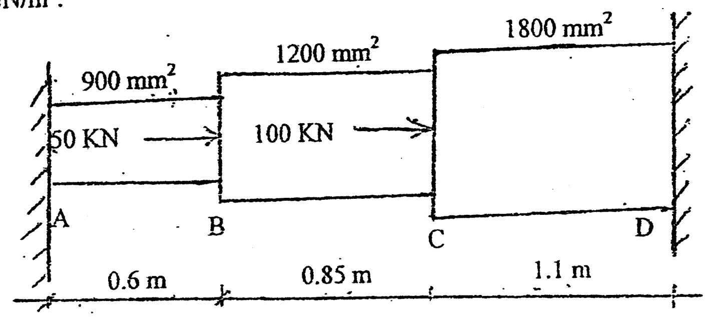


5. Derive the expression for Euler's Critical load for Strut with one end fixed and other hinged. Also explain the limitations to the use of this formula. [8]

6. A hollow steel shaft, of 6 cm and 4 cm outer and inner diameters respectively, rotates with a speed of 250 RPM. Permissible shearing stress for the material is 80 MN/m^2 and maximum torque is 1.2 times the mean torque. For the shaft obtain; (a) Power transmitted by the shaft (b) Strength of hollow shaft. [8]

7. Prove that the longitudinal stress at thin cylinders is equal to the half of circumferential stress at that thin cylinders. [8]

8. A bar ABCD fixed at A and D is subjected to axial forces as shown in figure below. Determine the forces in each portion of the bar and displacement of point B and C. Take $E = 210\ GN/m^2$. [12]



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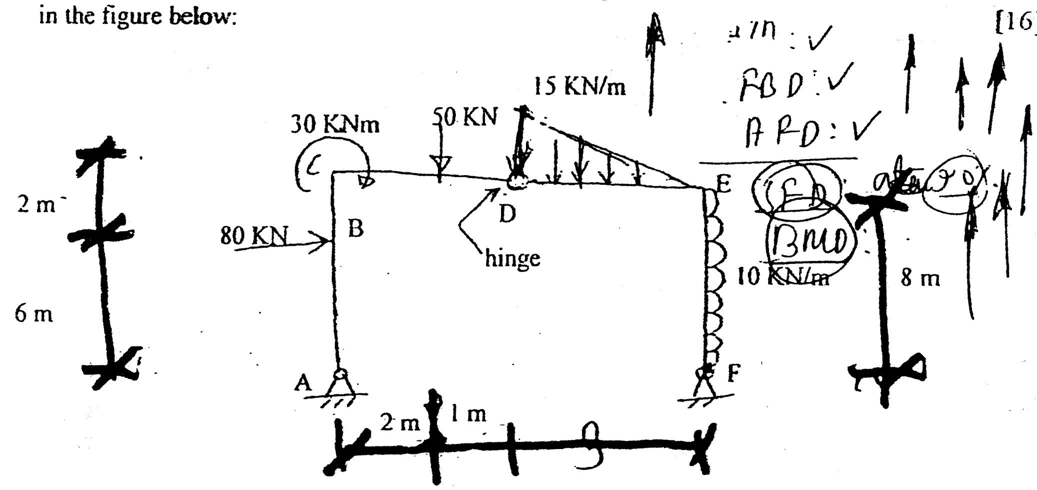
07 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Chaitra

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

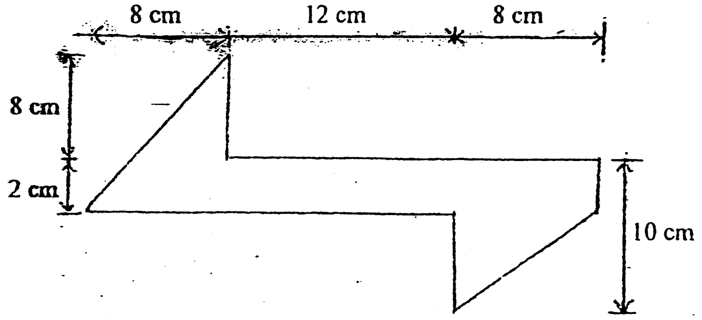
Subject: - Strength of Materials *(CE502)*

- ✓ 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.*

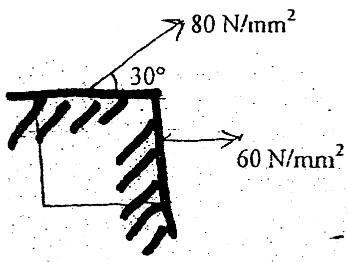
1. Draw axial force, shear force and bending moment diagram of the frame loaded as shown in the figure below: [16]



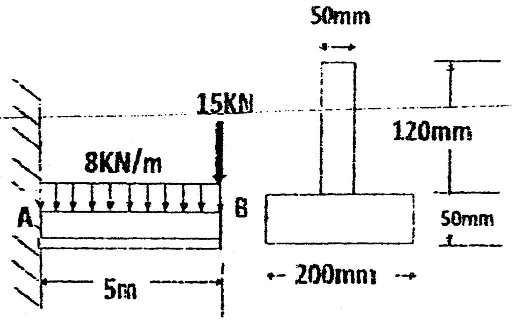
2. Determine the orientation of the principal axes and the moment of inertia about the centroidal axes of composite section as shown. [12]



3. Determine the orientation of principal axes and principal stresses for the element loaded as shown in figure below. Also calculate maximum shear stress and orientation of their plane. [8]



4. A cantilever beam 5m in length is subjected to the loads as shown in figure. Determine the maximum bending stresses in the beam. Also, determine the value of bending stress 25 mm below from the top surface of the beam. [8]



5. Derive a relation between Young's modulus of elasticity and bulk modulus. [8]

6. A hollow steel shaft having 10 cm outer diameter and 7 cm inside diameter is rotating at a speed of 300 rpm. If the permissible shear stress is 80 N/mm^2 and the maximum torque is 1.3 times the mean torque. Determine the power transmitted by the shaft. [8]

7. A thin walled cylindrical shell made up of copper plate has been filled with a liquid at atmospheric pressure. An additional 80cc of liquid is then pumped into 3 m cylindrical shell whose internal diameter is 300 mm and wall thickness 14 mm. Find the values of pressure developed on the wall of cylinder due to this extra liquid. Take Poisson ratio = 0.36 and Modulus of elasticity E = 10^6 kg/cm^2. [8]

8. Derive an expression for Euler's formula for crippling load of a column of length L with its both ends hinged condition. [12]

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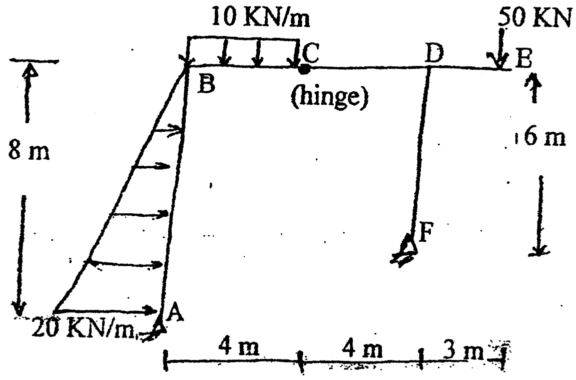
04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Shawan

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

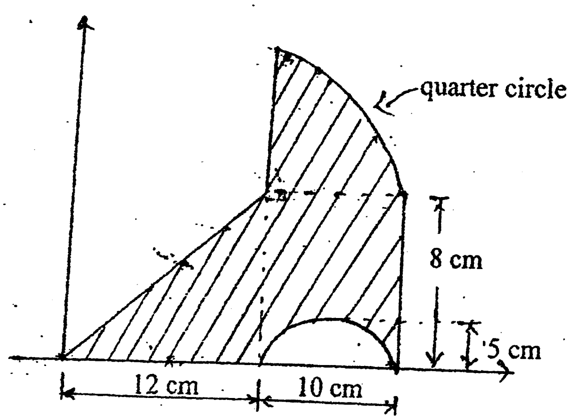
Subject: - Strength of Materials *(CE502)*

- ✓ 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. Draw bending moment; shear force and axial force and diagrams for the given frame. Also indicate salient points, if necessary. [16]

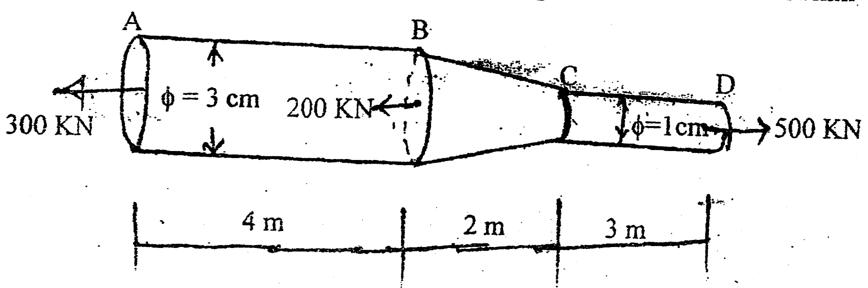


2. Calculate the principal moment of inertia, direction and position for the given shaded figure. [12]

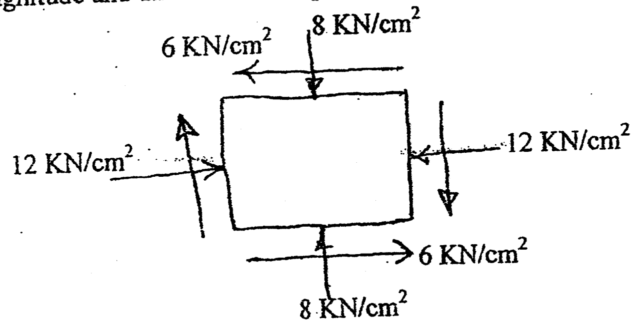


3. a) Derive a relation between Young's modulus and Bulk modulus. [8]

   b) Determine the elongation of the bar as shown in figure. Take $E = 2 \times 10^5 N/mm^2$ [8]



4. Figure below shows the state of stress of a point in a two dimensional stressed body. Determine the magnitude and direction of the principle stresses. [8]



5. A simply supported timber joist of 5 m span has to carry uniformly distributed load 6 KN/m over its whole span and a point load of 15 KN at its center. Determine the dimensions of the joist if the maximum permissible stress in bending is 10 N/mm^2. Take the depth of the joist is twice of its breadth. [8]

6. Prove that the longitudinal stress at thin cylinders is equal to the half of circumferential stress at that thin cylinder. [6]

7. A hollow steel shaft 3 m long must transmit 150 KW of power at 150 rpm. The total angle of twist in this length should not exceed 2.5 degrees and allowable shearing stress is 60 MPa. Determine the inside and outside diameters of the shafts if G = 85 Gpa. [6]

8. Derive an expression for Euler critical load for a strut with one end fixed and another hinged. Explain the limitations to the use of this formula. [8]

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04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Chaitra

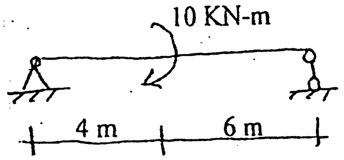
Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Strength of Materials *(CE502)*

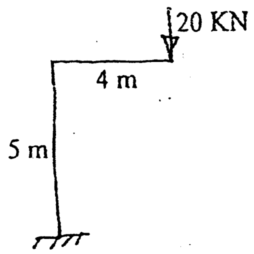
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. a) Draw bending moment diagram in the simple beam and frame shown in figure below: [4]

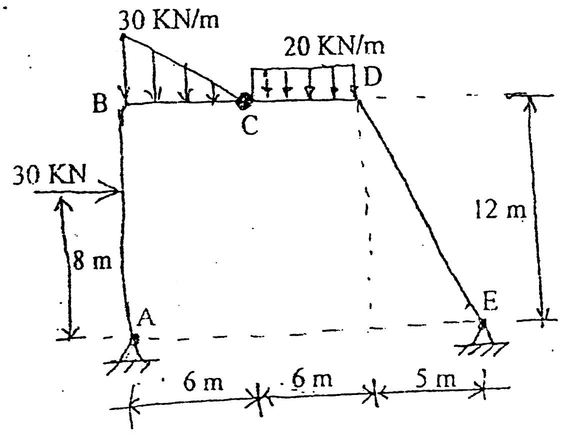
i)



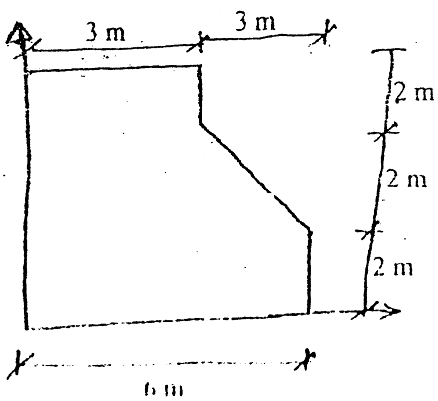
ii)



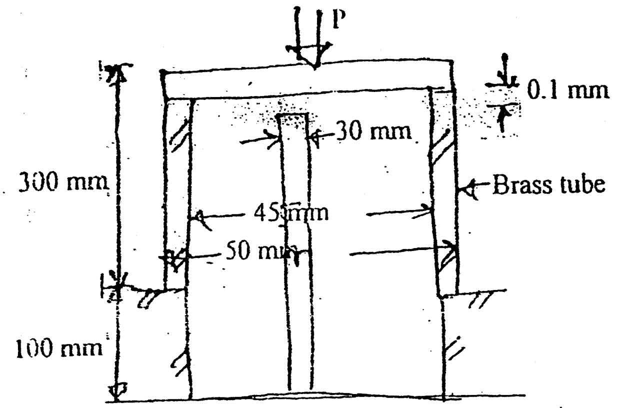
b) Draw axial force, shear force and bending moment diagram for the frame shown in figure below. [12]



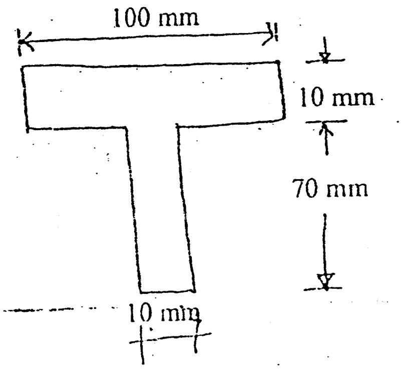
2. Find the principal axes and principal moments of inertia about axes through centroid of the given figure. Verify your results using Mohr's circle. [12]



3. Determine the maximum permissible load if the compressive stress in the rod is not to exceed 110 MPa and that in the tube is not to exceed 80 MPa. Take E_s = 200 Gpa and E_b = 100 GPa.



