

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  $i \frac{dy}{dx}$ . [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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**(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]

```

5
44
333
2222
11111

```
  - 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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**(Sample Question)**

Exam.	New Course		
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Year / Part	I / I	Time	3 hrs.

**Subject:** -Engineering Physics (*SH 102*)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
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1. (a) What is degree of freedom? [1]  
(b) Write the significance of numerical aperture of an optical fiber. [1]  
(c) Write down the relation between electric field intensity and potential gradient. [1]  
(d) Define displacement current. [1]
2. (a) A particle of mass 100gm is in oscillation in a medium having damping constant 0.05kg/s with a system of force constant 250N/m. Calculate the angular frequency for this system. [2]  
(b) Derive the Maxwell's third thermo-dynamical relation. [2]  
(c) Prove continuity equation by using Maxwell's equations. [2]  
(d) Calculate the error in the velocity for an electron if error in displacement is 1Å. [2]
3. Derive time period of oscillation of a compound pendulum in terms of equivalent length of a simple pendulum. [4]

**OR**

- Derive the differential equation of forced oscillation and write the amplitude of forced oscillation. Explain the condition of resonance with a graph. [4]
4. A hall has dimension 10m×12m×6m, and average absorption coefficient of hall is 0.5. Calculate the (a) number of reflections of sound wave made per second in the hall and (b) reverberation time of the hall. Velocity of sound wave is 350m/s. [2+2]
  5. Derive the specific heat of solid using Einstein's method and explain the result with necessary graph. [4]

**OR**

- Derive the Vander Waal equation for real gas in terms of critical constants a and b. [4]
6. (a) Prove that in Newton's rings experiment due to reflected light, the diameter of bright ring is proportional to the square root of odd number multiple of half of wavelength. [4]  
(b) Light of wavelength 550 nm is incident normally on a grating that has 400 lines per mm. At what angle does the second order principal maximum occur? [4]  
(c) What is Nicol prism? How does it work as polarizer and analyzer? [4]  
(d) Two thin convex lenses having focal lengths 10 cm and 4 cm are coaxially separated by a distance of 5 cm. Find the equivalent focal length of the combination. Also, find the positions of principal points. [2+1+1]
  7. (a) Derive the electric field due to short electric dipole at any point on equatorial line. [4]

**OR**

Derive the electric potential at a point due to charged disc. [4]

(b) A parallel plate capacitor of capacitance  $100 \text{ pF}$  with each of area  $100 \text{ cm}^2$  and potential difference  $50 \text{ V}$ . If a mica of dielectric constant  $5.4$  is inserted between the plates, find the magnitude of (a) electric field strength in mica and (b) polarization vector. [2+2]

8. Calculate the displacement current between the capacitor plates of area  $1.5 \times 10^{-2} \text{ m}^2$  and rate of electric field change is  $1.5 \times 10^{12} \text{ Vm}^{-1}\text{s}^{-1}$ . Also, calculate the displacement current density. [2+2]

9. Define Poynting vector and prove the relation  $\vec{S} = \frac{1}{\mu} (\vec{E} \times \vec{B})$ . [1+3]

10. Define de-Broglie wavelength. Derive the time dependent Schrodinger wave equation. [1+3]

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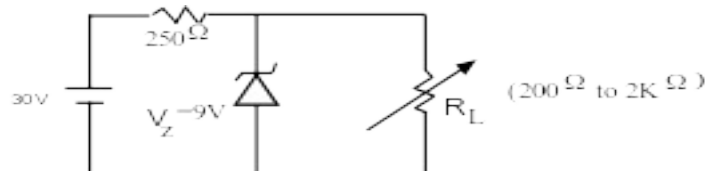
**(Sample Question)**

Exam.	New Course		
Level	BE	Full Marks	60
Programme	BCT/BEI/ BME/BAM/ BIE/BAS	Pass Marks	24
Year / Part	I / I	Time	3 hrs.

**Subject:** -Fundamental of Electrical and Electronics Engineering (*EX 101*)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
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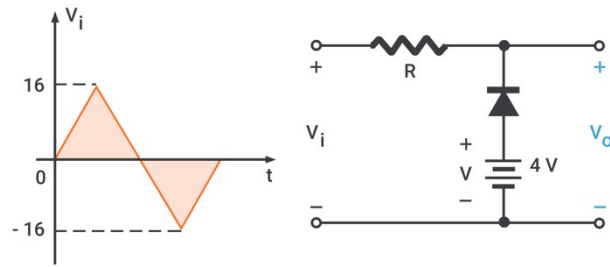
1. Differentiate current source with voltage sources. An aluminum wire 7.5 m long is connected in parallel with a copper wire 6 m long. When a current of 5 A is passed through the combination, it is found that the current in the aluminum wire is 3 A. The diameter of the aluminum wire is 1 mm. Determine the diameter of the copper wire. The resistivity of copper is  $0.017 \mu\Omega\text{-m}$ ; that of aluminum is  $0.028 \mu\Omega\text{-m}$ . [2+4]
  
