

B.Tech Dec-Jan 2023-24  
(CE/ME/ECE/EE/A&R/CSE/EEE/IT)  
Sem

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Sem-I

Roll No.

Total No. of Pages : 03

Total No. of Questions : 09

B.Tech. (CE/ME/ECE/EE/A&R/CSE/EEE/IT) (Sem.-1)

**MATHEMATICS-I**

Subject Code : BTAM-101-18

M.Code : 75353

Date of Examination : 04-12-2023

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**

1. Answer Briefly :

a) Test the convergence of the following series  $\sum \frac{n!}{n^n}$ .

b) State the Raabe's test.

c) State Rolle's theorem.

d) State Langrange's mean value theorem.

e) Prove that  $\int_0^{\frac{\pi}{2}} \sin 2x \log \tan x dx = 0$

f) Evaluate  $\int_0^3 \int_0^1 (x^2 + 3y^2) dy dx$ .

g) Change the order of integration of  $\int_0^1 \int_x^{\sqrt{x}} f(x,y) dy dx$ .

h) Find the first order derivative of  $z = x^2 + y^2 + 2x + 3axy$ .



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i) Find the rank of the following matrix  $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 5 & 7 \end{bmatrix}$

j) Find the determinant of the following matrix  $\begin{bmatrix} 2 & 3 & 4 \\ 1 & 7 & 1 \\ 8 & 2 & 3 \end{bmatrix}$

SECTION - B

2. If  $z(x+y) = x^2 + y^2$ . Show that  $\left(\frac{\partial z}{\partial x} - \frac{\partial z}{\partial y}\right)^2 = 4\left(1 - \frac{\partial z}{\partial x} - \frac{\partial z}{\partial y}\right)$

3. Evaluate  $\iint e^{ax+by} dx dy$  over the triangle bounded by  $x = 0, y = 0, ax + by = 1$ .

4. Test the convergence of the series  $\sum \frac{(n!)^2}{(2n)!} x^{2n}$ .

5. Verify if the matrix  $A = \begin{bmatrix} \cos \phi & -\sin \phi & 0 \\ \sin \phi & \cos \phi & 0 \\ 0 & 0 & 1 \end{bmatrix}$  is orthogonal and hence find its inverse.

SECTION - C

6. Find the maximum and minimum value of  $xy + \frac{a^3}{x} + \frac{a^3}{y}$ .

7. a) Solve the simultaneous equations  $3x + 2y + 4z = 7, 2x + y + z = 4, x + 3y + 5z = 2$ .

b) Find the inverse of the matrix  $\begin{bmatrix} 1 & 2 & 2 \\ -1 & 1 & 1 \\ 3 & -2 & 1 \end{bmatrix}$ .

8. a) Find the area of the surface of revolution of the solid generated by revolving the ellipse  $\frac{x^2}{16} + \frac{y^2}{4} = 1$  about the x-axis.
- b) Evaluate  $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} xyz dx dy dz$
9. a) Test the convergence of the series  $\frac{1^2}{4^2} + \frac{5^2}{8^2} + \frac{9^2}{12^2} + \frac{13^2}{16^2} + \dots$
- b) Using Maclaurin's series, expand  $\tan z$  upto the term containing  $x^5$ .

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Total No. of Pages : 02

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B.Tech.(AI&ML/CE/CSE/CS&D/EE/ECE/DS/EEE/IT/ME/Robotics & Artificial Intelligence/Internet of Things and Cyber Security including Block Chain Technology)) (Sem.-1)

## ENGINEERING GRAPHICS & DESIGN

Subject Code : BTME101-21

M.Code : 93799

Date of Examination: 23-12-2023

Time : 3 Hrs.

