

TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
**(Sample Question)**

Exam.	New Course		
Level	BE	Full Marks	60
Programme	All except BAR	Pass Marks	24
Year / Part	I / I	Time	3 hrs.

*Subject: -Engineering Mathematics I (SH 101)*

- ✓ 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) Evaluate  $\lim_{x \rightarrow 0} \left( \frac{\tan x - x}{x^2 \tan x} \right)$ . [2]  
 (b) Expand the function  $\sinh x$  in Maclaurin's series up to four terms. [2]  
 (c) Show that the curvature at any point of the circle  $x^2 + y^2 = a^2$  is constant. [2]
  
2. (a) Evaluate  $\int_{-1}^1 \frac{dx}{x^3}$ . [2]  
 (b) Apply beta gamma functions to evaluate  $\int_0^a x^2 (a^2 - x^2)^{\frac{3}{2}} dx$ . [2]  
 (c) Find the volume of the paraboloid formed by revolving the region bounded by the parabola  $y^2 = 4ax$ ,  $x = a$  about  $x$ - axis. [2]
  
3. (a) Find the integrating factor of the differential equation  $\frac{dy}{dx} = \frac{1}{x+y+1}$ . [2]  
 (b) State Clairaut's differential equation and find its general solution. [2]  
 (c) Find the particular integral of  $(D^2 + 4D + 3)y = e^{-3x}$  where  $D = \frac{d}{dx}$ . [2]
  
4. Find the angle through which the axes be turned to reduce the equation  $11x^2 + 4xy + 14y^2 = 5$  into one with  $xy$  term missing. [2]
  
5. (a) Prove that the line  $\frac{x-3}{2} = \frac{y-4}{3} = \frac{z-5}{4}$  is parallel to the plane  $4x + 4y - 5z = 0$ . [2]  
 (b) Find the equation of the sphere through the circle  $x^2 + y^2 + z^2 - 2x + 3y + 4z - 5 = 0$ ,  $x^2 + y^2 + z^2 - 3x - 4y + 5z - 6 = 0$  and passing through the point  $(1, 1, 2)$ . [2]
  
6. Find the pedal equation of the curve  $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$ . [4]
  
7. Find the asymptotes of  $(x+y)^2(x+2y+2) = x+9y-2$ . [4]

8. Apply method of differentiation under integral sign to evaluate  $\int_0^{\infty} \frac{e^{-kx} \sin mx}{x} dx$  for

$$m > 0 \text{ and hence deduce that } \int_0^{\infty} \frac{\sin mx}{x} dx = \frac{\pi}{2}. \quad [4]$$

OR

Apply method of integration to find the area included between the curve  $a(y^2 - x^2) = x(x^2 + y^2)$  and its asymptotes. [4]

9. Find the centroid of the region bounded by  $y = 4 - x^2$  and  $x = 0$ . [4]

10. Identify the conic  $14x^2 - 4xy + 11y^2 - 44x - 58y + 71 = 0$ . Find its center and length of axes. [4]

11. Prove that the lines  $x = \frac{y-2}{2} = \frac{z+3}{3}$  and  $\frac{x-2}{2} = \frac{y-6}{3} = \frac{z-3}{4}$  are coplanar. Find their plane and point of intersection. [4]

12. Find the equation of a right circular cylinder whose guiding curve is the circle  $x^2 + y^2 + z^2 - x - y - z = 0$ ,  $x + y + z = 1$ . [4]

13. Solve  $\frac{dy}{dx} - y \tan x = -y^2 \sec x$ . [4]

OR

Solve  $4y^2 - 2px + y = 0$ , where  $\frac{dy}{dx}$ . [4]

14. A mass of 1 kg is attached at one end of a spring on a frictionless horizontal surface fixed at one end. The force of 6 N applied to the string stretches 1.5 m from its natural length. If the mass from the rest 1 m to the right of its equilibrium position, determine the position of mass as a function of time. [4]