4. The intensity of the resultant stress on a certain plane is 60 N/mm^2 (tensile) and is inclined at an 30° to the normal of the plane. The stress on a plane right angle to this plane has a normal tensile component intensity of 40N/mm^2. [12]
   Find: (a) The resultant stress in the second plane
   (b) The principal plane and principal stresses
   (c) The plane of maximum shear and its intensity
5. Derive a ratio for thickness of cylindrical portion to spherical portion for a cylindrical vessel with hemispherical ends. [6]
6. A solid bar of metal 50 mm diameter and 200 mm length is tested under tension. A 10 KN load produces an elongation of 0.0051 mm. The same bar undergoes θ twist of 1° when subjected to a torque of 4 KNm. Determine Young's modulus and Poisson's ratio of the shaft material. [6]
7. What is pure bending? Prove that $\frac{M}{I} = \frac{\sigma}{Y} = \frac{E}{R}$, where the symbols have their usual meanings. [1+7]
8. Calculate the bucking load for a strut of T section shown in figure below. The strut is 3m long and hinged at both ends. Take E = 200 GN/m^2 [8]



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05 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

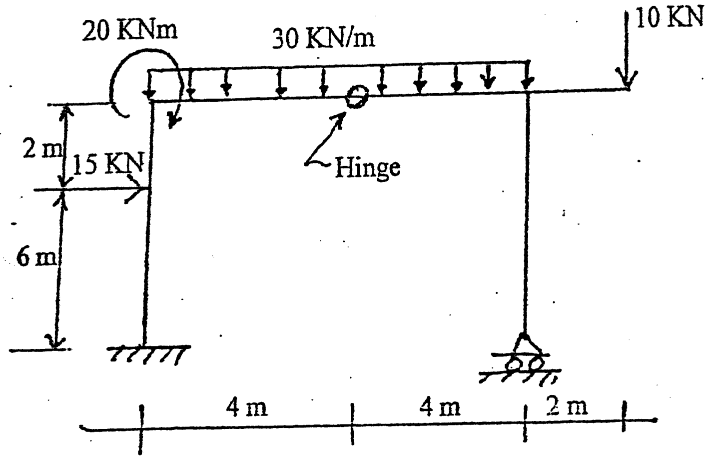
2070 Ashad

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

Subject: - Strength of Materials *(CE502)*

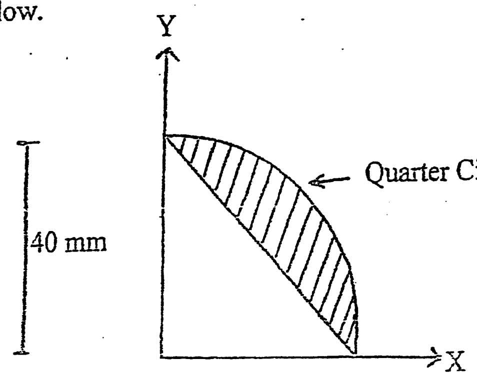
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt __All__ questions.*
- ✓ *The figures in the margin indicate __Full Marks__.*
- ✓ *Assume suitable data if necessary.*

1. Determine the reactions at supports, draw free body diagrams of each members and plot axial force, shearing force and bending moment diagram for the frame loaded as shown in figure below. [16]



2. a) "The moment of inertia forms the basis of dynamics of rigid bodies and strength of material". Explain the statement. [4]

   b) Determine principal moment of inertia and their orientation of the shaded area as shown in figure below. [8]



3. a) Explain with neat sketch a typical stress-strain diagram for characteristics of mild steel. Also describe stress concentrations in the strained body. [5+3]

   b) A steel bar 2.5 cm diameter and 25 cm long was subjected to a tension test. On applying a tensile load of 25 KN the elongation was found to be 0.005 cm and decrease in diameter was 0.00025 cm. Calculate the value of: [8]

      i) Modulus of elasticity
      ii) Poisson's ratio
      iii) Change in volume

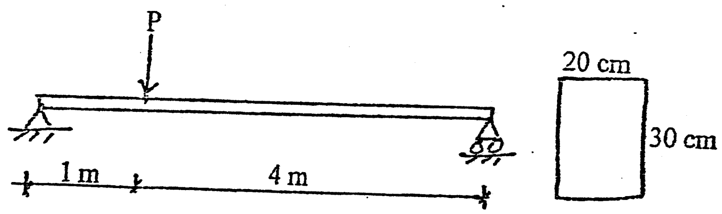
4. An element in a stressed material has a tensile stress of 500 MN/m^2 and a compressive stress of 350 MN/m^2 acting on two mutually perpendicular planes and equal shear stresses of 100 MN/m^2 on these planes. Find principal stresses and plot Mohr's circle to verify your results. [8]

5. Determine change in diameter and volumetric strain for the cylindrical shell of 2 m external diameter and 5 m length, subjected to an internal pressure of 350 N/cm^2. The Principle stress is not to exceed 16 KN/cm^2. Assume E = 200 GPa and poisson's ratio 0.25. [6]

6. A hollow shaft of external diameter 150 mm an internal diameter 100 mm is 3.5 m long. If the permissible shear stress is limited to 50 MN/m^2, how much torque can be transmitted and what will be the maximum angle of twist? $G = 100\ GN/m^2$ [6]

7. a) What are the assumptions in pure bending? Explain. [2]

   b) Determine the maximum value of P in the simply supported beam shown in figure below if the bending stress is limited 12000 KN/m^2. [6]



8. a) Derive an expression for the equivalent length of a strut when its one end is fixed and other hinged. [4]

   b) What do you understand by term buckling in the column theory? Also explain the limitations of Euler's formula for the analysis of long column. [4]

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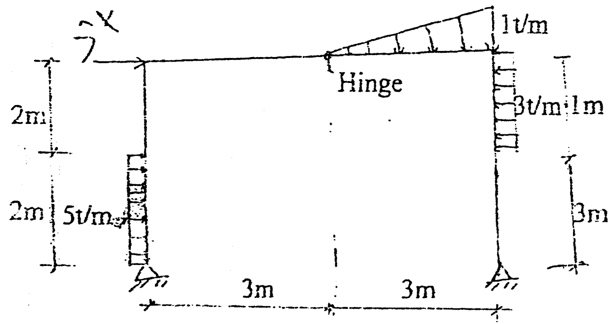
TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Ashad

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

Subject: - Strength of Material *(CE 502)*

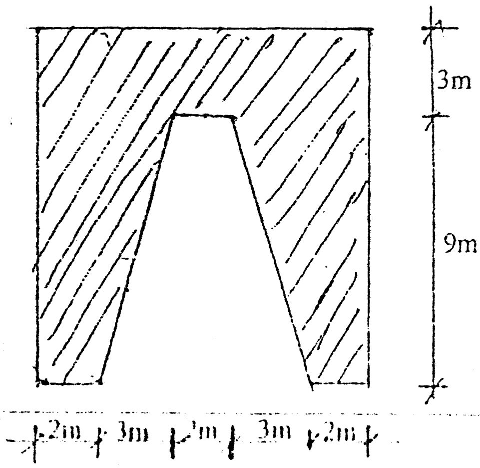
✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt All questions.*
✓ *The figures in the margin indicate Full Marks.*
✓ *Assume suitable data if necessary.*

1. Draw axial force, shearing force and bending moment diagrams for the following frame loaded as shown. Indicate salient points if any. [16]



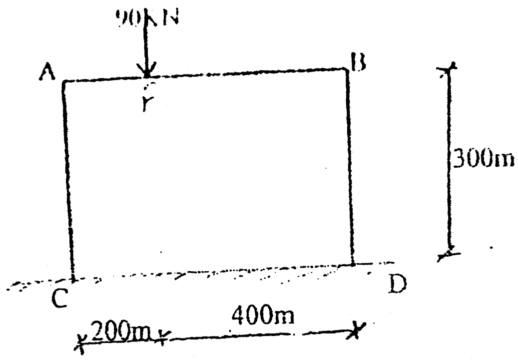
2. a) State and prove parallel axis theorem for product of inertia. [4]

   b) Determine the principle moment of inertia about centrodial axis and locate the principle axes for the section shown in figure below. [8]



3. a) Derive the relation between Bulk modulus and Young's modulus of Elasticity. [8]

   b) Determine vertical displacement of point E, if AB is a rigid bar and remains horizontal, AC and BD are rods made of steel and aluminium having diameter 20mm and 40mm respectively. E for steel and aluminium are 200GPa and 70GPa respectively [8]

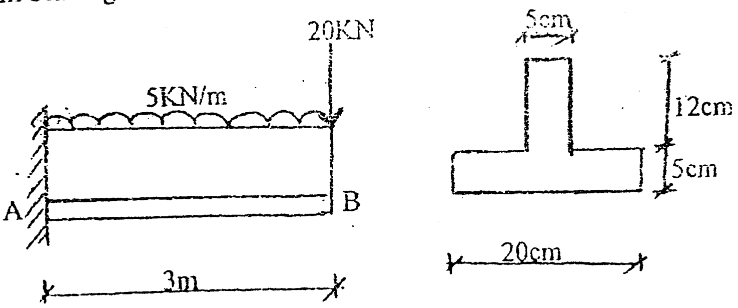


4. a) Derive an expression for the normal stress and shear stress on an oblique section of rectangular strained body when it is subjected to direct stresses in two perpendicular directions accompanied with simple shear stress. [8]

b) Find the external and internal diameters required for a hollow shaft which is to transmit 40 KW of power at 240 rev/minute. The shear stress is to be limited to $100MN/m^2$. Take external diameter to be twice the internal diameter. [6]

5. a) A thin cylindrical shell 4m long and thickness 1.5cm is of 1.5cm internal diameter. Determine the change in length and diameter if the shell is subjected to an internal pressure of $25N/mm^2$. $E=2.05\times10^5 N/mm^2$ and poisson's ratio=0.3. [6]

b) A cantilever beam 3m in length is subjected to load as shown below. Determine maximum bending stress at 25mm below from the top surface of the beam. [8]



c) A round bar is clamped at bottom and free at top. Its effective length is 2m. A horizontal force of 300N at top produces a horizontal deflection of 20mm. Determine the buckling load for the bar if the load is applied axially on top. [8]

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05 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Chaitra

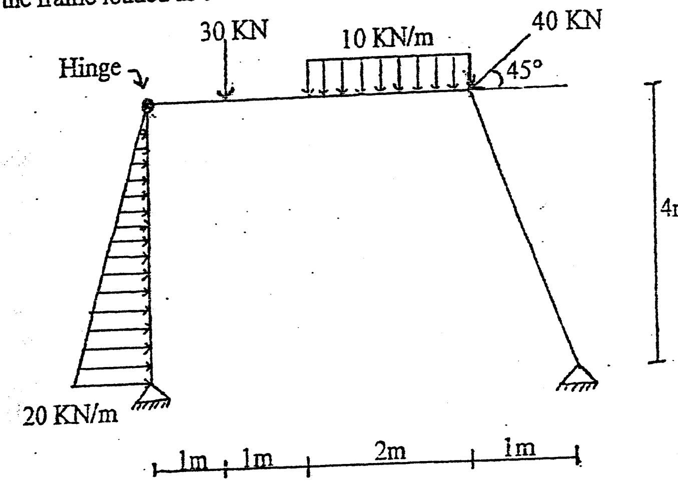
Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	II / I	Time	3 hrs.

Subject: - Strength of Material *(CE502)*

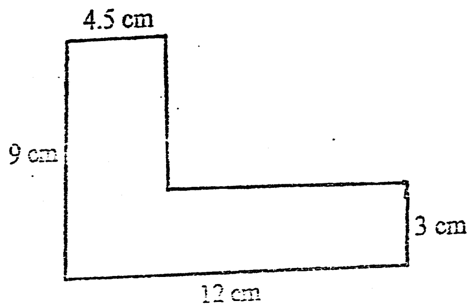
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt* ***All*** *questions.*
- ✓ *The figures in the margin indicate* ***Full Marks.***
- ✓ *Assume suitable data if necessary.*

1. a) What do you mean by principle of superposition? Explain with suitable example. What are its limitations? [4]

   b) Draw axial force, shear force and bending moment diagram indicating salient points for the frame loaded as shown. [12]



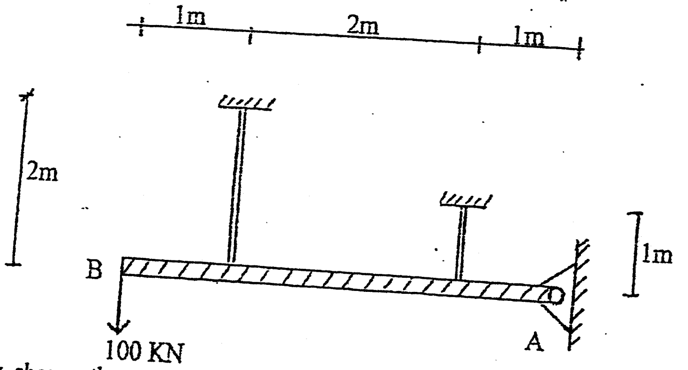
2. Determine the principal moment of inertia and orientation of principal axes for the composite section shown in figure below about its centroid. [12]



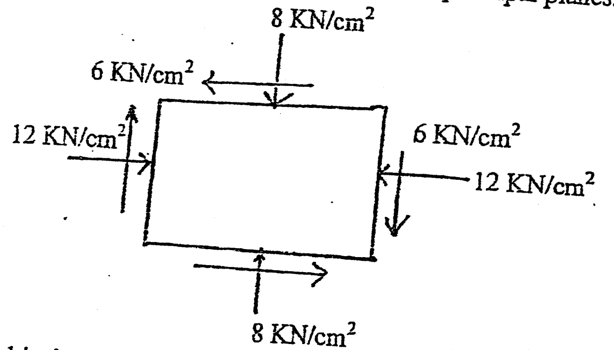
3. a) How is offset method defined in drawing stress-strain relationship? Where is it required? [2]

   b) A vertical rod of length 3m tapers uniformly from a diameter of 80mm at the top to 40mm at the bottom. If it is rigidly fixed at the upper end and is subjected to an axial load of 45KN, determine the total extension in the bar. Take density of material = $2\times10^5 kg/m^3$ and young's modulus = $210GN/m^2$. [6]

c) A rigid bar AB is hinged at A and supported by a 2m long copper rod and a 1m long steel rod. It carries a load of 100 KN at the free end B as shown in figure below. If the area of cross-section of the steel and copper rods be $10cm^2$ and $8cm^2$ respectively and their respective values of E be $200GN/m^2$ and $100GN/m^2$, find stresses in each rod and reaction at A (assume no bending in steel and copper rods). [8]



4. Figure below shows the state of stress of point in a two dimensional stressed body. Determine the values of principal stresses and orientation of principal planes. [8]

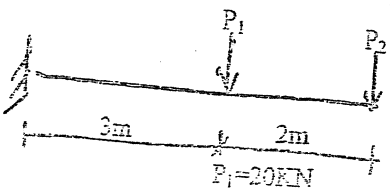


5. A thin walled cylindrical shell made up of copper plate has been filled with a liquid at atmospheric pressure. An additional 50 c.c. of liquid is then pumped in to 2m long cylinder whose internal diameter is 25 cm and wall thickness is 12 mm. Find the values of pressure developed on the wall of cylinder due to this extra liquid. Take poission ratio = 0.34 and modules of Elasticity = 10^6 kg/cm^2. [6]

6. A steel bar of 2.5 cm diameter when subjected to a torque of 300N produces an angle of twist of 1.35 degrees in the length of 25cm. The same bar when subjected to tension elongates 0.01cm in length of 15cm under a load of 70KN. Deduce the value of poisson's ratio for the material. [6]

7. a) Describe the importance of computing deflections in beams. Also give two typical examples of pure bending of beam. [2+1]

b) Find the slope and deflection under the load P_1. [5]



$E=2\times10^5 MPa$
$I=2\times10^8 mm^4$

$P_1=20KN$
$P_2=30KN$

8. Define buckling load and effective length of column and derive a Euler's formula for crippling load of a column of length L with its both ends hinged condition.