Max. Marks : 60

### INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

### SECTION-A

1. Write short notes on :

- a) Explain any two types Lines used in Engineering Drawing.
- b) Explain the following terms with a suitable drawing: Apex, Slant Height, Base Rim and Generator.
- c) Draw projections of a line lying on a Profile Plane whose top view is larger than its front view. Which angle is bigger " $\theta$ " or " $\phi$ " ? Show with the help of a suitable free hand drawing.
- d) Show conventional representation of Glass and Wood on a Drawing Sheet.
- e) Explain the importance of a title block.
- f) Draw a regular Pentagonal Lamina of side 55mm.
- g) Explain the difference between an isometric projection and isometric drawing.
- h) Show by means of traces, a plane perpendicular to HP and inclined to VP.
- i) Explain with the help of an example the Aligned system of placement of dimensions.
- j) Draw projections of a line inclined to VP and parallel to HP with a suitable freehand drawing. Also, show traces.



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### SECTION-B

2. Line "KP" 68 mm long; has its end "K" on HP and 22 mm from VP. It is inclined at  $42^\circ$  to the W and  $35^\circ$  to the "HP". Draw its projections when the line is lying in first quadrant.
3. Draw a scale of R.F 1/50 to read meters and decimeters and long enough to measure up to 6m. Show 5.7m on the scale.
4. A point "M" is 36mm behind VP and 42mm below HP. Draw its projections and find out its shortest distance from the reference line.
5. End "A" of a line AB is 49 mm in front of VP and 11 mm above HP and end "B" is 7 mm in front of VP and 59 mm above HP. The distance between end projectors is 52mm. Draw its projection and find TL,  $\theta$ ,  $\phi$ , HT and VT.

### SECTION-C

6. A regular hexagonal lamina of side 20 mm, perpendicular to HP and lying on HP on one of its sides. The plane is parallel to VP and 20 mm from VP. Draw its projections and show traces.
7. A cone of base diameter 45 mm and axis 58 mm long; is lying on HP on a point of its circumference such that its generator is perpendicular to HP. Draw its projections assuming the object lying in first quadrant.
8. Draw isometric drawing of a hexagonal prism of base edge 25mm and axis 62mm long.
9. A right regular pentagonal pyramid of base edge 32mm and axis 63mm long rests on its base on the HP such that one of its base edges is perpendicular to VP. Draw its projections.

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**B.Tech. (Artificial Intelligence & Data Science/AIML/ Block Chain/CE/CSE/EE/EEE/FT/IT/ME/Internet of Things and Cyber Security including Block Chain Technology)(Sem.-1)**

**ENGLISH**

**Subject Code : BTHU101-18**

**M.Code : 93806**

**Date of Examination : 29-12-2023**

**Time : 3 Hrs.**

**Max. Marks : 60**

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select at least TWO questions from SECTION - B & C.

**SECTION-A**

**1. Do as directed :**

- a) Give full form of the abbreviations : ICJ, IMO
- b) Give full form of the abbreviations : NATO, EU
- c) Give two synonyms : Begin
- d) Give two antonyms : Fortunate
- e) Give two words with prefix : anti
- f) Give two words with suffix : ful
- g) Punctuate : have you ever been to taj mahal
- h) What is describing?
- i) What should we bear in mind while writing conclusion?
- j) What are redundancies?



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**SECTION-B**

2. Discuss creating coherence in writing.
3. Discuss sentence structures.
4. **a) Fill in with articles :**
  - i) My mother is ... English teacher.
  - ii) It was ... bolt from the blue.
  - iii) She is .... MLA.
  - iv) I shall meet ....President today.**b) Use the following phrases in your own sentences :**
  - i) in search of
  - ii) at the end
  - iii) under the table
  - iv) in spite of
5. **a) Fill in the blanks with prepositions :**
  - i) She always stands .... him in the house.
  - ii) The child was run ..... by a car.
  - iii) He sits....the fire.
  - iv) You have to complete your work ..... courage.**b) Correct the following :**
  - i) I have not seen him since six years.
  - ii) He or Raju are guilty.
  - iii) I prefer tea than coffee.
  - iv) He is brave than his friends.