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**Examination Control Division**  
**(Sample Question)**

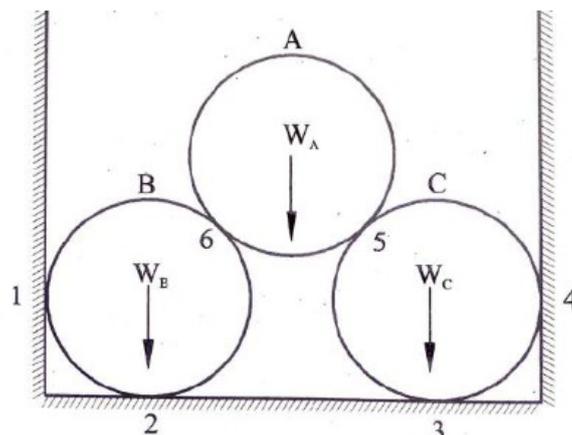
Exam.	New Course		
Level	BE	Full Marks	60
Programme	BCE/BAG	Pass Marks	24
Year / Part	I / I	Time	3 hrs.

**Subject: -Engineering Mechanics (CE 101)**

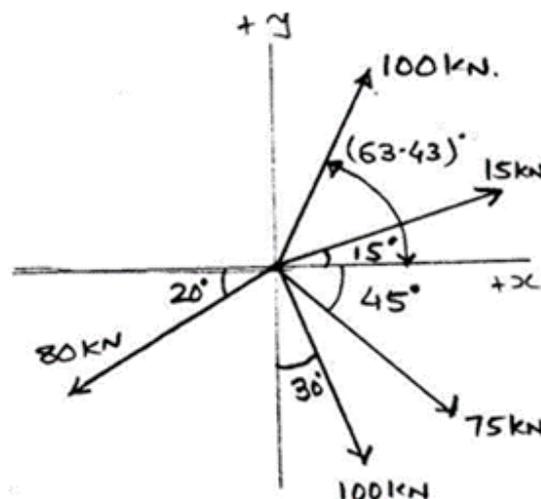
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
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1.a) Define Engineering Mechanics. Mention the scope of Engineering Mechanics in the field of Engineering. Explain in brief about the application of equations of static equilibrium. (1+1+1)

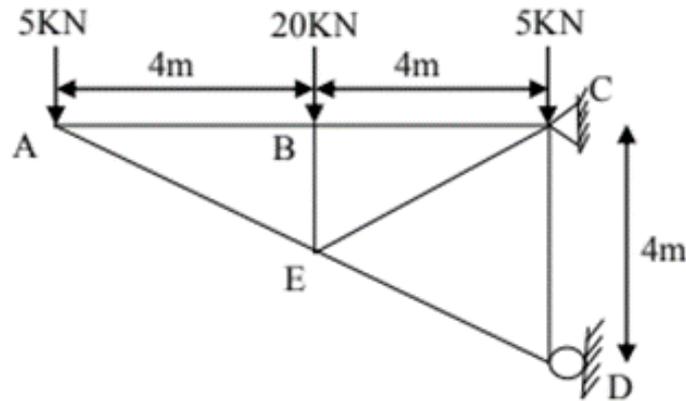
b) Three smooth identical spheres A, B and C are placed in a rectangular channel as shown in the figure. Calculate the reaction at all contact points. (6)