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

TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2079 Bhadra

Subject: - Surveying I *(CE 504)*

- ✓ 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 general principles of surveying? Why in surveying principle of "working from whole to part" and accuracy are to be followed? Explain. [1+3]

2. In a preliminary study plan of a hydropower project, the horizontal distance between the dam and the powerhouse, which is 1 km on the field, is represented by a line 25 cm. Calculate the representative factor used in the map. Draw a diagonal scale long to read upto 1 m and long enough to measure 500 m. Also indicate the following distances (i) 123 m (ii) 256 m [4]

3. Define the term precision and the accuracy. You are given the task of surveying to measure the linear distance between A and B. Noted that A and B are not visible. Explain the procedure for the distance measurement with the neat sketch. [1+3]

4. A 30 cm steel tape measured 30.015 m, when standarized fully supported condition under a 70 N pull at a temperature of 20°C. The tape weighed 0.9 kg (9N) and had a cross-sectional area of 0.028 cm^2. What is the true length of the recorded distance AB for the following conditions? Assume all full tape length except in the last one. Take $\alpha = 1.15 \times 10^{-5}/°C$, $E = 2.11 \times 10^6$ N/cm^2. [6]

Recorded distance AB	114.095 m
Average temperature	12°C
Condition of support	Suspended
Tension	100 N
Elevation difference / 100 m	2.5 m

5. What is misclosure ratio? Explain a neat sketch show how the closing error is adjusted graphically in compass traverse. [1+3]

6. The FB of line AB of an open traverse ABCDEFG is 40°45′. The deflection angles between the lines were measured with a theodolite and were as follows: 26°37′ (R) at B, 66°45′ (L) at C, 20°56′ (R) at D, 33°54′ (R) at E and 26°54′ (L) at F. If the BB of the last line FG observed was 209°33′, check whether the observation for deflection angles were correct or not. If not, compute the correct bearings of all the lines and correct deflection angles. [8]

7. During the construction of a road, 5 pegs are to be set out at the centre lines of the road. For this purpose, fly level is run from a benchmark of RL 3010 m, the following readings were obtained:
Backsight: (-)1.234, 2.594, 1.327, 2.869
Foresight: 0.456, 1.123, 0.499
From the last position of instrument first 5 pegs at 30 m intervals are to be set out on a uniform rising gradient of 1 in 80. Enter the readings on a level field book and work out the staff readings on the top of the pegs. If last peg is to be established to have a RL of 3012.476 m, find the correct RLs of each station. [6]

8. The results of reciprocal levelling between stations A and B 250 m apart on opposite side of a wide river were as follows:

Level of	Height of eye piece (m)	Staff readings
A	1.339	2.518 on B
B	1.332	0.524 on A

Find: a) The difference of level between A and B
b) Curvature and refraction correction if mean radius of earth = 6365 km
c) The error due to imperfect adjustment of the diaphragm wires.
d) If RL of B = 1460.605 m, find RL of A. [6]

9. Describe Cross-sectioning and L-section levelling with sketches. [4]

10. What is orientation in plane table surveying? Describe the more reliable method with a sketch. [1+3]

11. What are the different methods of measuring horizontal angles in theodolite survey? Explain any one method with supporting sketch. [1+3]

12. A theodolite is set over station 'O' to measure direction to stations A, B, C and D. The observed circle readings are as follows: Compute the mean horizontal angle by mean direction method and adjust them if necessary. Also calculate, missing data of vertical circle reading. [5+1]

Instrument	Target Station	Telescope	Horizontal Circle Readings	Vertical Circle Readings
O	A	Direct	00°00'00"	120°15'10"
		Reversed	179°59'40"	?
	B	Direct	60°55'10"	?
		Reversed	240°55'20"	308°51'40"
	C	Direct	140°50'50"	?
		Reversed	320°51'20"	269°15'10"
	D	Direct	270°20'10"	177°20'10"
		Reversed	90°20'20"	?
	A	Direct	00°00'20"	-
		Reversed	180°00'30"	-

13. What are the purposes of the triangulation and trilateration survey describe in briefly? Write down the general specification of tertiary triangulation. [1+3]

14. Calculate the area of traverse by co-ordinate and double meridian distance method. [3+3]

Line	AB	BC	CD	DA
Latitude (m)	-370	240	-260	390
Departure (m)	220	-400	-300	480

15. Find the volume of cutting in a length of 60 m with the following data for a two level section using prismoidal and trapezoidal (average end rule) formula. Also calculate prismoidal correction. Formation width = 9 m, side slope = 2:1, transverse slope = 6:1. The ground levels at 30 m intervals are given below. [3+3]

Chainage (m)	0	30	60
GL (m)	281.50	281.80	282.40

The formation has upward slope of 1 in 40 with the formation level at 0 chainage being 278.00 m.

16. What is EDM? Describe about the principles of distance measurement techniques in EDM. [1+3]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Baishakh

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

Subject: - Surveying I (*CE 504*)

- ✓ 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. Fixing a new point at least from two control point and consistency are the most important principles in surveying works, explain with illustration. [4]

2. A rectangular plot of land of area 2.25 hectare is represented on a map of similar rectangle area of 36 cm^2. Calculate the representative factor of the scale of the map. Draw a scale to read up to a meter from the map. The scale should be long enough to measure up to 400m. Also draw a scale to read 275 m from the map using diagonal scale. [4]

3. Define systematic error and random error. A base line was measured by 20m tape suspended in catenary under a pull of 145 N, the mean temperature being 14°C. The lengths of various segments of the tape and the difference in level of the two ends of a segment are given in table. [2+6]

Span	Length (m)	Difference in level (m)
1	19.992	+ 0.346
2	19.930	− 0.214
3	19.892	+ 0.309
4	19.940	− 0.106

If the tape was standardized on the flat under a pull of 95 N at 18°C determine the correct length of the line. Take:

Cross-sectional area of the tape = 3.35 mm^2, mass of the tape = 0.025 kg/m, coefficient of linear expansion = 0.9×10^{-6} per °C, Young's modulus = 14.8×10^4 MN/m^2

4. Define meridian. Describe with example about the graphical adjustment of disclosure during plotting of compass traverse. [1+4]

5. The clockwise angles of a closed polygon are observed to be as follows: [6]

Station	A	B	C	D	E	F
Angles	223°46′	241°17′	257°02′	250°21′	242°19′	225°15′

If the true bearings of BC and CD are 123°14′ and 200°16′ respectively, and magnetic bearing of EF is 333° 21′, calculate the true bearing of all other sides and the magnetic declination.

6. The following consecutive staff readings were taken on pegs at 15m interval on a continuously sloping ground: 0.895, 1.305, 2.800, 1.960, 2.690, 1.255, 2.120, 2.825, 1.450, 1.895, 1.685, 2.050 (Stn. A). R.L. of station A where the reading 2.050 was taken is known to be 50.250 m. From the last position of the instrument two stations B and C with R.L. 50.000 m and 51.000 m respectively are to be established without disturbing the instrument: Workout the staff reading at B and C and compute the RL of all points in HI level book format. [8]

7. The results of reciprocal leveling between stations A and B 250 m apart on opposite sides of a wide river were as follows. [4]

Level at	Height of eyepiece (m)	Staff reading
A	1.399	2.518 on B
B	1.332	0.524 on A

Find (a) The true difference of level between the stations.(b) Error due to curvature and refraction, assuming the mean radius of the earth 6365 km.(c) Collimation error.

8. Why is two peg test carried out? State the points to be considered in fly leveling. [1+3]

9. What are the fundamental lines of theodolite? Write desired relation between them with necessary sketch. [1+4]

10. The following observations were recorded in a theodolite traverse ABCDA. Compute the correct horizontal angles and find missing readings from the following readings in given table. Find the permissible angular error, if least count of theodolite is 20″. [8]

Inst.Stn.	Target Stn.	HCR Observations		VCR Observation	
		FL	FR	FL	FR
A	D B	90°00′00″ 180°16′10″	269°59′50″ 00°16′10″	$88^0$50′10″	?
B	A C	90°00′10″ 200°25′50″	270°00′20″ 20°26′10″	?	308°51′20″
C	B D	90°00′00″ 179°08′40″	269°59′40″ 359°08′30″	99^0 00′ 50″	?
D	C A	89°59′50″ 160°12′40″	270°00′10″ 340°12′30″	?	270°14′20″

11. Calculate the area of transverse by coordinate and double meridian distance method. [4]

Line	PQ	QR	RS	SP
Latitude (m)	-390	-270	380	280
Departure (m)	320	-170	-620	470

12. Find the volume of cutting in a length of 200m with the following data for a two level section using the prismoidal and trapezoidal formula. Also calculate the prismoidal correction. Formation width 10m, side slope = 2:1, transverse slope = 5:1. The ground level at 50m intervals are given below.

Chainages (m)	0	50	100	150	200
Ground level (m)	580.50	582.00	583.60	584.25	585.40

The formation has a upward slope of 1 in 40 with the formation level at 0+000 chainage being 580.000m. [8]

13. Write short notes on: (Any Three) [3×4]

a) Principles involved in choosing stations for a chain and tape survey.
b) Plane table resection and advantages of plane table surveying.
c) Differentiates between triangulation and trilateration.
d) Classification and principles of EDM.

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TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING **Examination Control Division** **2078 Bhadra**	**Exam.**	**Regular**		
	Level	BE	**Full Marks**	80
	Programme	BCE	**Pass Marks**	32
	Year / Part	II / I	**Time**	3 hrs.

Subject: - Surveying I *(CE 504)*

- ✓ 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 briefly the principles of surveying with suitable examples. [4]
2. Explain 'Scale of a Map' and how the scale has been classified and its range of values? The distance between Kathmandu and Pokhara is 200 km. In a highway map it is represented by a line 5 cm long. Find it's R.F. Draw a diagonal scale to show single km and maximum 600 km indicate the following distances. a) 224 km b) 338 km c) 459 km d) 579 km [3+5]
3. A tape of nominal length 30 m is standardized in catenary at 50N tension and found to be 29.8940 m. If the mass of the tape is 0.015 kg/m, calculate the horizontal length of a span recorded as 24 m. (Note: Calculation should be done taking at least 4 decimal) [5]
4. What is the fundamental principle of chain surveying? What are the operations involved in chain surveying? Explain with neat sketches. [4]
5. Determine the Permissible angular mis-closure and adjusted bearings in the following link traverse PABCQ. Bearing of line PA = 30°15′ and bearing of line QC = 225°45′. The deflection angle measured are $\Delta_A = +100°30'$, $\Delta_B = +135°45'$ and $\Delta_C = +140°00'$. Least count = 30′. [6]
6. In the compass surveying you corrected all the bearing then plotted to it why there is closing error? Define closing error. If the closing error direction is perfectly horizontal, then describe the graphical method with neat sketch. [4]
7. What are the principles of plane table surveying? Describe the process of Orientation of plane table by Back sighting. [4]
8. What are the basic principles of levelling and describe reciprocal levelling. [3+2]
9. Following readings were taken during a leveling work from TBM1 to TBM2; 2.191, 2.505, 2.325, 1.496, 3.019, 2.513, 2.811, 1.752 and 3.824 m. Level instrument was changing after 4th and 7th readings. Enter the above readings in a level field book format and compute RLS of all the points and adjust the RLs if error arises also. RLs of TBM1 and TBM2 are 1449.870 and 1448.710 m respectively. [6]
10. A level instrument was set up exactly mid-way between two pegs A and B 60 m apart and found true difference of level = 0.320 m. The level instrument was then set up at a point Q on the line AB 6m from B and inside of AB and following readings were taken at a and B. [5]

Instrument at	Sighted to	Staff readings S(m)
		Middle
Q	A	1.387
	B	1.069

Compute the correct staff readings on A and B when the line of collimation is exactly horizontal. Also compute collimation precision ratio.

11. What are the methods used to plot the theodolite traverse? State what errors are eliminated by repetition method. [4]

12. Calculate the mean horizontal angles. If necessary, adjust them also. [6]

Instrument	Sighted to	HCR Observation	
		Face Left	Face right
O	P	00°00′00″	179°59′40″
	Q	294°29′50″	114°30′20″
	R	137°54′20″	317°54′40″
	P	00°00′40″	180°00′20″

13. Define trilateration. Write down the General specifications of different types of triangulation. [4]

14. The following perpendicular offset were taken from a chain line to a hedge. [5]

Chainage (m)	0	5.5	12.7	25.5	40.5
Offset (m)	5.25	6.5	4.7	5.2	4.2

Find the area enclosed by the boundary, using any two method.

15. Find the volume by the trapezoidal and Prismoidal formula with the following data: [6]

Chainages(m)	0	30	60
Central depth of cut (m)	1.85	2.15	2.45

Formation width = 12 m, Side slopes = 2:1, Transverse slope = 6:1. Also calculate the Prismoidal correction.

16. What are the principles of actual operation of EDM? Describe the sources of errors of EDM. [4]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Kartik

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

Subject: - Surveying I *(CE 504)*

- ✓ 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 Surveying? Differentiate between Plane and geodetic surveying. [1+3]
2. How do you apply principle of surveying in two way linear distance measurement? Explain. [4]
3. Four bays of base line AB were measured under a tension of 120N and the data was given below. If the tape was standardised on the flat under a pull of 89N and a temperature of 20°C. Calculate the true length of line. [6]

Bay	Length (m)	Difference in level (m)
1	29.478	+ 0.294
2	29.208	- 0.384
3	29.396	+ 0.923
4	29.916	- 0.726

Filed temperature = 31°C; CSA of tape = 3.24 mm^2; density = 7700 kg/m^3; coefficient of linear expansion = 0.000001/°C; Young Modulus = 15.3×10^4 MN/m^2

4. What is chain survey? Describe principle and methods of chain survey. [4]
5. How can open traverse be checked during compass survey? Describe Bowditch method of adjustment of closed traverse graphically. [2+4]
6. During compass survey in link traverse from station M2 to M8, following observations were recorded. [6]

Station	Deflection angle (degrees)	Leg	Bearing (degrees)
M2	-70	M1-M2	105
A	+20	M2-A	
B	-90	A-B	
M8	+70	B-M8	
		M8-M9	36

Compute bearings of link legs. Check accuracy of work if least count of compass used is 1 degree. Correct affected bearings if necessary.