## SECTION-C

6. Write a report on climate change suggesting ways to save the environment.
7. Make a precis of the following passage :

For many years now the Governments has been promising for the eradication of child labour in hazardous industries in India. But the truth is that despite all the rhetoric no Government so far has succeeded in eradicating this evil, nor has any been able to ensure compulsory primary education for every Indian child. Between 60 and 100 million children are still at work instead of going to school, and around 10 million are working in hazardous industries. India has the biggest child population of 380 million in the world; plus the largest number of children who are forced to earn a living. We have many laws that ban child labour in hazardous industries. According to the Child Labour (Prohibition and Regulation) Act 1986, the employment of children below the age of 14 in hazardous occupations has been strictly banned. But each state has different rules regarding the minimum age of employment. This makes the implementation of these laws difficult. Also, there is no ban on child labour in non-hazardous occupations. The act applies to the organised or factory sector and not the unorganized or informal sector where most children find employment as cleaners, servants, porters, waiters, among other forms of unskilled work. Thus, child labour continues because the implementation of the existing law is lax.

8. Draft a business letter placing an order of furniture items required by your company. Imagine details.
9. Write an essay on "*Health and Physical Exercising.*"

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B.Tech. (AI&ML/IOS/CE/DS/CSE/IT/Robotics & Artificial Intelligence/Internet of Things and Cyber Security including Block Chain Technology) (Sem.-1)

**MATHEMATICS-I**

Subject Code : BTAM-104-18

M.Code : 75362

Date of Examination : 23-12-2023

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**

1. Answer briefly :

a) Calculate  $\left(\frac{1}{2}\right)$ .

b) Show that  $\beta(m, n) = \beta(n, m)$ .

c) Compute  $\lim_{x \rightarrow 0} \frac{x \cos x - \sin x}{x^2 \sin x}$ .

d) If  $A = \begin{bmatrix} 0 & 1 \\ 9 & 1 \end{bmatrix}$  and  $B = \begin{bmatrix} 1 & 2 \\ 5 & 7 \end{bmatrix}$  Compute  $AB$ .

e) Find the eigen values of the matrix  $\begin{bmatrix} 2 & 3 \\ 5 & 7 \end{bmatrix}$ .

f) Define symmetric and skew-symmetric matrices.

g) State rank and nullity theorem.

h) Evaluate  $\int_1^{\infty} \frac{dx}{x}$ .



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i) Find the rank of the matrix  $\begin{bmatrix} 3 & 2 & 4 \\ 1 & -2 & 3 \\ -3 & -10 & 1 \end{bmatrix}$ .

j) State Mean value theorem.

**SECTION - B**

2. Find the eigen value and eigen vector of the following matrix  $A = \begin{bmatrix} 1 & 2 \\ 3 & 9 \end{bmatrix}$

3. Find the maximum and minimum value of  $f(x,y) = xy + \frac{1}{x} + \frac{1}{y}$

4. Verify Cayley-Hamilton theorem for the matrix  $A = \begin{bmatrix} 1 & 3 & 7 \\ 4 & 2 & 3 \\ 1 & 2 & 1 \end{bmatrix}$

5. Find the volume generated by revolving the area bounded by the parabola  $y^2 = 8x$  and its latus rectum about the  $x$ -axis.

**SECTION - C**

6. Solve the following system using Gauss elimination  $2x - 2y = -6, x - y + z = 1, 3y - 2z = -5$ .

7. a) Find the volume of the solid generated by the revolution of the cardioid  $r^2 = a^2 \cos 2\theta$  about the line  $\theta = \frac{\pi}{2}$ .

b) Show that  $\int_0^{\frac{\pi}{2}} \frac{\sin x}{\sin x + \cos x} dx = \frac{\pi}{4}$ .

8. a) Use Cramer's rule to solve :  $-x + 3y - 2z = 5, 4x - y - 3z = -8, 2x + 2y - 5z = 7$ .

b) Prove that  $\beta(m,n) = \frac{r m r n}{r(m+n)}$

9. a) Show that the transformation  $T : R^3 \rightarrow R^3$  define by  $T(x, y, z) = ax + by + cz$  is linear, where  $a, b$  and  $c$  are fixed real numbers.

b) Let  $T : R^3 \rightarrow R^3$  define by  $T\{x, y, z\} = (x, x + y, x + y + z)$ . Find the associated matrix corresponding to standard basis.