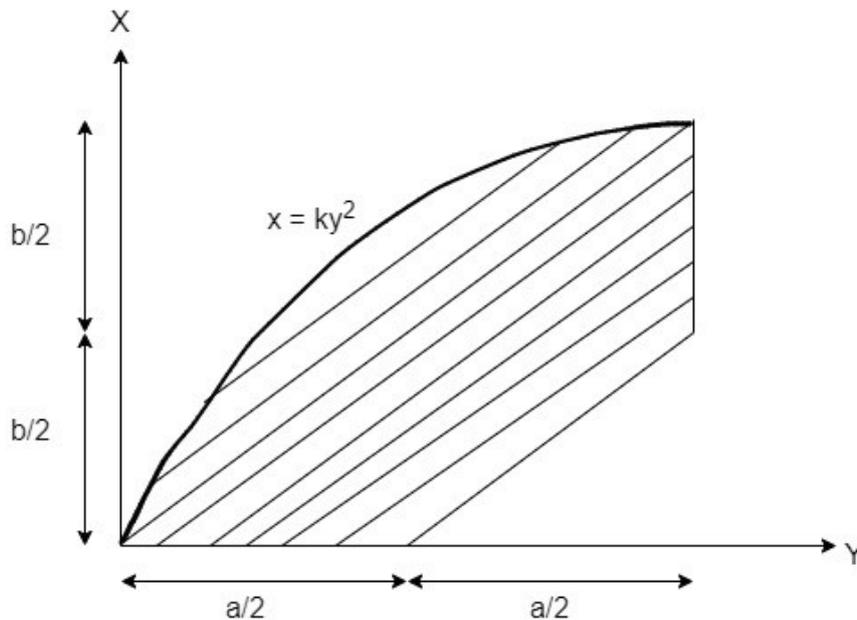
2.a) Define a couple and show that “couple is a free vector”. Find the magnitude and direction of the resultant force of the given system of concurrent forces as shown in the figure below. (2+3)



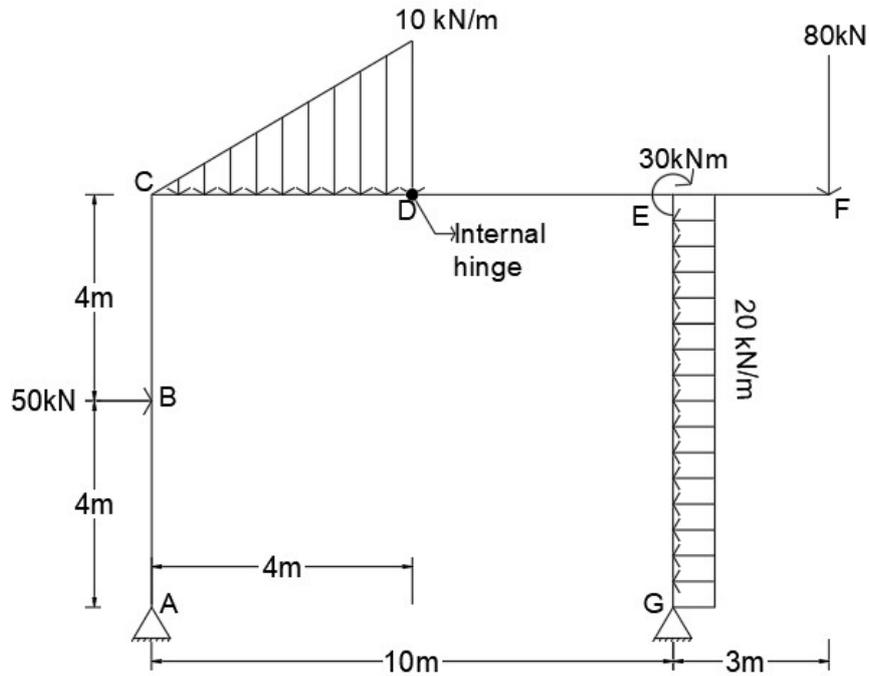
- b) Define Friction and explain with suitable diagrams the different conditions of equilibrium and motion of a block. What are the applications of frictional force in our daily life? (3+1)
- 3.a) Mention the application of symmetry for the analysis a plane truss. Calculate the force developed in all the members of the truss loaded as shown in figure below. (1+4)