7. When do you recommend for permanent adjustment of a level? Describe with testing procedure. [4]
8. During permanent adjustment of level by two peg method following observation were made on staffs C and D held vertically 50 m apart on fairly level ground [6]
   Instrument at E mid of CD
   Staff reading at C = 1.455 and Staff reading on D = 1.860
   Instrument at F such that CF = 5m and DF = 45 m
   Staff reading on C = 1.500 and staff reading on D = 1.925
   Find the magnitude and direction of closing error and precision of instrument. What is the reading in C and D with respect to horizontal line of sight?

9. Following staff reading were taken during a levelling operation at common interval of 20m. The respective staff readings are as follows
1.253, 1.752, 1.005, 0.675, 1.998, 0.825, 1.737, 1.444, 1.619, 0.750 and 2.619 m. The instrument is shifted after 4^{th}, 6^{th} and 9^{th} readings. The RL of starting station is 1280 and that of end station is 1279.924 m respectively. Compute RL, apply necessary check and adjust RL of each station by any method. [6]

10. Describe radiation and intersection methods of plane table survey. [4]

11. What are fundamental lines in theodolite? Explain relationship among them. [2+2]

12. Following angular observation were made during reiteration method of measurement by a theodolite. Compute the Horizontal angles included between survey lines OA, OB and OC by mean direction method. Apply necessary check and corrections if least count of instrument to be adopted is 1 minute. Also find missing data in VCR. [6+2]

Inst stn	Sighted to	Face	HCR observation			VCR observation		
			D	M	S	D	M	S
O	A	L	00	00	00	65	45	00
		R	180	00	00	?	?	?
	B	L	100	40	40	?	?	?
		R	280	39	50	268	55	00
	C	L	161	20	40	?	?	?
		R	341	20	20	300	40	00
	A	L	00	00	20			
		R	180	00	00			

13. Differentiate between triangulation and trilateration with advantages and disadvantages. [4]

14. Compute the area of the following traverse by DMD method. [4]

Line	Latitude (m)	Departure (m)
AB	0.00	405.85
BC	182.00	0.00
CD	87.50	-151.55
DE	-85.50	-148.10
EA	-184.00	-106.20

15. The width of formation level of a certain cutting is 8m and the side slopes are 1:1. The surface of the ground has a transverse slope of 1 in 6. If the depths of cutting at the Centre lines of three sections 30 m apart are 2 m, 3 m and 4 m respectively. Determine the volume of earth work involved in this length of cuting by trapezoidal approach and prismoidal approach. Also find prismoidal correction. [5+1]

16. Describe Principles of Electronic Distance Measurement. [4]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Chaitra

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

Subject: - Surveying I *(CE 504)*

- ✓ 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 principle of surveying illustrating examples. [4]
2. Tabulate the various errors occurred in taping with their sources and directions. A 30m steel tape was standardized in catenary conditions under a pull of 15 kg and found to be 30.006m. This tape was used to measure a distance of 86m in catenary conditions at a pull of 15 kg. Supports were provided at every 15m. The weight of the tape was 30gm/m. Apply necessary tape corrections for the measured length of line. [3+4]
3. Explain the criteria for selecting suitable scale. A map is drawn to some scale so that a plot of 6.304 ha is represented by 4.7 cm × 4.6 cm on the plan. Calculate the suitable RF of scale of the map and draw a scale to read upto a meter from the map and scale should be long enough to measure upto 500m. Also indicate 123.400m in the scale. [2+4]
4. What are the major considerations while selecting the main station and lines of chain survey? How would you decide the number of offsets based on the objects? [2+2]
5. How can the accuracy of a closed traverse be checked and adjusted if necessary, in compass traverse. [2+2]
6. The fore bearing of line AB of a link traverse ABCDEF is 61°06'00". The right turn angles were observed as follows: ∠B = 93°06'50", ∠C = 155°45'30", ∠D = 247°09'40" and ∠E = 90°58'20". If the bearing of the last line observed was 108°05'40". Check whether the observations for angles are correct or not. If not compute the correct bearings of all lines. [6]
7. Explain with neat sketch profile leveling and cross section leveling. What are the uses of these in civil Engineering? [2+3]
8. Reciprocal leveling was conducted across a wide river to determine the difference in level of points A and B, A situated on one bank of the river and B situated on the other. The following results on the staff held vertically at A and B from level stations 1 and 2 respectively, were obtained. The level station 1 was near to A and station 2 was near to B. [2+2+2]

Instrument at	Staff reading (m)	
	A	B
1	1.486	1.726
2	1.191	1.416

a) If the reduced level of B is 1160.18m above the datum, what is the reduced level of A?

b) Assuming that the atmospheric conditions remain unchanged during the two sets of the observations, calculate the collimation error, precision ratio, the combined curvature and refraction correction if the distance AB is 300 m.

9. During fly leveling the following note is made.

   B.S: 0.62, 2.05, 1.42, 2.63 and 2.42 m
   F.S.: 2.44, 1.35, 0.53 and 2.41 m
   The first B.S was taken on a BM of RL 1470 m. From the last B.S. it is required to set 4 pegs each at a distance of 30 m on a rising gradient of 1 in 200. Enter these notes in the form of a standard level book and calculate the R.L. of the top of each peg by the rise and fall method. Also, calculate the staff readings on each peg. [6]

10. What are the methods of orienting of plane table? Describe the methods of plane table surveying with their salient features. [4]

11. List out the errors which are eliminated by taking face observations of theodolite; also explain the mechanism of elimination with neat sketches. Explain the working principles of micrometer optical theodolite. [2+2]

12. The following observations were recorded in a theodolite traverse ABCDEA. Compute the mean horizontal angles and adjust them if necessary. Also calculate the VCR and VA when sighted from station A to target stations E and B. [6]

<table>
<tr><th rowspan="2">Inst. Station</th><th rowspan="2">Target Stn</th><th colspan="2">Horizontal Circle Reading</th><th colspan="2">Vertical Circle Reading</th></tr>
<tr><th>Face Left</th><th>Face Right</th><th>Face Left</th><th>Face Right</th></tr>
<tr><td>A</td><td>E</td><td>0°0'0"</td><td>180°0'40"</td><td>65°10'30"</td><td>??</td></tr>
<tr><td></td><td>B</td><td>128°47'20"</td><td>308°47'40"</td><td>??</td><td>297°25'40"</td></tr>
<tr><td>B</td><td>A</td><td>0°0'0"</td><td>180°0'40"</td><td colspan="2" rowspan="8"></td></tr>
<tr><td></td><td>C</td><td>102°6'40"</td><td>282°6'40"</td></tr>
<tr><td>C</td><td>B</td><td>0°0'0"</td><td>180°0'20"</td></tr>
<tr><td></td><td>D</td><td>108°52'20"</td><td>288°53'0"</td></tr>
<tr><td>D</td><td>C</td><td>0°0'0"</td><td>180°0'0"</td></tr>
<tr><td></td><td>E</td><td>91°0'0"</td><td>271°0'0"</td></tr>
<tr><td>E</td><td>D</td><td>0°0'0"</td><td>180°0'0"</td></tr>
<tr><td></td><td>A</td><td>109°11'20"</td><td>289°12'0"</td></tr>
</table>

13. Explain the advantages of trilateration over triangulation. List out the general specifications of primary triangulation. [4]

14. Calculate the area of transverse by double meridian distance methods. [4]

Line	AB	BC	CD	DE	EA
Latitude (m)	+218	-277	-109	-207	+375
Departure (m)	+202	+80	-332	-301	+351

15. Find the volume of earthwork by trapezoidal and Prismoidal formula in three consecutive sections at 30m interval. Formation level of starting chainage = 1201.85m. Formation width = 6m. Downward slope of formation = 100:1, Side slope = 2:1 and transverse slope = 6:1. The ground has an upward gradient of 50:1. The depth of cutting at 0 chainage is 1.65m. Compute the prismoidal correction also. [6]

16. What is EDM? Explain the operational principles of EDM measuring distances. [4]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Ashwin

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

Subject: - Surveying I *(CE 504)*

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

1. What do you mean by surveying? List out the secondary disciplines of surveying. [1+3]
2. A 1.5 km long road is indicated in a map by a length of 37.5 cm. Find the scale of the plot and indicate through a sketch how a suitable scale can be constructed to read upto 1 m in the map. [4]
3. Tabulate the various errors occurred in chaining/taping with their sources and directions. A 20m steel tape was standardized in catenary conditions under a pull of 10 kg and found to be 20.006m. This tape was used to measure a distance of 86m in catenary conditons at a pull of 10 kg. Supports were provided at every 10m. The weight of the tape was 30gm/m. Apply necessary tape corrections for the measured length of line. [2+6]
4. What is the principle of chain surveying? Compare the well condition triangle with error. [4]
5. Explain the method of compass traverse adjustment as you done with neat sketch. [4]
6. The fore bearing of line AB of a link traverse ABCDEF is 61°06'00". The angle to the right at stations with theodolite were observed as follows: $\angle B = 93°06'50"$, $\angle C = 155°45'30"$, $\angle D = 247°09'40"$ and $\angle E = 90°58'20"$. If the BB of the last line observed was 108°05'40". Check whether the observations for angles are correct or not. If not compute the correct bearings of all lines. [8]
7. Explain the principles of leveling. Which types of errors are eliminated by balancing of sight, illustrates with suitable examples. [3+2]
8. During fly leveling, the following staff readings were noted: [6]
   BS = 0.63, 2.05, -2.424, (B) and 2.56m
   FS= 2.444, 1.35 and -2.42m.
   The (B) was taken on a BM of RL 1280.00m. From the last point, it is required to set up 4 pegs each at 30m interval on a falling gradient of 1 in 200.
   a) Prepare the level book and calculate the RL of the top of each peg by rise and fall method.
   b) Also calculate the staff readings on each peg and apply usual checks.
9. Determine the RL of station B of a bridge axis AB of axis length 58.60m from the following information. If RL of station A was 1295m. Apply necessary check. [5]

Instrument near to	Sighted to	Staff reading		
		T	M	B
A	A	1.57	1.559	1.548
	B	1.9	1.585	1.271
B	A	1.96	1.647	1.335
	B	1.685	1.671	1.659

10. What are the principles of plane table surveying? List out the advantages and disadvantages of plane table surveying. [4]

11. List out the errors which are eliminated by taking face observations of theodolite; also explain the mechanism of elimination with neat sketches. Explain in brief about the temporary adjustment of theodolite. [2+2]

12. The following observations were recorded in a theodolite traverse ABCDA. Rule out the proper filed book and compute horizontal angles and adjust them if necessary. [6]

Instrument station	Target station	HCR observation	
		Direct	Reversed
A	D	90°00'10"	269°59'40"
	B	200°25'40"	20°25'30"
B	A	89°59'30"	270°00'10"
	C	180°16'10"	00°16'00"
C	B	90°00'10"	270°00'10"
	D	179°08'40"	359°08'20"
D	C	89°59'50"	270°00'00"
	A	160°12'40"	340°12'30"

13. Explain the principle of triangulation. List out the general specification of third order triangulations survey. [4]

14. Calculate the area of the following traverse by using DMD method. [4]

Line	AB	BC	CD	DA
Latitude (m)	225.28	-139.61	-336.90	251.23
Depature (m)	227.26	417.26	-196.47	-448.05

15. A roadway embankment of formation width of 10m and side slope 2:1 is to be constructed. The ground level along the centre line is as follows:

Change	0+000	0+040	0+080	0+120	0+160
GL (m)	1115.70	1114.30	1116.75	1115.15	1118.45

The embankment has arising gradient of 1 in 100 and the formation level at zero chainage is 114.95m. Assuming the ground level across the centre line, compute the volume of Earth work. [6]

16. What is EDM? Explain the fundamental principles of EDM measuring distances. [4]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Chaitra

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

Subject: - Surveying I *(CE 504)*

- ✓ 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 surveying? Explain about the four major principles of surveying. [4]
2. Describe the various types of errors in surveying. [4]
3. A steel tape was standardized in catenary at 7 kg pull. Distance of 360m was measured with this tape under a pull of 5 kg. Assuming that the tape was supported at every 20m length, determine the correct length of line if the weight of tape=10gm/cc and cross sectional area of tape=$0.03cm^2$. Take $E = 210\times10^3$ N/mm^2. [4]
4. A plan represents an area of $39672m^2$ and represents 4.75cm x 5.22cm on plan. Find the scale of the plot and indicate through a sketch how a suitable scale can be constructed to read up to 1m on the plan. The scale should be long enough to measure upto 400m. [4]
5. How would you adjust closing error graphically in compass traverse. Explain with neat sketches. [4]
6. Why is it necessary use well conditioned triangle? Explain the importance of the tie line in chain survey. [4]
7. The following table gives the FB and BB of the sides of a closed compass traverse PQRSTP. [8]

line	PQ	QR	RS	ST	TP
FB	188°45'	119°15'	346°30'	337°00'	293°30'
BB	7°45'	298°15'	168°30'	158°30'	113°00'

Check the bearings for local attraction. Correct the bearing by the method of included angles.

8. What is closing error in level circuit? How the closing error can be adjusted in a level circuit, explain them. [4]
9. Following readings were taken during a leveling work from TBM1 to TBM2 2.191, 2.505, 2.325, 1.496, 3.019, 2.513,(-)1.685, 2.811, 1.752, 3.824m. Level instrument was changing after 4^{th} and 8^{th} readings. Enter the above readings in a level field book format and compute RLs of all the points and adjust the RLs if error arises. RLs of TBM1 and TBM2 are 1449.870 and 1448.710m respectively. [6]
10. The following staff reading were taken during a reciprocal leveling: [6]

Instrument at near	Staff reading on	
	A	B
A	1.252	1.052
B	1.419	1.253

If the distance AB is 250m, compute the RL of B. If RL of A is 1450.500m, find the combined correction, collimation error and correct reading for A during second setup.

11. What is plane table surveying? Explain the intersection method and its advantages. [4]

12. Explain about construction principle of theodolite and function of micrometer screw in optical theodolite. [4]

13. Using mean direction method, calculate the mean horizontal angle. [6]

Instrument at	Sighted to	Set	HCR observation	
			Left Face	Right Face
O	A	I	00°00'00"	179°59'30"
	B	I	121°00'00"	301°00'20"
	A	II	90°00'10"	269°59'40"
	B	II	211°00'40"	31°00'20"

14. Explain the classification of triangulation system. [4]

15. The offsets in meter from a survey line to an irregular boundary line are given below: [4]

chainage (m)	0	10	20	30
Offset (m)	4.6	7.2	9.6	6.4

Calculate the area enclosed by 1st line, last line, survey line & boundary line using Simpson's rule and trapezoidal rule.

16. Find the volume of cutting in a length of 60m with the following data for a two level section using the prismoidal and trapezoidal formula. Also calculate the prismoidal correction. Formation width 9m, side slope = 2:1, transverse slope =6:1. The ground level at 30m intervals are given below.