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B.Tech. (AI&DS/M.L./Block Chain/CE/CSE/EE/EEE/ECE/Cyber Security/E&TE/FT/IT/ME/Internet of Things and Cyber Security including Block Chain Technology) (Sem.-1)

**CHEMISTRY-I**

Subject Code : BTCH101-23

M.Code : 93800

Date of Examination: 16-12-2023

Time : 3 Hrs.

Max. Marks : 60

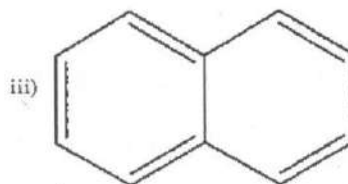
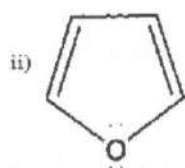
**INSTRUCTIONS TO CANDIDATES :**

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2. SECTION - B & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**

1. Write briefly :

- a) What are N type and p-type semiconductors?
- b) What are Chromophores? Give examples.
- c) Out of the following compounds write which are aromatic or antiaromatic.



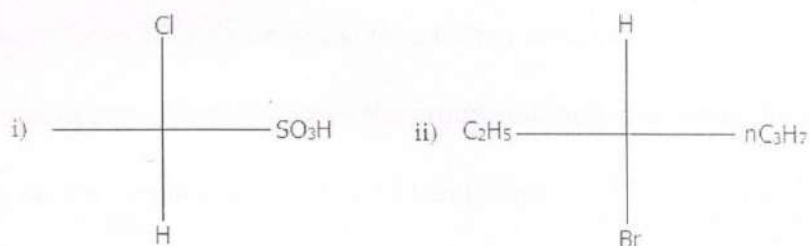
- d) Distinguish between an Ideal gas and Real gas.
- e) What is electrochemical corrosion? Discuss.
- f) What is Markownik of Rule? Give an example.
- g) What is Lewis concept of Acids and Bases?



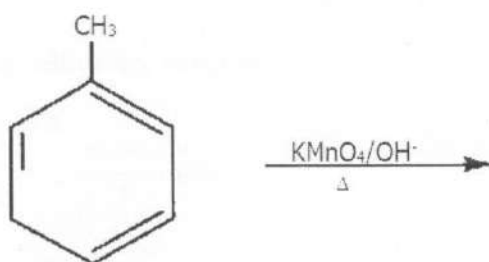
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h) Why electron affinity of noble gases are Zero?

i) Assign R/S configuration to each of the following compounds.



j) Complete the following reaction:



### SECTION-B

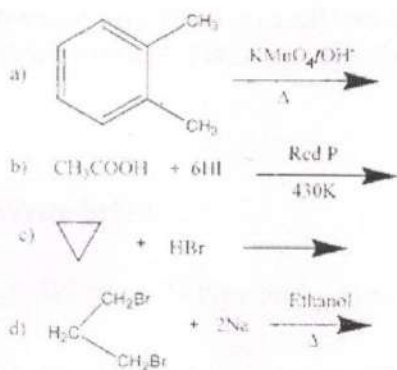
2. a) Explain crystal field theory in detail. How it can be utilized in explaining the octahedral complexes of transition metal ions.
- b) Differentiate between bonding and antibonding molecular orbitals.
3. **Define the following terms:**
  - a) Bathochromic shift
  - b) Auxochromes
  - c) fluorescence
  - d) hyperchromic shift
4. Explain in detail the vander waal Equation of state for real gases.
5. a) The e.m.f. of the cell reaction  $3\text{Sn}^{+4} + 2\text{Cr} \rightarrow 3\text{Sn}^{+2} + 2\text{Cr}^{+3}$  is 0.89. Calculate the standard free energy change for the reaction.
- b) Discuss the Zeolite process for softening of water.

SECTION-C

6. Explain why:

- a) Electron affinity of fluorine is less than that of chlorine.
  - b) Ionisation energy decreases down the group and increases along the period.
  - c) Which has the smallest size (Cl or Cl<sup>-</sup>) and why?
7. a) What is diastereomerism? Explain by giving at least two examples.  
b) Discuss the conformational analysis of propane.

8. Complete the following reactions:



9. Explain the following :

- a) HSAB principle
- b) Enantiomerism
- c) Electronegativity
- d) Free energy.