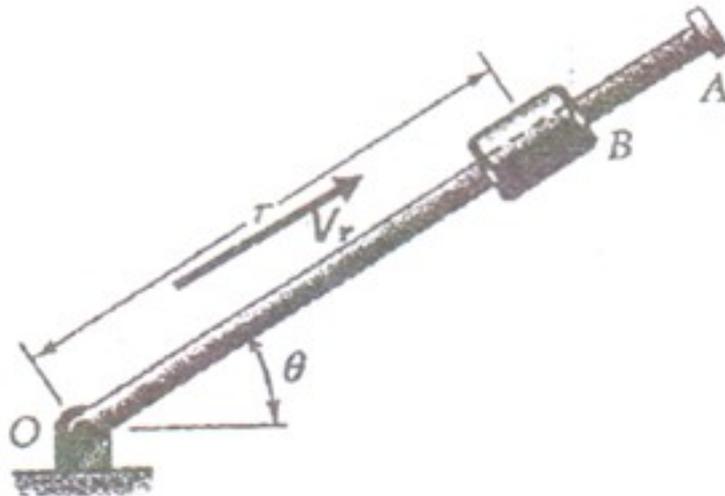
- b) State and prove the parallel axis theorem for moment of inertia. Calculate the centroidal x-distance of the shaded area as shown in figure below. (2+4)



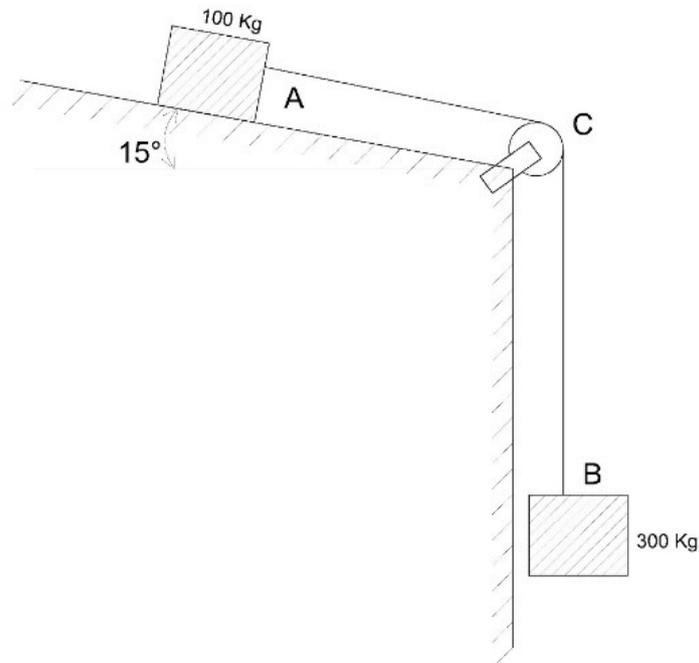
- 4) Explain various types of load that may occur in the structures. A Frame is loaded as shown in figure below. Draw Axial Force, Shear Force and Bending Moment Diagrams. Indicate the salient features if any. (2+12)



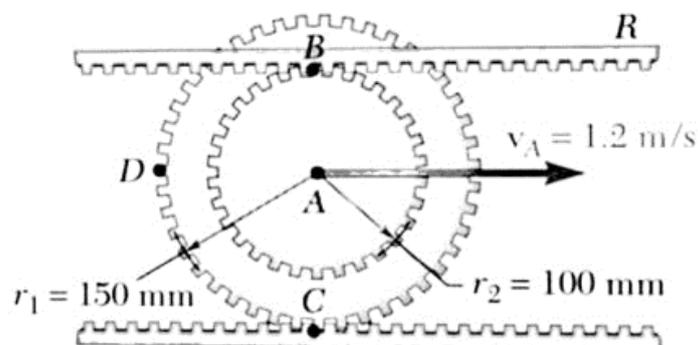
- 5.a) Define dependent motion of particles and deduce the expression for position, velocity and acceleration of two particles which are under dependent motion. Rotation of an arm about 'O' is defined by  $\Theta = 0.75t^2$  where  $\Theta$  is in radians and  $t$  is in seconds. Collar B slides along the arm such that  $r = 1 - 0.3t^2$  where  $r$  is in meters. After the arm has rotated through  $45^\circ$ , 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. (2+4)