Chainages (m)	0	30	60
Ground level (m)	1181.50	1181.80	1182.40

The formation has a downward slope of 1 in 40 with the formation level at 0+000 chainage being 1179.000m. [6]

17. Write short notes on principles of EDM. [4]

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03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Ashwin

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

Subject:* - Surveying I *(CE504)

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

1. List out the principles of surveying and describe any two of them. [4]
2. A map is drawn to some scale so that a plot of 51750 m^2 is represented by 4.6cm × 4.5cm on the plan. Calculate the RF of the scale of the map. Draw a scale to read up to a single metre from the map and scale should be long enough to measure upto 600m. [4]
3. A tape of nominal length 30 m is standardized in catenary at 50N tension and found to be 29.8950m. If the mass of the tape is 0.015 kg/m, calculate the horizontal length of a span recorded as 23 m. [6]
4. What is the need of a reference sketch of stations? Explain by giving the sample page of a detailing field book and how offsets values are to be measured and recorded in the detailing field book? [4]
5. Define closing error. Describe about the various plotting method in compass traverse. [4]
6. The following observations were taken with a compass in case of a closed traverse. Calculate the angles and correct the bearings for local attraction, if any. Calculate the true bearings, if declination is 1°30′ East. [8]

Line	FB	BB	Declination
AB	51°30′	230°00′	1°30′
BC	182°45′	2°30′	
CD	4°00′	284°45′	
DE	165°15′	345°45′	-
EA	251°30′	71°30′	

7. Suggest a best method to transfer RLs from one bank of river to the other bank with derivation. Which type of errors are removed by this above method? [4]
8. The following consecutive readings were taken with a dumpy level and a 4m staff on a continuously sloping ground on a straight line at a common interval of 30m.
   0680, 1.455, 1.855, 2.880, 2.800, 3.380, 1.055, 1.860, 2.265, 3.540, (B) 0.835, 0.945, 1.530 and 2.445.

   The RL of B was 1180.750m. Rule out a page of a level field book and enter above readings. Calculate the RLs of the points by the rise and fall method, and also the gradient of the line joining the first and last points. [6]
9. Following staff readings were noted during a two peg test operation:

Instrument Station	Staff Readings		Remarks
	A	B	
At mid point P	1.585	1.287	Distance between A and B = 60.00m
Near A i.e. 6m inside between A and B	1.355	1.045	

Compute the collimation precision. If error is there, compute the correct readings for A and B during II set up and describe the procedure for making the line of collimation in horizontal. [4+2]

10. What are the principles of plane table surveying? Describe the process of Orientation of plane table by Back sighting with supporting sketch. [4]

11. Explain temporary adjustments of theodolite survey. [4]

12. A direction theodolite with a least count of 10" is set over station 'O' to measure direction to stations A, B, C and D. The observed circle readings are as follows: Compute the mean horizontal angle and adjust them if necessary. Also calculate, missing data of vertical circle reading. [6]

Instrument	Target Station	Telescope	Horizontal Circle Readings	Vertical Circle Readings
O	A	Direct	00°00'10"	120°15'10"
		Reversed	180°00'20"	?
	B	Direct	60°55'10"	?
		Reversed	240°55'20"	308°51'40"
	C	Direct	140°50'50"	?
		Reversed	320°51'20"	269°15'10"
	D	Direct	270°20'10"	177°20'10"
		Reversed	90°20'20"	?
	A	Direct	0°00'20"	89°00'10"
		Reversed	180°00'30"	?

13. Describe selection criteria of Triangulation and Trilateration stations. What are the field applications of Triangulation? [4]

14. From the chainages and offsets given below, find the area between the boundary, the first and last offsets and base line. [4]

Chainages(m)	0	12	20	25	34	42	52
Offsets (m)	0	6.9	7.6	9.8	10.2	9.9	6.8

15. Find the volume of filling in a length of 50m with the following data for a two level section, using the trapezoidal and prismoidal formula, where formation width = 10m, side slope 2:1, transverse slope = 8:1. The ground level at 25m interval are given below.

Chainages (m)	0	25	50
RL of GL	1080.50	1079.80	1078.40

The formation has a downward slope of 1 in 50 with the formation level at 0 chainage being 1081.50m. [8]

16. What is EDM? Describe about the principles of distance measurement techniques in EDM. [4]

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05 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Chaitra

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

Subject: - Surveying I *(CE504)*

- ✓ 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. Mention the various fundamental principles of surveying and describe about the major three of them by giving suitable examples. [4]

2. What are the selection criteria of scale for drawing a map? A rectangular plot of land of area 0.55 hectare is represented on a map of similar rectangle area of 6.11 cm^2. Calculate the representative factor of the scale of the map. Draw a scale to read upto a meter from the map. The scale should be long enough to measure upto 400m. [2+4]

3. A 30m steel tape was standardized in catenary condition under a pull of 5 kg and found to be 30.008m. This tape was used to measure a distance of 66m in three equal span in catenary conditions at a pull of 5 kg. The weight of tape was 30 gm/m. Apply necessary tape correction for the measured length of line. [6]

4. Why and how to take offsets to different objects? Describes briefly with neat sketches of detailing field book of chain survey. [4]

5. What is misclosure in compass traverse? Describe about the graphical adjustment of such misclosure during plotting of compass traverse. [4]

6. The fore bearing of line AB of an open traverse ABCDEFGH is 81°45′. The deflection angles between the lines were measured with a theodolite and were as follows: 25°30′(R) at B, 37°45′(L) at C, 45°15′(R) at D, 55°30′(L) at E, 75°15′(L) at F and 80°00′(R) at G. If the FB of the last line observed was 63°00′. Check whether the observations for deflection angles are correct or not. If not compute the correct bearings of all the lines. [8]

7. Discuss briefly the effect of curvature and refraction in levelling. Derive an expression for curvature correction and for combined curvature and refraction correction. [4]

8. A page of a level field book with some missing data are given below. Find those missing data and calculate the reduced levels of all the points. [6]

Stations	BS	IS	FS	Rise (+)	Fall (-)	RL (m)	Remarks
A	3.250					1249.260	
B	1.755		?		0.750		CP_1
C		1.950			?		
D	?		1.920	?			CP_2
E		2.340		1.500			
F		?		1.000			
G	1.850		2.185		?		CP_3
H		(-) 1.575		?			
I		?			2.820		
J	?		1.895		?		CP_4
K			(-) 1.350	?			
	$\Sigma BS = 12.795$						

9. Reciprocal leveling was conducted across a wide river to determine the difference in level of points A and B, A situated on one bank of the river and B situated on the other. The following results on the staff held vertically at A and B from level stations 1 and 2, respectively, were obtained. The level station 1 was near to A and station 2 was near to B.

Instrument at	Staff reading on	
	A	B
1	1.486	1.726
2	1.191	1.416

If the reduced level of B is 1260.18 m above the datum, what is the reduced level of A? Assuming that the atmospheric conditions remain unchanged during the two sets of the observations, calculate

a) The combined curvature and refraction correction if the distance AB is 300 m, and
b) The collimation error [6]

10. Describe about the reliable method of orientation of plane tabling and at what circumstances intersection method of plane tabling is more preferable than radiation. [4]

11. Explain briefly about the temporary adjustments of a theodolite. [4]

12. The following observations were recorded in a theodolite traverse ABCDA. Compute the mean horizontal angles and missing readings by entering the following readings in a standard booking format. [6]

Instrument Stations	Target Stations	HCR Observations		VCR Observation	
		Direct	Reversed	FL	FR
A	D B	89°59′50″ 160°12′40″	270°00′10″ 340°12′30″		
B	A C	90°00′00″ 179°08′40″	269°59′40″ 359°08′30″	120°14′20″	?
C	B D	90°00′00″ 200°25′40″	269°59′50″ 20°25′20″		
D	C A	90°00′10″ 180°16′10″	270°00′00″ 00°16′00″	?	308°51′20″

13. Define trilateration. Write down the General specifications of 2nd and 3rd order triangulation. [4]

14. The following offsets were taken at 20m interval from a survey line to an irregular boundary line 0.00m, 1.53 m, 5.37 m, 3.50 m, 4.32 m, 7.25 m, 4.30 m, 6.55 m. Calculate the area enclosed between the survey line by(i) Trapezoidal Rule (ii) Simpson's 1/3 rule. [4]

15. Find the volume of cutting in a length of 60m with the following data for a two level section using the trapezoidal and prismoidal formula, where formation width = 9m, side slope 2:1, transverse slope = 6:1. The ground levels at 30m interval are given below.

Chainages (m)	0	30	60
RL of GL (m)	1181.50	1181.80	1182.40

The formation has a downward slope of 1 in 40 with the formation level at 0(zero) chainage being 1179.00m. [6]

16. What are the principles of actual operation of EDM? Describe the sources of errors of EDM. [4]

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

05 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2074 Ashwin

Subject: - Surveying I *(CE504)*

✓ 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 surveying. Explain its importance of civil engineers. [4]

   b) Explain perpendicular and oblique offset with neat sketch. [4]

   c) A steel tape was exactly 20 m long at 20°C when supported throughout its length under pull of 100 N. A line was measured with this tape under pull of 160N at mean temperature of 30°C and found to be 1020 m long. The cross sectional area of tape is 0.03 cm^2, weight per meter length is 24 gm, coefficient of thermal expansion for steel is $11\times10^{-6}/°C$ and modulus of elasticity of steel is 2.1×10^{6} kg/cm^2. Find true length of line if tape was supported at every 10 m during measurement. [8]

2. a) Explain whole circle bearing and reduced bearing of Compass Survey with neat sketch. [4]

   b) Write the propagation of electromagnetic energy. [4]

   c) The bearing of a closed traverse ABCDEEA are given as follows, find the stations affected by local attraction and correct them if necessary. [8]

Line	Fore Bearing	Back Bearing
AB	216°30'	36°10'
BC	135°55'	316°25'
CD	81°30'	260°30'
DE	321°10'	141°20'
EF	246°20'	66°50'
FA	299°20'	119°00'

3. a) State the points to be considered in fly leveling. [4]

   b) Explain reciprocal leveling with neat sketch. [4]

   c) The following consecutive readings were taken with a Level and a 4 m leveling staff on continuously sloping ground at a common interval of 30 m. [8]

   0.585 on A, 0.936, 1.953, 2.846, 3.644, 3.938, 0.962, 1.035, 1.689, 2.534, 3.844, 0.956, 1.579, 3.016 on B

   The elevation of B was 1120.450. Make up the level field book and apply the usual checks. Find the gradient between first and last point.

4. a) The following offsets were taken from a chain line to hedge. [8]

Distance (m)	0	5	10	15	20	25	30	35	40
Offset(m)	0	2.5	5	7.5	8.8	7.5	6.5	3.5	0

Calculate the area enclosed between the chain line and hedge by,

i) The simpson's rule
ii) The trapezoidal rule

b) The following observations were recorded in a theodolite traverse ABCDA. Compute the mean horizontal angles and adjust them if necessary. [8]

Inst. Station	Target Station	Horizontal circuit reading	
		Face Left	Face Right
A	D	90°00'00"	269°59'30"
	B	204°25'40"	24°25'30"
B	A	90°00'00"	270°00'30"
	C	190°36'10"	10°36'00"
C	B	90°00'00"	269°59'50"
	D	169°08'40"	349°09'20"
D	C	90°00'00"	270°00'00"
	A	165°12'40"	345°12'30"

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

i) Principles of chain survey
ii) Advantages and disadvantages of plane table survey
iii) Principle of triangulation and trilaleration
iv) Temporary adjustment of theodolite
v) Sources of error in leveling

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05 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2073 Chaitra

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

Subject: - Surveying I *(CE504)*

- ✓ 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 surveying. Explain its importance for civil engineers. [4]

   b) Explain historical background of surveying and write basic principles of surveying. [4]

   c) A line was measured with a steel tape which was exactly 30 m at 20°C and at a pull of 10 kg, the measured length being 1860 m. The temperature during measurement was 35°C and the pull applied was 20 kg. Find the true length of the line, if the cross sectional area of the tape was 0.025 sq.cm. The co-efficient of expansion of the material of the tape per °C = 3.5×10^{-6} kg/sq.cm and the modulus of elasticity of material of the tape = 2.2×10^{6} kg/sq.cm. [8]

2. a) Explain the errors and adjustments in compass traversing. [4]

   b) Write the principle of electromagnetic distance measurement. [4]

   c) Following are the bearing observed in a compass traverse survey. At what station do you suspect local attraction? Find the correct bearing and true bearing of each of the lines given that magnetic declination was 3°30'E. [8]

Line	F.B	B.B
AB	191°30'	13°00'
BC	79°30'	256°30'
CD	32°15'	210°30'
DE	262°45'	82°15'
EA	230°15'	53°00'

3. a) State the points to be considered in fly leveling. [4]

   b) Explain reciprocal leveling with neat sketch. [4]

   c) The following consecutive readings were taken with a Level and a 4 m leveling staff on continuously sloping ground at a common interval of 30 m. [8]

   0.585 on A, 0.936, 1.953, 2.846, 3.644, 3.938, 0.962, 1.035, 1.689,2.534, 3.844,0.956,1.579, 3.016 on B.

   The elevation of B was 1120.450. Make up the level field book and apply the usual checks. Find the gradient between first and last point.