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Total No. of Pages : 02

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**B.Tech.( Artificial Intelligence & Machine  
Learning/CE/CSE/DS/CS&D/ECE/EEE/EE/IT/ME/Robotics & Artificial  
Intelligence/Internet of Things and Cyber Security including Block Chain  
Technolog) (Sem.-1)**

**ENGINEERING PHYSICS**

Subject Code : BTPH101-23

M.Code : 93794

Date of Examination: 14-12-2023

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**

I. Write short notes on :

- a) What is a Unit Cell?
- b) Distinguish between Intrinsic and Extrinsic Semiconductors.
- c) What are Type I and Type II Superconductors?
- d) Show that Curl of gradient is zero.
- e) What is Uncertainty Principle?
- f) Distinguish between Stimulated emission and Stimulated absorption.
- g) What is Holography?
- h) Define Normalized frequency.
- i) What are Carbon Nanotubes (CNTs)?
- j) What is the use of He in He-Ne laser?



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**SECTION-B**

2. What are X-rays? Discuss the diffraction of X-ray from crystals and obtain Bragg's law.
3. What is Photodetector? Explain the construction and working of Photodiode. Discuss the disadvantages of Photodiode.
4. What is Meissner effect? Explain it using London equations.
5. a) Write the Maxwell's equations and discuss the physical significance of each equation.  
b) Explain Dielectric polarization. What is Displacement current?

**SECTION-C**

6. What are Einstein's coefficients? Derive the relation between Einstein's coefficients and discuss the physical interpretation.
7. Define Acceptance angle and Numerical Aperture. Derive the expression for Acceptance Angle.
8. What is Photoelectric Effect? Explain the laws of Photoelectric Effects using Quantum Approach.
9. Explain the synthesis of nanomaterials using Ball Milling and Sol-gel Techniques.

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B.Tech.(AI&ML/AI&DS/Data Science/Block Chain/CE/CSE/Cyber Security/EE/ECE/Cyber Security/Electronics & Telecommunication Engineering/FT/IT/ME/Internet of Things and Cyber Security including Block Chain Technology) (Sem.-1)

### PROGRAMMING FOR PROBLEM SOLVING

Code : BTPS101-18

M.Code : 93803

Date of Examination: 13-12-2023

Time : 3 Hrs.

Max. Marks : 60

#### INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

#### SECTION-A

1. Write short notes on :

- a) What are bitwise operators? Explain any two bitwise operators with proper syntax.
- b) Draw the block diagram of computer and explain in brief each component of computer.
- c) What is an algorithm? Give an example.
- d) Give an example of logical error in C.
- e) Write the syntax of switch control statement.
- f) What is an array? How to initialize each element of the array?
- g) What is a function? Differentiate between user-defined and library function.
- h) What is structure? Write the syntax to create a structure.
- i) What is a pointer? How can we access a variable using pointer?
- j) Differentiate between while and do-while loop.



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**SECTION-B**

2. What is recursion? Write a program to compute the Fibonacci series using recursion.
3. Write a program to find the smallest element in an array.
4. Explain in detail various types of operators in C.
5. Explain various data types in C.

**SECTION-C**

6. Write a program or algorithm to implement selection sort.
7. Explain in detail various string library functions with the help of proper syntax.
8. What is the role of compiler? What is object and executable code?
9. Write a program to display sum of first n natural numbers.

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B.Tech. (AI&ML/CE/CSE/CS&D/DS/EEE/EE/ECE/IT/ME/Robotics &  
AI/(Internet of Things and Cyber Security including Block Chain  
Technology) (Sem.-1)

**BASIC ELECTRICAL ENGINEERING**

Subject Code : BTEE101-18

M.Code : 93797

Date of Examination: 11-12-2023

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A****1. Answer the following :**

- a) Classify various types of electric cables.
- b) A series RL circuit draws a current of 1 A, when contacted across a 10 V, 50 Hz AC supply. Assuming the resistance 5 ohms, find the inductance of the circuit. What is its power factor.
- c) What is phasor representation?
- d) Based on power factor, categorize the different kinds of electrical loads.
- e) What is the difference between wire & cable?
- f) Give an explanation of the peak and form factors in terms of alternating current.
- g) What are the classifications of magnetic materials based on their magnetic properties?
- h) State and explain the Kirchhoffs Laws.
- i) Identify and explain the different losses in a transformer,
- j) State the purpose of earthing in electrical systems.