- b) List out the different types of impacts with diagrams that may occur between two particles. Two bodies A and B are connected by an inextensible and weight less cord as shown in figure. Initially the bodies are at rest. Dynamic coefficient of friction between body A and inclined surface is 0.40. Compute the velocity of the bodies at any time  $t$  before the body A has reached at the end of the inclined surface. (1+4)



- 6) Deduce the expression for Kinetic energy in translational and rotational motion of the rigid body. The center of double gear has a velocity and acceleration to the right of 1.2 m/s and  $3 \text{ m/s}^2$  respectively. The lower rack is stationary. Determine a) the angular acceleration of the gear, b) the acceleration of points B, C and D. (1+1+4)



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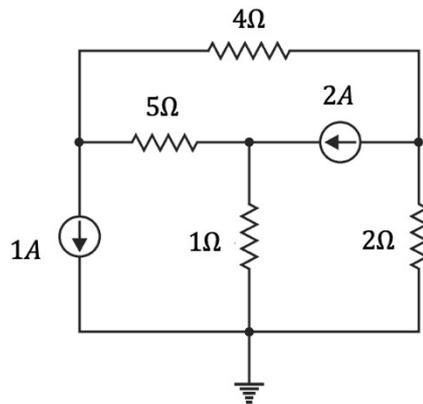
**Examination Control Division**  
**(Sample Question)**

Exam.	New Course		
Level	BE	Full Marks	60
Programme	BCE/BCH	Pass Marks	24
Year / Part	I / I	Time	3 hrs.

**Subject: - Basic Electrical and Electronics Engineering (EE103)**

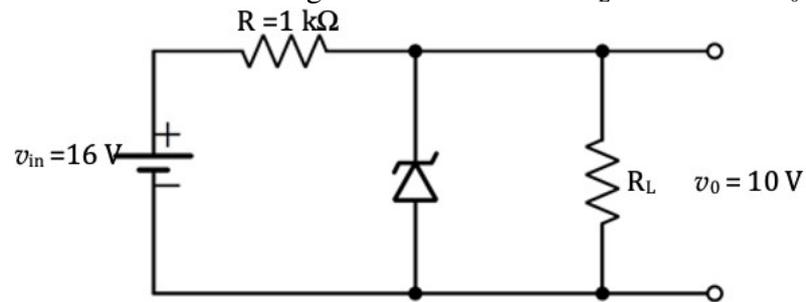
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. Explain why household electrical wiring is typically arranged in a parallel configuration rather than a series configuration. Use nodal analysis to find the current and voltage drop through 5 Ohm Resistor of the circuit shown in Fig. below. [2+4]



2. Two coils having impedance  $Z_1$  and  $Z_2$  are connected in series across a 230 V, 50 Hz power supply as shown in Fig. The voltage drop across  $Z_1$  is equal to  $120 \angle 30^\circ$  V. Calculate the value of  $Z_2$  and  $C_2$ . [6]
3. Three equal impedances each of  $10 \angle 60^\circ$  ohms are connected in star across 3-phase, 400 volts 50 Hz supply. Calculate [6]
- i. Line voltage and phase voltage
  - ii. Line current and phase current
  - iii. Power factor and active power consumed
4. Explain the no-load and loaded operation of transformer with equivalent circuit and phasor diagram. [6]
5. Define rotating magnetic field. A 50 Hz, 8 pole induction motor has full load slip of 4%. The resistance/phase is 0.01 Ohms and standstill reactance per phase is 0.1 ohm. Find the ratio of maximum to full load torque and the speed at which maximum torque occurs. [2+4]
6. Derive emf equation of synchronous generator. A four-pole dc machine having wave-wound armature winding has 51 slots, each slot containing 20 conductors. Calculate the back emf generated in the armature when driven at 1500 rpm. Assume flux per pole to be 0.5 mWb. [3+3]
7. Why transistor is called Bipolar Junction Transistor? Explain the operation of the npn transistor in the active mode. [6]