2. Derive the condition for maximum power transfer in a circuit. [3]
  
3. A certain waveform has a form factor of 1.2 and a peak factor of 1.5. If the maximum value is 100, find the r.m.s and average values. [3]
  
4. Explain what a waveform is in the context of electrical signals and discuss its key characteristics. [3]
  
5. The waveforms of the voltage and current of a circuit are given by,  
 $e = 120 \sin(314 t)$  and  $i = 10 \sin(314 t + \pi/6)$  [6]  
 Calculate the values of the resistance, capacitance which are connected in series to form the circuit. Also, calculate power factor and power consumed by the circuit.
  
6. Three identical coils, each having resistance of  $10 \Omega$  and inductance of  $0.03 \text{ H}$  are connected in delta across a three-phase,  $400 \text{ V}$ ,  $50 \text{ Hz}$  supply. Calculate: 1) The phase current, ii) The line current, iii) The total power consumed, iv) p.f. and pf. angle. Draw a neat phasor diagram. [6]
  
7. Explain IV characteristics of PN junction diode in detail. [4]
  
8. A Zener regulator has 9 volt Zener voltage with variable load resistance as shown: [4]



Calculate:

- a. Current through the series resistance
- b. Maximum and minimum load current.
- c. Maximum and minimum zener current
- d. Maximum and minimum power dissipation in the zener diode.

9. Sketch the output waveform for given circuit and input waveform [4]



- 10 Explain the working principle and current flow mechanism of npn transistor with necessary diagrams. [4]
- 11 What is biasing? Explain different types of biasing in BJT. [4]
- 12 Explain the construction and working of n channel depletion type MOSFET with the help of drain and transfer characteristics curve [4]
13. a) Explain OP-AMP as an integrator and adder (summing circuit). [4]
- b) Draw the circuit diagram of Phase shift Oscillator and derive the frequency of oscillation. [5]

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**(Sample Question)**

Exam.	(New Course)		
Level	BE	Full Marks	30
Programme	All Except BAR & BCE	Pass Marks	12
Year / Part	I / I	Time	3 hrs

*Subject: -Engineering Drawing (ME101)*

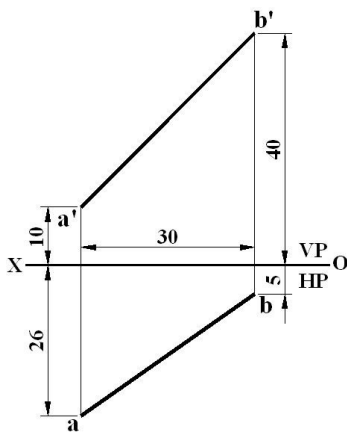
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
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- ✓ Assume suitable data if necessary.

1. Draw an ellipse with major axis and minor axis of 80 mm and 50 mm respectively. [3]
2. Top view of a straight line **AB** measures 50 mm. The line is parallel to the VP and inclined to the HP at  $30^\circ$ . Its end **A** is 10 mm above the HP and 15 mm in front of VP. Draw its projections and determine its true length. [3]

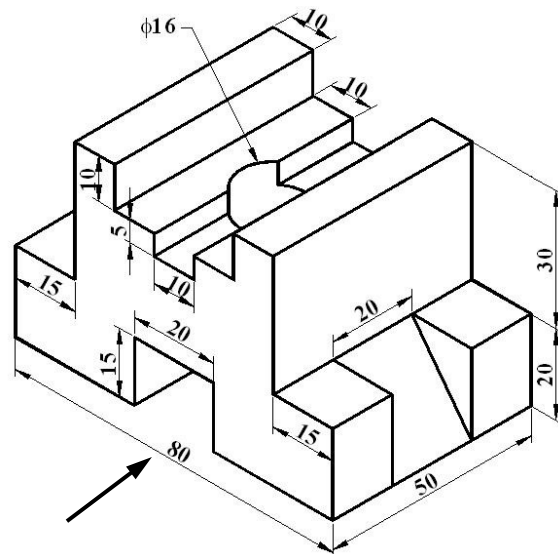
**Or**

Orthographic projection of a line **AB** is given in **Figure P.2**. Determine its true length and inclination with the HP. [3]

3. Pictorial view of an object is shown in **Figure P.3**. Draw (with dimension) its (a) sectional front view and (b) top view. [9]



**Figure P.2**



**Figure P.3**

4. Draw front and top views of a right solid cut by a plane as shown in **Figure P.4(a)**. Find the true shape of the section. Then develop lateral surface of the solid. [8]

**Or**

Draw the lines of intersection of the surfaces of geometrical solids shown in **Figure P.4(b)**. Also develop the lateral surface of the vertical solid. [8]

5. Draw isometric drawing from the given orthographic views as shown in **Figure P.5(a)**. [7]

**Or**

Draw oblique drawing from the given orthographic views as shown in **Figure P.5(b)**. [7]

P.5(b).