4. a) The following offsets were taken from a chain line to hedge. [8]

Distance (m)	0	5	10	15	20	25	30	35	40
Offset (m)	0	2.5	5	7.5	8.8	7.5	6.5	3.5	0

   Calculate the area enclosed between the chain line and hedge by,

   i) The simpson's rule
   ii) The trapezoidal rule

b) The following observations were recorded in a theodolite traverse ABCDA. Compute the mean horizontal angles and adjust them if necessary. [8]

Inst. Station	Target station	Horizontal circle reading	
		Face Left	Face Right
A	D	$90^0 00' 00''$	$269^0 59' 30''$
	B	$204^0 25' 40''$	$24^0 25' 30''$
B	A	$90^0 00' 00''$	$270^0 00' 30''$
	C	$190^0 36' 10''$	$10^0 36' 00''$
C	B	$90^0 00' 00''$	$269^0 59' 50''$
	D	$169^0 08' 40''$	$349^0 09' 20''$
D	C	$90^0 00' 00''$	$270^0 00' 00''$
	A	$165^0 12' 40''$	$345^0 12' 30''$

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

i) Principles of chain survey
ii) Advantages and disadvantages of plane table survey
iii) Principle of triangulation and trilateration
iv) Temporary adjustment of theodolite
v) Source of errors in leveling

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06 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Shrawan

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

Subject: - Surveying I *(CE504)*

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

1. a) Explain about the objectives of surveying. Differentiate between plane and geodetic surveying. [4]

   b) Give a list of sources of errors in linear measurements and say which of them are cumulative and which are compensating. [4]

   c) A steel tape was exactly 30 m long at 20°C when supported throughout its length under a pull of 10 kg. A line was measured with this tape under a pull of 15 kg and at a mean temperature of 32°C and found to be 780 m long. The cross section area of tape = 0.03 cm^2 and it's total weight = 0.693 kg. α for steel = 11×10^{-6} per °C and E for steel = 2.1×10^6 kg/cm^2. Compute the true length of the line if the tape was supported during measurement at every 15 m. [8]

2. a) With neat sketches explain about types of field books in chain survey. [4]

   b) Explain Graphical method of adjusting a traverse in compass survey. The following bearing was observed in a compass traverse. [4]

   c)

Line	FB	BB
AB	69°30'	246°30'
BC	191°30'	13°00'
CD	230°15'	53°00'
DE	262°45'	80°45'
EA	32°15'	210°30'

   At which of these stations would local attraction be suspected? Find the corrected bearing of the lines. [8]

3. a) Why reciprocal levelling is done? Also derive the formula for reciprocal levelling. [6]

   b) The consecutive readings taken during a levelling operation are as follows: 0.685, 1.315, -1.825, -0.635, 1.205, 1.235, 2.631, 1.355, -2.015. The instrument was shifted after the third and sixth readings. The third reading was taken to a benchmark of assumed elevation 100.00. Find the reduced levels of other points. [6]

   c) What is the purpose of L-sectioning and cross section levelling, Explain with field procedure. [4]

4. a) Explain temporary adjustments of theodolite survey. Also show the different fundamental lines of theodolite. [4]

b) During the Survey of suspension bridge the following observations were made in triangle ABC. AB is the bridge axis. The least count of the instrument is 01'00". [8]

Inst. Station	Sighted to	Horizontal circle reading	
		Face Left	Face Right
A	B	0° 00'00"	180°00'20"
	C	54°38'20"	234°38'00"
B	C	0° 00'00"	179°59'50"
	A	89°20'40"	269°21'00"
C	A	0° 00'00"	180°00'00"
	B	36°01'00"	215°58'20"

Compute the angles by mean direction method and correct them if necessary. If the length of line BC is 58.232m, find the span of bridge axis AB.

c) Explain briefly different types of triangles used in triangulation system with sketches. Write down the specification of 1st order triangulation. [4]

5. a) Explain the working principle of plane table survey and explain orientation by back sighting. [4]

b) Find the volume of cutting in a length of 60 m with the following data for a two level section using the prismoidal and trapezoidal (average end area) formula. Also calculate the prismoidal correction. Formation width = 9m, side slope = 2:1, transverse slope = 6:1. The ground levels at 30 m intervals are given below: [8]

Chainage:	0	30	60
GL (m):	281.50	281.80	282.40

The formation has a downward slope of 1 in 40 with the formation level at 0 chainage being 279.00 m.

c) Workout co-ordinates method for finding Area. [4]

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05 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Chaitra

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

Subject: - Surveying I *(CE504)*

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

1. a) Explain distance measurement in sloping ground. [4]

   b) A 30 m steel tape was standardized in carenary condition under pull of 5 kg and found to be 30.015m. The tape was used to measure distance of 24.726 m in catenary conditions at a pull of 5 kg. The weight of the tape was 30 gm/m. Apply necessary tape correction. [6]

   c) A plan represents an area of 18000 m^2 and measures 8 cm×9 cm. Find the scale of the plot and indicate through a sketch how a suitable scale can be constructed to read up to 1 m in the plan. If the same plan is to be drawn on a topo sheet with a scale of 1:12500, what will be the represented area of that plan on the sheet? [6]

2. a) Explain calculation of internal angles in Q.B system. [4]

   b) Explain the field procedure for chain surveying. [4]

   c) The following bearings are observed in a compass traverse survey. [8]

Line	AB	BC	CD	DE	EA
Fore Bearing	S11°30'W	N67°30'E	N32°15'E	S82°45'W	S50°15'W
Back Bearing	N13°00'E	S66°30'W	S30°30'W	N80°45'E	N53°00'E

   Apply necessary checks and determine the corrected bearings.

3. a) Explain personal errors in leveling, intersection method in plane table. [2+2]

   b) A leveling instrument was set up exactly mid way between two pegs 50 m apart at A and B. The staff readings were 1.875 and 1.790 m respectively. The level was shifted to a point 5 m from B on the line AB produced and the staff readings were 1.630 and 1.560 m. Determine the correct staff readings when the line of columniation is exactly horizontal during 2^{nd} set up. [6]

   c) Following readings were taken during a leveling work from TBM_1 to TBM_2.

   2.191, 2.505, 2.325, 1.496, 3.019, 2.513, 2.811, 1.752 and 3.824 m. Level instrument was changed after 4^{th} and 7^{th} readings. Enter the above readings in a level book format and compute RLs of all the point and adjust the RLs if error arise. RLs of TBM_1 and TBM_2 are 449.870 and 448.710 m respectively. [6]

4. a) Explain triangulation, trilateration and graphical intersection in plane tabling. [6]

b) Explain about the construction principles of theodolite and uses of theodolite. [4]

c) The following observations were recorded in a theodolite traverse ABCDEA. Compute the mean horizontal angles and adjust them if necessary. [6]

Inst. Stn	Target stn	HCR observation	
		Direct	Reversed
A	D	90°00'10"	269°59'40"
	B	200°25'40"	20°25'30"
B	A	89°59'30"	270°00'10"
	C	180°16'10"	00°16'00"
C	B	90°00'0"	269°59'50"
	D	179°08'40"	359°08'20"
D	C	89°59'50"	270°00'10"
	A	160°12'40"	340°12'30"

5. a) What is EDM? Explain principles of EDM for measuring horizontal distances. [4]

b) Find the volume of cutting in a length of 60 m with the following data for a two level section using the prismoidal and trapezoidal formula (average end area). Also calculate the prismoidal correction. Formation width = 10 m, Side slope = 2:1, Transverse slope = 6:1. The ground levels at 30 m intervals are given below. [8]

Chainage (m)	0	30	60
GL (m)	540.70	541.00	541.60

The formation has a downward slope of 1 in 40 with formation level at 0 chainage being 538.20 m.

c) Calculate the area of transverse by double meridian distance method. [4]

Line	PQ	QR	RS	SP
Latitude (m)	-300	640	100	-440
Departure (m)	450	110	-380	-180

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05 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Kartik

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

Subject: - Surveying I *(CE504)*

✓ 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 surveying. Explain its importance for civil Engineers with examples. [4]
   b) The area of a field is 50,000 m^2. The length and breadth of the field on the map are 10 cm and 8 cm. Construct a diagonal scale which can be read up to one meter. Find out R.F. of scale. [6]
   c) A baseline was measured in catenary at 10°C with a pull 5 kg in four segments 30.536, 29.635, 29,827 and 22.066 m. The difference of level was 0.30, 0.60, 0.20 and 0.45 m respectively. Calculate the length of base line if the tape was standardized as 30 m on the flat at 20°C with pull 15 kg. Density of tape materials = 7690 kg/m^3, α = 0.000011 per °C, mass of tape per meter unit length = 20 gm E = 210×10^3 N/mm^2. [6]

2. a) What are the different types of offsets and methods of taking offsets? [4]
   b) What is magnetic declination? Find the value of magnetic declination if the magnetic bearing of the Sun at noon is 356°. [4]
   c) Compute the corrected bearings from a closed compass survey ABCDEA. [8]

Line	AB	BC	CD	DE	EA
FB	140°30'	223°15'	287°00'	12°45'	60°00'
BB	322°30'	44°15'	107°45'	193°15'	239°00'

3. a) Explain the effect of curvature and refraction in leveling. Derive an expression for the curvature correction and refraction correction. The following consecutive staff readings were taken on a continuously sloping ground at 30 m intervals: -0.680, 1.855, 3.380, 3.830, 1.835, 2.250. 1st reading was taken on a B.M of R.L 435.982 m compute the R.L.s by rise and fall method and the gradient between B.M and last point. [4+4]
   b) Explain the temporary adjustment of level. A leveling instrument was set up exactly mid way between two pegs P and Q, 50 m apart. The staff readings on P and Q were 1.790 m and 1.895 m respectively. The instrument was shifted and set up at a distance of 5 m from Q on the line PQ produced. The staff readings taken were 1.563 m and 1.682 m at P and Q respectively. Compute the correct staff readings. [4+4]

4. a) Explain orientation by back sight in plane table survey. [4]
   b) Describe classification of EDM instrument. [4]
   c) Prepare a booking format of angle measurement between OA and OB by reiteration method including two sets and compute mean angle by FL and FR and mean direction method. [8]

5. a) Describe about measuring principle of electronic distance measurement. Compare these methods. [4]
   b) What is trilateration? Write the specification of first order triangulation. [4]
   c) A road embankment is 10 m wide at the formation level, with a side slope 1:1. The embankment has a rising gradient of 1 in 100 m. The existing ground level along the center line are as follows: [8]

Chainage (m)	0	100	200	300
Ground level (m)	503	498.50	504.50	502.50
Formation level (m)	500			

Compute the volume of Earthwork

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02 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Shawan

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

Subject: - Surveying I *(CE504)*

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

1. a) What are the principles of surveying? Explain clearly. [6]

   b) A steel tape 30 m long was standardized at 20°C with a pull of 10kg. A line was measured with this tape under the pull of 5 kg at a mean temperature of 32°C and found to be 2100m. The cross sectional area of tape is 0.03 cm^2. Young's modulus of elasticity of tape material is 2.1×10^6 kg/cm^2, α for steel is 12×10^{-5}/°C; the weight of tape is 0.693 kg. Determine the true distance measured and also find the normal tension if the measured length is equal to the true distance. [10]

2. a) Define whole circle bearing, quadrantal bearing, local attraction and magnetic declination. [6]

   b) The bearing observed in traversing with a compass at a place where local attraction was suspected are given below: [10]

Line	Fore bearing	Back bearing
AB	S 45°30'E	N 45°30'W
BC	S 60°00'E	N 60°40'W
CD	N 03°20'E	S 05°30' W
DA	S 85°00'W	N 83°30'E

At what stations do you suspect local attraction? Find the corrected bearings of the lines.

3. a) Explain Crossection and Profile leveling with suitable sketches. [6]

   b) Following is the page of a level field book. Calculate the mission readings. [10]

Stations	BS	IS	FS	Rise	Fall	RL	Remarks
1	?					1150.00	BM
2		2.457			0.827	?	
3		2.400		0.057		?	
4	2.697		?		?	1148.070	CP
5	?		2.051	0.646		1148.716	CP
6		2.500		1.068		1149.784	
7		2.896			?	1149.388	
8		?			0.124	?	
9			2.672	0.348		1149.612	

4. a) Write the advantages and disadvantages of plane table survey. [4]

b) Calculate the mean angle AOB by the mean direction method form the following data in a standard booking format: [6]

			HCR Observation	
Inst.station	Target station	Face	Set I	Set II
0	A	L	00°00'00"	90°00'10"
	B	L	121°00'00"	211°00'40"
	B	R	301°00'20"	31°00'20"
	A	R	179°59'30"	269°59'40"

c) Calculate the area of a closed traverse by double meridian distance method. [6]

Line:	AB	BC	CD	DA
Latitude (m):	(-)300	(+)640	(+)100	(-)440
Departure (m):	(+)450	(+)110	(-)380	(-)180

5. Write short notes on: (any two) [2×8]

i) Principles of triangulation and trilateration

ii) Principles of chain survey

iii) Principle of electronic distance measurement.

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02 TRIBHUVAN UNIVERSITY	Exam.	Regular		
INSTITUTE OF ENGINEERING	Level	BE	Full Marks	80
Examination Control Division	Programme	BCE	Pass Marks	32
2070 Chaitra	Year / Part	II / I	Time	3 hrs.

Subject: - Surveying I *(CE504)*

- ✓ 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) Write the principles of surveying. [6]

   b) A steel tape standardized in catenary condition at 20°C temperature and 12 kg pull was found to be 29.985 cm. A line measured with this tape under a pull of 16 kg and at a mean temperature of 28°C was found to be 680 m long. Assuming that the tape is supported at every 20 m length. Find the true length of the line given that cross sectional area of tape = 0.03 cm^2, Young's modulus of elasticity, $E = 2.10\times10^6 kg/cm^2$, coefficient of linear expansion, $\alpha = 11\times10^{-6}/°C$ and weight of tape = 10 gm/cc. [10]

2. a) Explain fore bearing, back bearing, Magnetic bearing and true bearing. [6]

   b) In a traverse survey following FB and BB were recorded at a place where local attraction was suspected. [10]

Lines	AB	BC	CD	DE	EA
FB	22°15'	39°30'	191°45'	330°15'	242°45'
BB	200°30'	222°30'	13°00'	147°45'	62°45'

   Find the correct bearings and included angles.

3. a) Explain reciprocal and precise leveling. [6]

   b) During fly leveling the following note is made: [10]

   BS: 0.62, 2.05, 1.42, 2.63 and 2.42 m
   FS: 2.44, 1.35, 0.53 and 2.41 m

   The first BS was taken on a BM of RL 1000.00m. From the last BS it is required to set 4 pegs each at a distance of 30 m on a rising gradient of 1 in 200. Enter these notes in the form of a level book and calculate the R.L.of the top of each peg by the rise and fall method. Also calculate the staff readings on each peg.

4. a) Explain Radiation and Intersection methods of plane table survey. [6]

   b) Compute the mean horizontal angles and adjust them if necessary: [10]

Inst.Station	Target Station	Horizontal circle Readings	
		F.L	F.R
O	A	00°00'20"	180°00'40"
	B	50°45'20"	230°45'30"
	C	140°50'55"	320°51'05"
	D	250°10'10"	70°10'00"

5. Write short notes on: (any two) [2×8]

   i) Trapezoidal and Simpon's 1/3 rule
   ii) Principle of electronic distance measurement
   iii) Principles of triangulation and trilateration

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Exam.	Old Back (2065 & Earlier Batch)

01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Chaitra

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

Subject: - Surveying I *(EG525CE)*

- ✓ 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 the term surveying. Differentiate between geodetic surveying and plane surveying. [4]

   b) What is graphical scale? Explain its importance on the map. [4]

   c) A 30 m tape weighing 8.9 N and has a cross sectional area of 2.58 mm^2 was standardized and found to be 30.005 m at 20° C with 52 N tension at fully supported condition. This tape was used for mearsuring the distances at contant temperature of 31.2° C and pull applied 110 N. The tape was supported at 0 and 30 m end. The observed distance was 630 m. Calculate the correct horizontal distance between points. Take coefficient of linear expansion of tape $\alpha = 12 \times 10^{-6}/°C$ and Young's modulus of elasticity of tape material. $E = 12 \times 10^{11} N/m^2$. [8]

2. a) Explain basic principles of chain survey and describe the field procedure of chain survey. [6]

   b) The following bearings were observed in a compass traverse. [10]

Line	AB	BC	CD	DE	EA
FB	305°00′	75°30′	115°30′	166°30′	225°00′
BB	125°30′	254°30′	297°30′	345°00′	450°00′

   At what stations do you suspect local attraction? Find the correct bearings of all the lines.