8. Find the Zener current from the given network when  $R_L = 3 \text{ k}\Omega$  and  $V_0 = 10 \text{ V}$ . [6]



9. Compare and contrast Miniature Circuit Breakers (MCBs) and Molded Case Circuit Breakers (MCCBs). [6]

10. Write Short notes on (Any Two): [2\*3=6]
- PN junction diode
  - Distribution Box
  - Types of Wires

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**(Sample Question)**

Exam.	New Course		
Level	BE	Full Marks	60
Programme	All Except BAR	Pass Marks	24
Year / Part	I / I	Time	3 hrs.

**Subject: - : Computer Programming (CT 101)**

- ✓ 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 computer program. Write an algorithm and draw a flowchart to calculate the HCF of two numbers entered by the user. [Hint: HCF is a number that divides both the numbers exactly. [1+4]
  2. Why do we need type casting in C? Explain Header files & Library functions in C with an example [2+3]
  3. Define Operator in C. Differentiate between pre and post-increment operators in C with proper examples. [1+3]
  4. How formatted outputs are different from unformatted outputs [3]
  - 5.a) Differentiate between counter-controlled & sentinel-controlled loops in C. Write a program in C to display the Armstrong numbers between given ranges P and Q. [Hint: An Armstrong number is a number that is equal to the sum of digits raised to the power total number of digits in the number, e.g.  $1634 = 1^4 + 6^4 + 3^4 + 4^4 = 1 + 1296 + 81 + 256 = 1634$ ] [2+5]
  - b) Display the following pattern using the concept of nested loop in C. [3]

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5
44
333
2222
11111

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  - 6.a) What is an array size? Write a program to read values of matrix of size MxN and display the second largest element. [1+5]
  - b) Write a program to find the length of a string without using string handling function. [3]
  - c) What is a null pointer? Differentiate between referencing and differencing in pointer. [1+2]
  7. Differentiate between auto and static storage classes? Write a program in C to find the sum of N even natural numbers divisible by 5. The value of N must be taken from the main

function and passed to a function named findsum that calculates the sum and the sum must be displayed from the main. [2+5]

8. What is the need of nested structure? Write a program to read and store campus details such as name, address, established\_year, and no\_of\_students in a structure. Input data for 4 campuses. Pass the structure variable to a function and print the names of the campus which has more than 1000 students. [1+5]

9. Write a program to read any string and write it to a file. Read the contents from the file and separate the uppercase and lowercase letters into two different files. [5]

10. Differentiate between procedural-oriented vs object-oriented paradigm. [3]

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Exam.	New Course		
Level	BE	Full Marks	60
Programme	BCE/BME/ BAG/BCH	Pass Marks	24
Year / Part	I / I	Time	3.0 hrs.

**Subject:** -Engineering Chemistry (SH103)

- ✓ 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 an electrochemical cell? For the galvanic cell,  $Zn(s)/Zn^{++}(aq\ 0.100M)//Pb^{++}(aqxM)/Pb(s)$ , the measured potential is +0.45V at 25°C. Calculate the concentration of  $Pb^{++}(aq)$ . The standard cell potential is +0.64V. [1+4]

**OR,**

What is over potential? Explain about it with suitable example. [2+3]

- 2.(a) Addition of small amount of acid or base does not change the pH of a solution having equimolar mixture of acetic acid and sodium acetate. Explain the mechanism. [2]

- (b) A student wants to prepare 1 litre of solution buffered at pH 10. How many grams of ammonium chloride has to be added into 1 litre of 0.25 M ammonia to make such a buffer? ( $pK_b$  for ammonia is 4.74). [3]