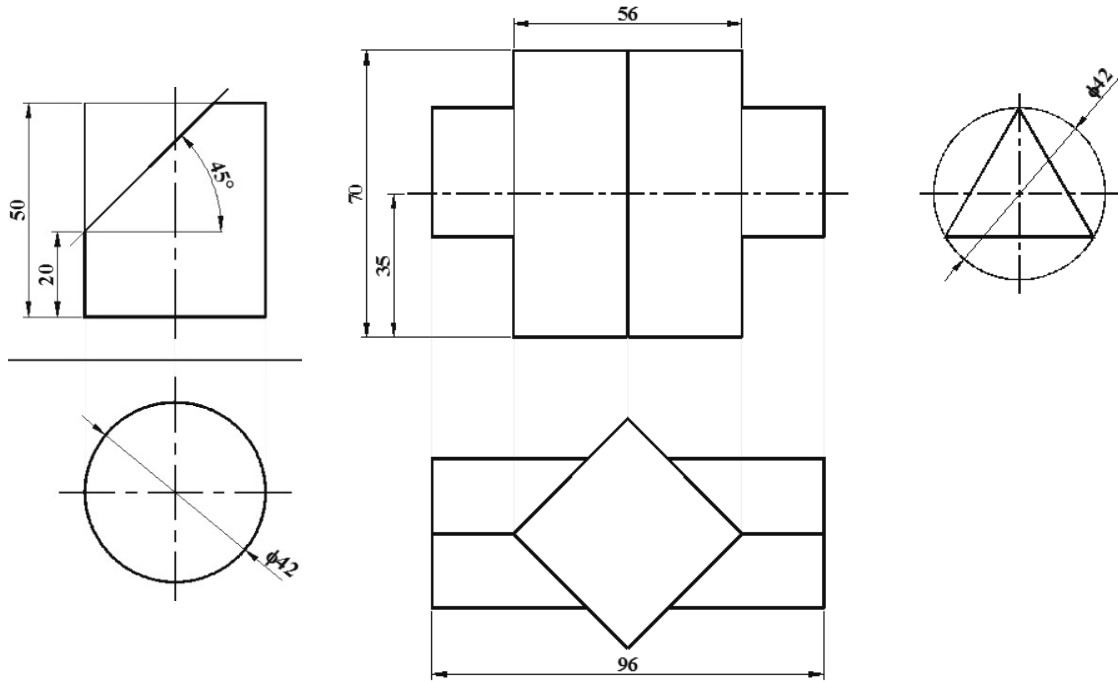


Figure P.4(a)

Figure P.4(b)

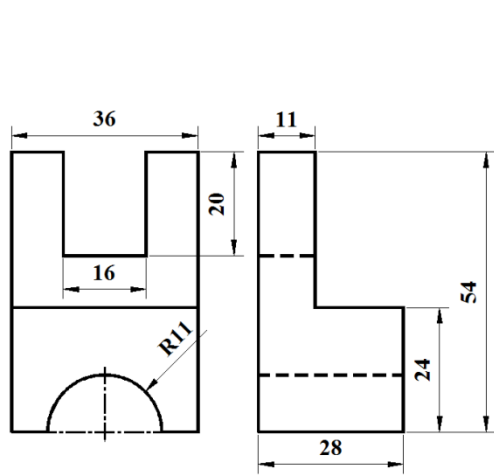


Figure P.5(a)

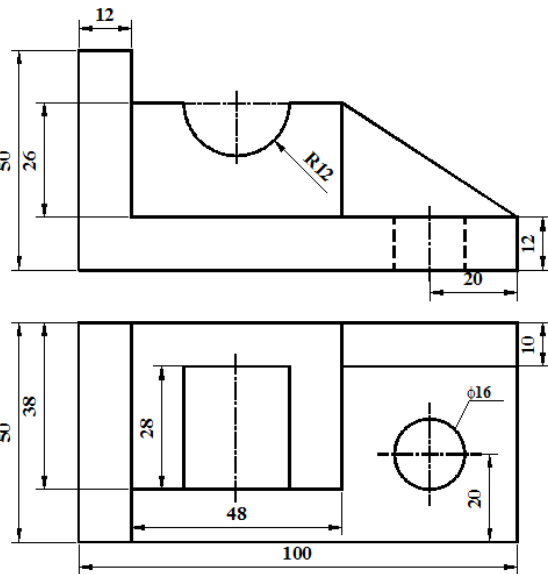


Figure P.5(b)

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