3. a) Explain about graphical adjustment of compass traverse. [6]

   b) Explain the principles of levelling. Describe reciprocal levelling with sketch. [10]

4. a) A levelling operation is carried out in a closed loop. Fill all the missing data of a levelling field book and do the arithmetic check also. [10]

Stations	BS	IS	FS	Rise	Fall	RLs(m)
A	?					?
B		2.572			0.319	295.909
C	?		1.987	?		?
D		0.918			0.236	?
E	?		?	1.433		?
F			2.115	?		298.848
G		1.750			?	?
H	?		2.057		?	?
A			1.456		1.847	?

b) Define orientation of plane table and explain orientation of plane table by back sighting. [6]

5. a) Discuss the temporary adjustment in theodolite survey? [8]

b) Develop a booking format for recording 2 sets of horizontal circle readings with appropriate numerical example. Calculate the mean horizontal angles and mean direction of the lines. [8]

6. Write short notes on: [8+8]

a) Distinguish between triangulation and trilateration.

b) What are the advantages and disadvantages of plane tabling?

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06 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2070 Ashad

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

Subject: - Surveying I *(CE504)*

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

1. a) What are the principles of surveying? Illustrate with suitable examples. [4]

   b) A distance of 20 m was set out with a 20 m tape from the top of station A to the top of station B. The tape being in catenary under a pull of 200 N and at a mean temperature of 31.25°C. The top of station A was 0.70 m above the top of station B. Calculate the exact horizontal distance between two stations, if the tape was standardised at a temperature of 20°C in catenary condition, under a pull of 100 N. Take $\alpha = 1\times10^{-5}$ per°C, Area of tape = 0.10 sq.cm, $E = 2\times10^{5}$ N/mm^2 and weight of the tape = 12 N. [8]

   c) What are the corrections applied in the linear measurement? Explain briefly. [4]

2. a) What are the advantages and disadvantages of plane table survey? Explain. [4]

   b) Define Triangulation and Trilateration. [4]

   c) Calculate the correct bearings of a link traverse XABCY from the following data: Bearing of lines XA = 292°15', and YC = 152°47'. Angles to the right ∠A = 229°30', ∠B = 323°45' and ∠C = 27°15' [8]

3. a) List out the plotting method of compass traverse. What is the closing error and how closing error is adjusted graphically in compass traverse? [8]

   b) In running a fly levelling from a BM of RL 1400.602 m, the following readings were obtained. [8]

      BS : 1.543, 2.694, 1.416, 2.923 m

      FS : 0.754, 1.236, 0.596 m

      From the last position of the instrument, six pegs at 20 m interval are to be set out on a uniform rising gradient of 1 in 50, the 1st peg is to have a RL of 1404.000 m. Calculate the staff readings required to be set out the pegs and also the RLS of the pegs in a tabular format.

4. a) Describe about the field procedure of taking longitudinal sectioning and cross section. State its purpose and importance for new road construction project. [8]

   b) From a theodolite station O angle observation towards various stations are taken with referencing from P and then Q, R,S and again horizon is closed at P. The observed face left readings at P, Q, R, S and P are 00° 00' 00", 95°10'20", 205°32'30", 260°55'40" and 359°59'50" respectively. Similarly face right readings towards P, Q, R, S and P are 180°00'10", 275°10'00", 25°32'20", 80°55'20" and 179°59'40" respectively. Compile the above reading in a tabular form and compute the average angles, check and balance them if necessary. [8]

5. a) The formation width of a certain cutting is 10 m and side slope is 1:1. The surface of ground has a uniform slope of 1:7. The depths of cutting at the centers of the three sections 50 m apart are 2 m, 3 m and 4 m respectively. Find the volume using trapezoidal and simpson's rule. [8]

   b) Draw a longitudinal section and corresponding mass diagram showing free hand, over [illegible]

06 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2069 Chaitra

12/2

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

Subject: **- Surveying I** ***(CE504)***

- ✓ 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 the term surveying and differentiate between geodetic and plane surveying. [4]

   b) What are the corrections applied in the linear measurement? Explain briefly. [4]

   c) A 20m steel tape standardized in catenary at a temperature of 12.5°C and a pull of 100N was found to be 19.978m. This tape was used to measure a base line. Throughout the measurement the tape was used in catenary for each tape length. Find the correct length of the baseline if the temperature during measurement was 25°C and pull applied was 150N weight of steel is 0.077 N/cm^3. The weight of suspended tape was 7.85 N. Take $E = 2.10 \times 10^5 N/mm^2$ and $\alpha = 12 \times 10^{-6}/°C$. The measured base line distance was 1120m. [8]

2. a) Explain briefly about the field produre of chain survey. [4]

   b) Explain briefly about radiation and intersection methods of plane table survey, [4]

   c) The following bearings were observed in a compass traverse. [8]

Line	AB	BC	CD	DE	EA
FB	305°30'	75°30'	115°30'	166°30'	225°00'
BB	125°30'	254°30'	297°30'	345°00'	44°00'

   At which stations do you suspect local attraction? Find the correct bearing of all the lines.

3. a) In which condition reciprocal levelling is used. Also derive the formula for reciprocal levelling. [6]

   b) A levelling operation is carried out in a closed loop. Fill all the missing data of a levelling field book given below: [10]

Station	BS	IS	FS	Rise	Fall	RL
A	?					?
B		2.572			0.319	295.909
C	?		1.987	?		?
D		0.918			0.236	?
E	?		?	1.433		?
F	1.372		2.115	?		298.848
G		1.750			?	?
H	?		2.057		?	?
A			1.456		1.847	?

4. a) What are the temporary adjustments in theodolite survey? Explain. [8]

   b) Develop a booking formate for recording 2 set horizontal angle with appropriate numerical example. Calculate the mean horizontal angle also. [4]

   c) Distinguish between triangulation and trilateration. [4]

5. a) What is meridian distance and double median distance? How it can be calculate? [4]

   b) Write the working principle of EDM equipment. [4]

   c) Calculate the area by the coordinate method from the following perpendicular offsets [illegible]

06 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2068 Chaitra

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

Subject: - Surveying I *(CE 504)*

- ✓ 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) Differentiate between geodetic and plane surveying. [2]

   b) Explain briefly how a distance can be measured by the method of phase comparison. [6]

   c) A 30m steel tape standardized in fully support condition at a temperature of 20°C and pull of 100N was found to be 19.985m. This tape was used to measure a line under a pull of 120N and a mean temperature of 17°C was found to be 1350m long. Throughout the measurement, the tape was used in catenary condition. Find the correct length of the line. Take weight of steel as $0.081 N/cm^3$, the weight of tape as 11.775N, $E = 2.10 \times 10^5 N/mm^2$ and $\alpha = 11 \times 10^{-6}/°C$. [8]

2. a) What are the methods of plane table survey? Explain each. [4]

   b) What is principle of chain survey? Explain in brief. [4]

   c) Following are the bearings observed in a compass traverse survey. At what stations do you suspect local attraction? Correct them by applying suitable correction method. [8]

Line	FB	BB
AB	191°30′	13°00′
BC	79°30′	256°30′
CD	32°15′	210°30′
DE	262°45′	82°15′
EA	230°15′	53°00′

3. a) What do you mean by two peg test? [4]

   b) A level was set up at mid point between two stations A and B. The distance to stations A and B was 60m and the reading on the staff held at stations A and B was 1.855m and 1.625. Then level was moved near to station B and the reading on the staff held at A and B was 2.385m and 2.655 respectively. Calculate the collimation error and its sign (upward or down ward). [12]

4. a) Explain classification of Triangulation system. [6]

   b) Prepare a field note of measurement of horizontal angles by direction and repetition methods. [10]

5. a) Explain area calculation by double meridian method. [8]

   b) Workout prismoidal formula to calculate volume. [8]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Bhadra

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

Subject: - Engineering Geology I *(CE 503)*

- ✓ 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. Why do engineers carry out engineering geological studies in Nepal? [3]
2. Describe an internal structure of the earth with a diagram. [2]
3. Define tenacity and hardness of minerals. List out the symmetry elements of crystal. [2+1]
4. a) Define petrography and petrogenesis. Describe the concordant and discordant body of igneous rock. [1+3]
   b) Describe texture, structure, mineral composition and engineering properties of Quartzite, Granite, phyllite and conglomerate. [4]
5. a) Describe deformations in rock with suitable example. [3]
   b) A quartzite bed is directed towards S20°W with an dip angle of 45°. Find out the strike of quartzite bed. [2]
   c) Write the field identification criteria for fault and fold. [4]
   d) Outline the engineering significance of joints. [2]
6. a) Mention the name of geological agents. Describe an erosional feature develop by running water and wind. [2+4]
   b) What is the difference between weathering and erosion? [2]
7. Describe a lithological characteristics of the Lesser and Tethys Himalayan zone. Highlights a major lithological difference between Siwalik and higher Himalaya. [3+2]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Baishakh

Exam.		Back	
Level	BE	**Full Marks**	40
Programme	BCE	**Pass Marks**	16
Year / Part	II / I	**Time**	$1\frac{1}{2}$ hrs.

Subject: - Engineering Geology I (*CE 503*)

- ✓ 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 petrology. Write down the scope and importance of engineering geology in the field of engineering geology. [1+2.5]

2. Differentiate between constructive and destructive plate boundary. Write briefly on internal structure of the earth. [2+1.5]

3. List out physical properties of minerals. Describe crystal system with sketch. [1+3]

4. a) Describe rock cleavage. "One rock is raw materials for another rock" Prove it. [2+4]

   b) Describe texture, structure, mineral composition and engineering properties of Marble, Granite, Slate and conglomerate. [4]

5. a) Describe criteria for identification of fault and fold in field. [3]

   b) What is rock attitude? A sandstone bedrock dip angle at 35° towards N45°W; Find out strike of bed rock with illustration. [1+2]

   c) What is unconformity? Describe different types of unconformity with figure. [1+2]

6. a) What do you understand by geological agent? Enumerate erosional landform of glacier and depositional land form of wind. [1+1.5+1.5]

   b) Different between chemical and physical weathering. What are the factors of weathering of rocks? [1.5+1.5]

7. a) What are the rock types found at the higher and Siwalik zones of Nepal Himalaya? Differentiate Midland zone and Dune valley. 1.5+1]

   b) List out the physiographic division of Himalaya. [1.5]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Bhadra

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

Subject: - Engineering Geology I *(CE 503)*

- ✓ 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. Describe scope and objectives of geology in the field of civil engineering. [2]
2. Mention the physical features of the earth surface. [2]
3. Describe the symmetry elements of crystals. Describe hardness of minerals. [1.5+1.5]
4. Describe Petrogenesis. How do you identify igneous rocks in the field? Describe civil engineering significance of Granite, Phyllite and Sandstone. [2+2+3]
5. How do you differentiate primary geological structures and secondary geological structures? Describe relationship of strike and dip of geological planes. Describe with illustrations; how do you find out strike line when dip direction is measured? [2+2+2]
6. a) What is geological cycle? What do you mean by geological work? [1+1]
   b) Distinguish between weathering and erosion. [2]
   c) Give a full account of geological work of running water. [3]
7. Describe briefly the tectonic sub-division of the Nepal Himalaya and describe Siwalik in details. [3+2]
8. Write notes on: (Any Two) [2×4]
   a) Rock cleavage
   b) Field identification criteria of fault
   c) Physical weathering

TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2078 Kartik

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

Subject: - Engineering Geology I *(CE 503)*

- ✓ 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 the importance of geology? What are different branches of geology? [2+1]
2. How is Himalaya formed? Describe internal structure of earth brief. [1+2]
3. Define Moh's Hardness Scale. Describe element of crystals. [1.5+1.5]
4. a) Distinguish between concordant and discordant bodies of igneous rocks. [2]

   b) Write down the physical and engineering properties of marble, slate and granite. [3+4]
5. a) Define attitude. The limestone bed is inclined towards east with an inclination angle of 45°. Find the strike. [2+2]

   b) Describe the classification of Fold on the basis of convexity. [2]

   c) Write down the engineering significance of fault. [3]
6. a) Write the difference between weathering and erosion. Describe the type of volcano. [2+2]

   b) Describe erosional and depositional features of river and glacier. [4]
7. a) Describe physiographic division of Nepal Himalaya. [3]

   b) Describe Siwalik zone in detail. [2]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Chaitra

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

Subject: - Engineering Geology I *(CE 503)*

- ✓ 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 structural geology. Describe scope and importance of geology in civil engineering practice in the context of Nepal. [0.5+2.5]
2. What is plate boundaries? How Himalaya formed? Describe stepwise in detail. [2+1.5]
3. How do you differentiate carbonate and silicate minerals? Describe Moh's Scale of Hardness. Describe symmetry elements of crystals. [0.5+1+1.5]
4. a) How do you identify sedimentary rocks in the field? Give a brief account of the classification of sedimentary rocks. [1+3]

   b) Enumerate the various agents of metamorphism and explain their role. Describe important engineering significance of three rock type. [2+4]
5. a) Define attitude of geological structures. Distinguish between primary geological structures and secondary geological structures. [1+2]

   b) Describe the classification of fold on basis of position of axial plane. [2]

   c) Write the engineering significance of fault joint. [2.5]
6. a) What do you understand by epigene geological agent? Point out erosional landforms of wind and depositional landforms of glacier. [1+1.5+1.5]

   b) Describe factors of weathering. Describe Chemical weathering of rock. [1.5+1.5]
7. a) What are the soil types and rock types found in the Higher Himalaya zone, Midland zone and Dun Valleys? Differentiate Elluvial soil and lacustrine soil. [1.5+1]

   b) List out the physiographic division of Himalaya. [1.5]
8. Write short notes on: (Any one) [2]

   a) Rock cleavage

   b) Erosion

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Ashwin

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

Subject: - Engineering Geology I *(CE 503)*

- ✓ 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. Describe scope and objectives of geology in the field of civil engineering. [2]
2. Describe crystal symmetry? Define Moh's hardness scale. [2+1]
3. a) Mention the factors of metamorphism. Describe metamorphic structures. [1+3]
   b) Describe civil engineering significance of Marble, Granite Sandstone. [3]
4. a) How can you Identify fold? Describe effects of faulting in civil engineering works. [1.5+3.5]
   b) Define Altitude. Determine the strike of bedding plane of limestone bedrock, which have dip direction N40°W and dip amount 64°. [1+4]
5. Mention geological works of different geological agents. Describe erosional features developed by wind and underground water. [1.5+2.5+2]
6. Discuss the tectonic division of Nepal Himalaya. [4]
7. Write short notes on: **(Any Two)** [2×4]
   i) Rock cleavage
   ii) Field identification criteria of fault
   iii) Physical weathering
   iv) Lutite

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Chaitra

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

Subject: - Engineering Geology I *(CE 503)*

✓ 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. Highlight the importance of engineering geology in civil engineering works. [2]
2. Define engineering geology according to IAEG. Differentiate convergent plate boundary and divergent plate boundary. [1+2]
3. Describe symmetry elements of crystals. Describe hardness of minerals. [1.5+1.5]
4. a) Describe Petrogenesis. How do you identify rocks in the field? Describe civil engineering significance of Granite, Phyllite and Sandstone. [2+3]
   b) Distinguish between concordant and discordant bodies of igneous rocks. [2]
5. How do you differentiate primary geological structures and secondary geological structure? Describe relationship of strike and dip of geological planes. Describe with illustration; how do you find out strike line when dip direction is measured? [2+2+3]
6. What is weathering? Describe in brief the factors that affect in weathering. [1+3]
7. What are the geological works of running water? Mention the features developed due to geological works of running water. [1+2]
8. Write short notes on following (any three) [3x2]
   a) Types of volcanoes
   b) Stalagmite and stalactite
   c) Mantle
   d) Isometric system
9. How do you differentiate physiographic division and tectonic division of Nepal? Describe. [2.5+2.5]

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05 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2075 Ashwin

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

Subject: - Engineering Geology I *(CE503)*

- ✓ 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 engineering geology and discuss the importance in civil engineering. [1+2]
2. Define plate tectonics and discuss the evolution of Himalaya. [3]
3. What is Mohs scale of Hardness? Describe the symmetry of crystal in detail. [1+2]
4. a) How do you differentiate Igneous rock and Sedimentary rocks in the field? [4]
   b) Write down the physical and engineering properties of Marble, Slate and amphibolite. [6]
5. a) Define fault with neat diagram and discuss its importance in civil engineering. [4]
   b) What is unconformity? Why unconformity is important in geological structure in civil engineering. [4]
6. a) What are geological agents? Describe the erosional landform developed by glaciers. [2+4]
   b) Differentiate between Conglomerate and Agglomerate. [2]
7. Mention the geomorphic sub-division of Nepal Himalaya and describe lesser Himalaya in detail. [2+3]

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03 TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING **Examination Control Division** **2074 Chaitra**				
	Exam.	**Regular**		
	Level	BE	**Full Marks**	40
	Programme	BCE	**Pass Marks**	16
	Year / Part	II / I	**Time**	1 ½ hrs.