3. Briefly discuss any four properties required for a catalytic material for industrial applications. Name any two catalytic materials for degradation of dyes in wastewater. [4+1]

4. For the complex ion  $[Fe(CN)_6]^{4-}$ , [2+1+1+1]

- (a) Predict the shape on the basis of valence bond theory.
- (b) Predict magnetic behavior.
- (c) Write IUPAC name of the complex ion.
- (d) Write the formula of the following coordination compounds;
  - i. Tetrahydroxoplatinate(II) ion
  - ii. Tris(ethylenediammine)chromium(III) chloride

5. (a) Discuss the crystal field splitting of  $d^6$  orbitals in octahedral complexes. [3]

- (b) What are rare earth elements? Write the importance of cerium. [1+1]

6. What is the principle of Infra-red spectroscopy? Write its applications. [3+2]

**OR,**

Briefly discuss principle of UV-visible spectroscopy and point out its applications.

7. a) What is the motif of green chemistry? Mention any four principles of green chemistry. [1+4]
- b) Briefly explain biological oxygen demand and chemical oxygen demand and their consequences with reference to water pollution. [5]
- c) What are addition polymers? Briefly explain mechanism of free radical polymerization. [1+4]

8. What are silicone oils, silicone rubbers and silicone resins, chemically? Mention their applications in engineering. [3+2]

**OR,**

(a) Write the preparation of polyurethane. What are applications of polyurethane? [1.5+1.5]

(b) How does natural polymer differ from synthetic polymers? Give any two applications of a natural polymer in engineering. [1+1]

9. What are nanomaterials? Briefly explain 0D, 1D, 2D and 3D nanomaterials. [1+4]

10. (a) Write the preparation any one explosive and mention its uses [2]

(b) What are lubricants? What the importance of solid lubricant in engineering? [3]

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Exam.	New Course		
Level	BE	Full Marks	30
Programme	BCE	Pass Marks	12
Year / Part	I / I	Time	1.5 hrs

**Subject:** - Civil Engineering Material (CE 103)

- ✓ 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**.
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1. Explain how the thermal properties effect in selection of materials in some construction projects with examples. (2)
2. Enlist the selection criteria of a good quarry site for a building stone. (3)
3. Write in brief about the manufacturing process of local brick. Define about properties of roof tiles. (2+1)
4. Define slaking of lime? Write a short note types of lime. (0.5+1.5 )
5. Difference between wet and dry process of cement manufacturing. Define role of gypsum and pozzolana when added in cement. (3+1)
6. Explain in steps about the hand mixing process for preparation of cement mortar. (2)
7. Define about air seasoning and kiln seasoning. Write a short note on bamboo (1.5+1.5 )
8. Difference between pig iron and cast iron. Write short note on Aluminum and surface hardening. (2+1+1)
9. Write about the functions of the paint and varnish. Write down the process of application of varnish. (1.5+1.5 )
10. Write about the properties and use of bitumen. Write in short about glass and rubber with their uses. (2+2)

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Exam.	New Course		
Level	BE	Full Marks	30
Programme	BCE	Pass Marks	12
Year / Part	I / I	Time	1.5 hrs.

**Subject:** -Engineering Geology I (CE 102)

- ✓ 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 engineering geology? Discuss its importance in civil engineering. [3]
2. How earth was originated? Describe the internal structure of earth with neat sketch [2+2]
3. a. Define crystal. Discuss the different symmetry of crystal. [1+2]  
b. Mention the different field identification criteria of igneous rock with its IUGS classification. [1+2]
4. a. Define attitude of rock. Differentiate between foliation plane and bedding plane. [2+2]  
b. Describe the geometric classification of joints. [3]
5. a. Describe the different landform produced by glaciers. [3]  
b. Can we predict volcano? Discuss the different landform produced by volcano. [1+2]
6. Discuss the process of Himalayan evolution with its different tectonic units. [2+2]

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