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SECTION-B

- For a balanced three-phase delta connection, determine the numerical relationship between the line and phase currents.
- A series RLC circuit of  $R = 40 \Omega$ ,  $L = 50.07\text{mH}$  and a capacitor is connected across a 400V, 50Hz, A.C supply. This RLC combination draws a current of 10A.

Calculate (i) Power factor of the circuit, (ii) Capacitor value.

- Briefly introduce the single-phase induction motor. Discuss the methods used for starting induction motors.
- State and explain Norton's theorem. Using Norton's theorem, determine the current flowing through the load resistance ( $R_L$ ) in Figure 1.

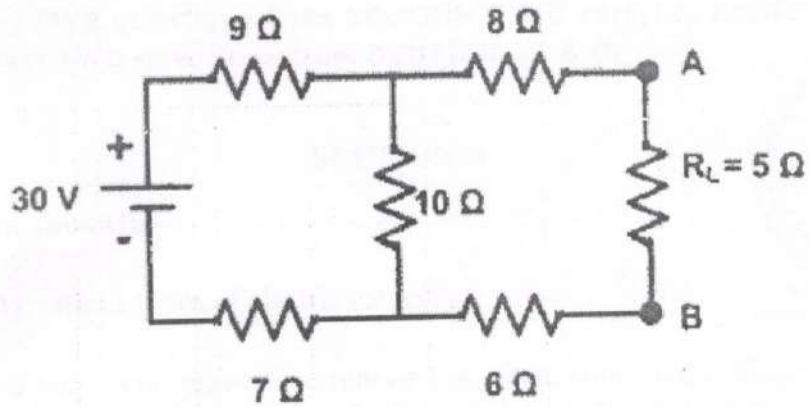


Fig.1

SECTION-C

- Describe the BH curve and its significance in characterizing magnetic materials.
- Compare Miniature Circuit Breaker (MCB) and Earth Leakage Circuit Breaker (ELCB).
- Explain the principle of operation of a transformer. Derive an EMF equation for a single-phase transformer. Also, draw the phasor diagram of a single-phase transformer at leading power factor load.
- What is the significance of a rotating magnetic field in motor operation? Describe the constructional features of a three-phase induction motor.

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B.Tech. (AI & DS/ AI & ML/ Block Chain / CSE / CE / CS / Computer Science and Design / EEE / EE / ECE / Electronics & Telecommunication Engineering / FT / IT / ME / Robotics & Artificial Intelligence/ Internet of Things and Cyber Security including Block Chain Technology) (Sem.-1)

### ENGINEERING MATHEMATICS-I

Subject Code : BTAM101-23

M.Code : 93796

Date of Examination: 08-12-2023

Time : 3 Hrs.

Max. Marks : 60

#### INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

#### SECTION-A

I. Answer briefly :

- a) What do you mean by bounded and unbounded sequences?
- b) Prove that the sequence  $\frac{2n-7}{3n+2}$  is monotonically increasing.
- c) Define  $p$ -Test for the series.
- d) Find the length of the arc of the parabola  $x^2 = 4ay$  extending from the vertex to one extremity of the latus rectum.
- e) Test for convergence of integral  $\int_0^{\infty} \frac{\sin^2 x}{x^2} dx$ .
- f) Define Beta function.
- g) State Euler's theorem for homogeneous function.
- h) Show that the function  $f(x, y) = \frac{2x^2y}{x^4 + y^2}$  has no limit as  $(x, y) \rightarrow (0, 0)$ .