Subject: - Engineering Geology I *(CE503)*

- ✓ 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. Describe the scope and objective of engineering geology in the field of civil engineering. [2]
2. What do you mean by Plate Tectonics? Differentiate between transform and divergent plate boundary. [2+2]
3. Write down the optical properties of minerals in Handspecimens. [3]
4. a) How do you differentiate three rock types in the field? [4]

   b) Write down the physical and engineering properties of phyllite, Granite and Limestone. [6]
5. a) Define joint and discuss the geometric classification of joint with its engineering importance. [4]

   b) Determine the dip direction of a bedding plane of limestone bed which has strike N55°E and dip amount 30°. [4]
6. a) What is geological cycle? Describe the depositional landform by wind. [2+4]

   b) What is Volcano? Discuss the positive topography developed by volcano. [2]
7. Classify the Nepal Himalaya based on lithology and describe higher Himalaya in detail. [2+3]

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03 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2074 Ashwin

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

Subject: - Engineering Geology I *(CE503)*

- ✓ 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 engineering geology as per IAEG. Describe scope of petrology and structural geology in the field of civil engineering in brief. [1.5+1.5]
2. Describe internal structure of the earth with suitable diagram. What are the basis of the study of internal structures? [2+1]
3. How do you classify minerals? Describe Isometric system with symmetry elements. [1.5+1.5]
4. a) Define and describe texture of sedimentary rocks. Describe rock cleavage. [3]
   b) What are the basis of rock identification in the field? [3]
   c) Describe physical and engineering properties of Limestone, phyllite and Granite. [3]
5. a) How is rock deformed? Describe type and stage deformation of rock. [3]
   b) How do you classify Joint? [3]
   c) What is relationship between strike and dip? How do you calculate apparent dip amount from measured true dip amount? [3]
6. a) Describe landform developed by erosion and deposition by running water and glacier. [5]
   b) What is volcanism? Describe chemical weathering. [3]
7. a) Describe physiographic division of Nepal Himalaya. [3]
   b) Describe classification of Terai zone with lithology. [2]

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03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Chaitra

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

Subject: - Engineering Geology I *(CE503)*

- ✓ 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 geology. Explain scope and importance in the context of Nepal. [0.5+1.5+1]
2. Describe plate tectonics. What are the plate boundaries? Describe mountain building process w.r.t. Himalaya. [0.5+1+1.5]
3. Describe Hardness of mineral with scale. What are the elements of crystals? [1.5+1.5]
4. a) Describe rock cycle with suitable diagram. How metamorphic rock formed? [3]
   b) Describe texture of igneous rock. [3]
   c) Describe physical and engineering properties of Quartile, Dolomite and Granite. [3]
5. a) How Fold and Joint formed? Describe parts of fault with suitable diagrams. [3]
   b) Describe classification of faults. [3]
   c) Define attitude of bedrock. A sandstone bedrock dips at 32°towards N 60°W; Find out strike of bedrock with illustration. [3]
6. a) Describe geological works of river and wind, with landform developed in brief. [5]
   b) What is weathering? Describe volcanic products. [3]
7. a) Describe geological division of Nepal Himalayas. [3]
   b) Describe lithology and altitude of Dun valley and Higher Himalaya. [2]

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03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Shrawan

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	40
Programme	BCE	Pass Marks	16
Year / Part	II / I	Time	1 ½ hrs.

Subject: - Engineering Geology I *(CE503)*

- ✓ 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. Mention relationship between civil engineering and Geology. [2]
2. Describe plate boundary. How is mountain formed? [3]
3. Describe physical properties of minerals. What are the elements of symmetry of orthorhombic system? [2]
4. a) How do you differentiate petrography and petrogenesis? Describe classification of sedimentary rocks. [1+3]
   b) Describe engineering properties, texture and structure of schist, sandstone and Phyllite. [6]
5. a) Describe criteria for identification of fault in the field. [2]
   b) How do you classify fault and joint genetically? Describe. [4]
   c) How do you calculate apparent dip amount, when true dip amount is measured? [4]
6. a) Describe factors for weathering. Mention erosional and depositional landform of wind. [1+4]
   b) Describe classification of volcano. [3]
7. Describe lithological characteristics of Higher Himalaya and Tethys zone. Describe altitude and lithology of churiya range, fore Himalaya and Trans Himalaya. [2+3]

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03 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2072 Chaitra

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

Subject: - Engineering Geology I *(CE503)*

- ✓ 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. Mention the importance of geology in civil engineering. [2]
2. How is Himalaya formed? Describe internal structure of the earth in brief. [1+2]
3. How do you define Hardness of mineral? Describe isometric system of crystal. [1+2]
4. a) How do you identify three rock types in field? Describe texture of sedimentary rock. [2+2]

   b) Describe texture, structure, mineral composition and engineering properties of quartzite, limestone and Granite. [6]
5. a) How do you differentiate fault and thrust? What are field evidences of fold? [2+2]

   b) Determine the strike direction of bedding plane when dipdirection in N40°W. [4]

   c) Describe deformations in rock strata. [1]
6. Define weathering. Describe depositional

   a) Features developed by river [2+3]

   b) Mention erosional features of glacier and underground water. [3]
7. Explain geological division of Terai and siwalik zone. Describe lithology and altitude range of Dun valley and midland. [3+2]

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03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Kartik

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	40
Programme	BCE	Pass Marks	16
Year / Part	II / I	Time	1 ½ hrs.

Subject: - Engineering Geology I *(CE503)*

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

1. How IAEG defines engineering geology? [2]
2. What is mountain? Mention different types of plate boundaries with neat sketch. [0.5+1.5]
3. Define crystals. Describe hardness and tenacity of minerals. [1+2]
4. a) Describe characteristics of igneous, sedimentary and metamorphic rocks. [1+2+3]
   b) Describe physical and engineering properties of phyllite and limestone. [2+2]
5. a) Describe criteria for identification of fault and fold in the field. [4+2]
   b) Dip direction of gneiss bedrock is S 17°E. Find out strike of such rock with neat and suitable diagram. [4]
6. a) Mention the name of geological agents. What geological agents do? Describe erosional features developed by air and underground water. [0.5+0.5+4]
   b) Describe the causative factors for rock weathering. [3]
7. Describe tectonic division of Nepal Himalaya with suitable cross-section. Describe lithological and elevation characteristics of Mahabharat Range. [3+2]

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03 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2071 Shawan

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

Subject: - Engineering Geology I *(CE503)*

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

1. How do you differentiate between Geology and Engineering Geology? [1+1]
2. What is plate tectonics? Mention different types of plate boundaries. [1+1]
3. Define Moh's Hardness Scale. Describe elements of crystals. [1.5+1.5]
4. Define Petrology. Describe the classification of sedimentary rock. [1+3]
5. Describe physical and engineering properties of following rocks: [3×2]
   a) Quartzite
   b) Slate
   c) Granite
6. Differentiate between Apparent dip amount and true dip amounts What is geological compass? [1+3]
7. What is geological structure? Describe types of geological structure . [2+4]
8. Define Geological cycle morine. Describe land form developed by geological works of running water. [2+2+4]
9. Describe tectonic division of Nepal Himalaya. Describe midland zone w.r.t elevation and rock characteristics. [3+2]

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03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Chaitra

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

Subject: - Engineering Geology I *(CE503)*

- ✓ 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 engineering geology according to IAEG. Sate the scope and objective of engineering geology. [1+1]
2. What is geological time scale? Describe the formation of Himalaya. [1+1]
3. How do you differentiate silicate and carbonate minerals? Describe the physical properties of minerals. [1+2]
4. Define Rock cycle. What are the characteristics metamorphic rocks? [1+3]
5. Describe the physical and engineering properties of the following rocks. [3×2]
   a) Gneiss
   b) Phyllite
   c) Limestone
6. Describe the different types of deformation in rocks. Give the geometrical classification of joints with neat diagram. [3+3]
7. What is fault? How do you differentiate between faults and fold in the field. [1+3]
8. Define volcano. Differentiate between and erosion. Describe the different types of landform produced by wind. [2+4+2]
9. Write down the geomorphic sub-division of the Nepal Himalaya. Describe the geology of lesser Himalaya. [2+3]

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02 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Chaitra

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

Subject: - Engineering Geology *(EG523CE)*

- ✓ 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) What is geology? Write down the branches of geology. Mention the scope of engineering geology. [2+2+4]

   b) Define plate tectonics. Describe Volcanism and its classes. [5+3]

2. a) What is igneous rock? Describe texture of sedimentary rocks. [3+5]

   b) Define fault. What are the different type of joints? Describe them. [3+5]

3. a) What are the physical properties of minerals? Describe them. [8]

   b) Define mass movement? Write down the mitigation measures to protect the slope from translational failure. [3+5]

4. a) What are the activities that should be carried out in the surface site investigation of a road alignment? Describe one of them [8]

   b) Define rockmass. Write down the properties of rock mass. [3+5]

5. a) What are different types of river morphology? Write down the characteristics of river that should be taken into account while selecting the site for construction. [8]

   b) How is Nepal Himalaya formed? Write down the characteristics of each geological zone. [8]

6. Write short notes on: [4×4]

   a) Attitude of bedrock
   b) Overbreak
   c) Thrust
   d) MCT

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04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Ashad

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

Subject: - Engineering Geology *(EG523CE)*

✓ 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) How is the earth formed? Write down its structure and environment. [4+4]
   b) What is seismicity? Describe about fold mountains. [5+3]
2. a) Why do engineers carry out engineering geological studies in Nepal? Write down the relationship between geology and earth science. [4+4]
   b) Describe symmetry elements of crystals. How are minerals identified? Describe. [3+5]
3. a) How are sedimentary rocks formed? Describe texture of igneous rock. [3+5]
   b) Define fold. Describe effect and engineering significance of fault. [3+5]
4. a) How does mass movement occurred? Describe classification of landslide according to Varne. [3+5]
   b) Define site investigation. Describe sub-surface site investigation of foundation site of a Dam. [2+6]
5. a) Define Over break. Describe geological investigation activities in Tunnel. [3+5]
   b) Describe Darcy's law. Describe types of aquifer with suitable diagram. [4+4]
6. Write short notes on: [4×4]
   a) Physical properties of igneous rock
   b) Engineering classification of rock masses
   c) Interpretation of Topographic maps
   d) Geology of Terai siwalik zones

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12/20

04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Chaitra

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

Subject: - Engineering Geology ***(EG523CE)***

- ✓ 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 engineering geology according to IAEG. Point out the importance of engineering geology in the field of civil engineering. Differentiate convergent plate boundary and divergent plate boundary. [2+4+2]

   b) Describe internal structure of earth with its neat sketch. What are the products of volcanoes? Mention them briefly. [4+4]

2. a) Define mineral. Describe physical properties of minerals. [2+6]

   b) What is rock cycle? Discuss the various based to classify igneous rock. Illustrate it with examples. [3+5]

3. a) What is landslide different from mass movement? Describe repairing measures of landslide. [2+6]

   b) What do you mean by rock mass? Describe classification system of rock mass. [2+6]

4. a) What do you understand by attitudes of beds? Describe classification of fold. [3+5]

   b) What is geological site investigation? Describe its methods in brief. [2+6]

5. a) Discuss the tactonic division of the Nepal Himalaya. [8]

   b) Describe river channel morphology. What are the geological works of running water? Describe the features developed due to geological works of running water. [3+1+4]

6. Write short notes on: [4×4]

   a) Types of volcanoes
   b) Forms of sedimentary rock
   c) Unconformity
   d) Isometric system

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04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Ashad

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

Subject: - Engineering Geology I *(CE503)*

- ✓ 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 engineering Geology. Highlight the scope of engineering geology. [2]
2. How is Himalaya formed? Name all plate boundaries. [2]
3. Describe physical properties of any three rock forming minerals. [3]
4. a) Describe rock cycle. Write the process of igneous rock formation. [4]
   b) Write physical and engineering properties of following rocks. [1.5×4]
      i) Dolomite
      ii) Slate
      iii) Schist
      iv) Quartzite
5. a) Define strike, dip and dip amount of a plane. [3]
   b) What is fold? With a neat and labelled diagram show different parts of a fold. Classify fold on the basis of orientation of hinge line and axial surface. [1+3+3]
6. Define geological cycle. Describe types of weathering. [2+3]
7. What are the landforms developed by erosional activities of river. [3]
8. Discuss about the geological division of Nepal Himalaya with simplified cross-section. [5]

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12/18

04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Chaitra

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

Subject: - Engineering Geology I *(CE503)*

- ✓ 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. What are the importances and objectives of engineering geology course in civil engineering? [1+1]
2. Mention any three evidences of plate tectonics. [2]
3. Define moh's scale of hardness. Describe crystal symmetry. [1.5+1.5]
4. a) Describe rock cleavage. Write down the physical and engineering properties of limestone, phyllite and granite. [2+3]

   b) Write down the formation process of metamorphic rock. Describe texture of igneous rock. [5]
5. a) Describe about attitude of rock. What are the differences between true and apparent dip? [2+2]

   b) What is joint? Point out engineering significance of joint and fault. [2+4]
6. What is volcano? Briefly describe about location and types of volcano. [1+3]
7. Describe different land forms produced by river. [4]
8. What are physiographic divisions of Nepal Himalaya. Describe the lithology of Tibetan-Tethys zone. [3+2]

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