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i) Evaluate  $\int_1^{\log 8} \int_0^{\log y} e^{x+y} dx dy.$

j) Evaluate  $\int_0^1 \int_0^{1-x} \int_0^{2-x} x y z dz dy dx..$

**SECTION-B**

2. Prove that the sequence  $a_n$  where  $a_n = \frac{1}{n+1} + \frac{1}{n+2} + \frac{1}{n+3} + \dots + \frac{1}{2n}$  is convergent.
3. Discuss the convergence or divergence of the series  $\frac{1}{1.2.3} + \frac{2}{2.3.4} + \frac{5}{3.4.5} + \dots$
4. Find the surface of the solid generated by the revolution of the ellipse  $x^2 + 4y^2 = 16$  about its major axis.
5. Prove that  $\beta(m, n) = \frac{\Gamma(m) \cdot \Gamma(n)}{\Gamma(m+n)}$  where  $m > 0, n > 0$ .

**SECTION-C**

6. If  $V = r^m$  where  $r^2 = x^2 + y^2 + z^2$ , show that  $\frac{\partial^2 V}{\partial x^2} + \frac{\partial^2 V}{\partial y^2} + \frac{\partial^2 V}{\partial z^2} = m(m+1)r^{m-2}$ .
7. Show that the first four terms of the Maclaurin's expansion of  $e^{ax} \cos by$  are :  

$$1 + ax + \frac{1}{2}(a^2x^2 - b^2y^2) + \frac{1}{3}(a^3x^3 - 3abxy^2).$$
8. Evaluate  $\int_0^\infty \int_0^x xe^{-x^2/y} dy dx$  by change of order of integration.
9. Evaluate  $\iiint \frac{dx dy dz}{(x+y+z+1)^3}$  over the region  $x \geq 0, y \geq 0, z \geq 0, x + y + z \leq 1$

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Total No. of Pages : 03

Total No. of Questions : 09

B.Tech. (CSE/ME/ECE/CE/IT/EE/EEE) (Sem.-1)

**ENGINEERING MATHEMATICS-I**

Subject Code : BTAM-101

M.Code : 54091

Date of Examination : 08-12-2023

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**



Dec-2023

1. Solve the following:

- a) Find the curvature of the curve  $r = a \sin \theta + b \cos \theta$  at any  $\theta$ .
- b) Find the total length of the curve  $r = a \sin^3 (\theta/3)$ .
- c) If  $u(x, y) = \cos^{-1} \left( \frac{x+y}{\sqrt{x} + \sqrt{y}} \right)$ ,  $0 < x, y < 1$ , then prove that  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = -\frac{1}{2} \cot u$ .
- d) Find the relative maximum and minimum values of the function  $f(x, y) = xy + (9/x) + (3/y)$ .
- e) If  $z = f(ax - by)$ , then show that  $b \frac{\partial z}{\partial x} - a \frac{\partial z}{\partial y} = 0$ .
- f) Evaluate  $\iint_R e^{x^2} dx dy$ , where the region  $R$  is given by  $R : 2y \leq x \leq 2$  and  $0 \leq y \leq 1$ .
- g) Prove that  $\nabla r^n = nr^{n-2} \vec{r}$ , where  $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ .

- h) Find  $\text{div } \vec{F}$  and  $\text{curl } \vec{F}$ , where  $\vec{F} = \text{grad}\{x^3 + y^3 + z^3 - 3xyz\}$ .
- i) Define irrotational vector. Is  $\vec{F} = (y + z) \hat{i} + (z + x) \hat{j} + (x + y) \hat{k}$  an irrotational vector?
- j) State Gauss Divergence theorem.

**SECTION-B**

- 2. Sketch the graph of the curve  $y = \frac{(x-1)(x-3)}{x^2}$ .
- 3. a) Find the volume of the solid generated by revolving the region bounded by the curves  $y = 3 - x^2$  and  $y = -1$  about the line  $y = -1$ .  
 b) Find the surface area of the solid generated by revolving the circle  $x^2 + (y - b)^2 = a^2$ ,  $b \geq a$  about the  $x$ -axis.
- 4. If  $z = f(x, y)$ ,  $x = r \cos \theta$ ,  $y = r \sin \theta$ , then show that  $\left(\frac{\partial f}{\partial x}\right)^2 + \left(\frac{\partial f}{\partial y}\right)^2 = \left(\frac{\partial f}{\partial r}\right)^2 + \frac{1}{r^2} \left(\frac{\partial f}{\partial \theta}\right)^2$
- 5. Find the extreme values of  $f(x, y, z) = 2x + 3y + z$ , such that  $x^2 + y^2 = 5$  and  $x + z = 1$ .

**SECTION-C**

- 6. Evaluate  $\iiint_{\Gamma} \sqrt{1 - \frac{x^2}{a^2} - \frac{y^2}{b^2} - \frac{z^2}{c^2}} \, dx dy dz$ , where the region is bounded by the Curve  $\Gamma: \frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$ .

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7. Prove that  $\nabla \times \left( \frac{\vec{a} \times \vec{r}}{r^n} \right) = \frac{2-n}{r^n} \vec{a} + \frac{n(\vec{a} \cdot \vec{r})}{r^{n+2}} \vec{r}$ , where  $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$  and  $\vec{a}$  is a constant vector.
8. Show that  $\nabla(\vec{X} \cdot \vec{Y}) = (\vec{X} \cdot \nabla)\vec{Y} + (\vec{Y} \cdot \nabla)\vec{X} + \vec{X} \times (\nabla \times \vec{Y}) + \vec{Y} \times (\nabla \times \vec{X})$ .
9. Verify Green's theorem for  $\int_C (xy + y^2)dx + x^2 dy$ , where  $C$  is bounded by  $y = x$  and  $y = x^2$ .

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B.Tech Dec-Jan-2023-24  
IT, CSE, ME, ECE,

Sem-1,2

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Total No. of Pages : 03

Total No. of Questions : 09

B.Tech. (AE / AI&ML / AI & Data Science / Robotics & AI / FT / CE /  
Computer Engg. / CSE / IOT / EE / EEE / IT / ME / (Internet of Things and  
Cyber Security including Block Chain Technology)) (Sem.-1,2)

### CHEMISTRY-I

Subject Code : BTCH-101-18

M.Code : 75343

Date of Examination : 02-01-2024

Time : 3 Hrs.

Max. Marks : 60

#### INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.



#### SECTION-A

1. Answer briefly :

- a) The following compounds show only one signal in  $^1\text{H}$  NMR. Write their structural formula, (a)  $\text{C}_5\text{H}_{12}$ , (b)  $\text{C}_2\text{H}_6\text{O}$ .
- b) Why  $d$  and  $f$  orbital show poor shielding effect?
- c) What is the essential condition of molecule to NMR active?
- d) What is the shape of  $\text{BF}_3$  molecule?
- e) What do you understand by effective nuclear charge?
- f) How does Vander Waals interaction occur?
- g) What are rocking and wagging vibrations?
- h) What is optical activity?
- i) Define entropy.
- j) Give one example of Hard and soft acid each.

DEC. 2023

## SECTION-B

2. a) Solve the Schrodinger wave equation for particle in one-dimensional box.  
b) What will happen if the walls of the one dimensional box are suddenly removed?
3. Draw the molecular diagram of  $O_2$ ,  $O_2^{2-}$  and  $O_2^{+}$ . Compare these on the basis of their bond order and magnetic behavior. Also, calculate its bond length and bond dissociation energy.
4. a) Discuss the principle of electron spectroscopy. Explain with reference to  $CH_2=CH_2$ , 1,3-butadiene and carbonyl compound.  
b) Describe the working principle and selection rule for NMR.
5. Explain the following terms with example :  
a) Ionic interaction  
b) Dipole interaction  
c) Vander Waals interaction.

## SECTION-C

6. a) Derive Nernst Equation and give its application.  
b) Simultaneous oxidation and reduction, according to the reaction .  
$$2 Cu^+ (aq) \longrightarrow Cu^{2+} (aq) + Cu(s)$$
  
Calculate  $E^\circ$  for the reaction? ( $E^\circ Cu^{2+} | Cu = 0.34 V$  and  $E^\circ Cu^{2+} | Cu^+ = 0.15 V$ )
7. Give reason for the following :  
a) Second ionisation energy of an atom is always greater than the first ionisation energy of an atom.  
b) Electron affinities of halogen are highest.  
c) The size of anion is larger than its parent atom.  
d) Why Na is smaller than  $Na^+$ ?



8. a) Define chirality. What are chiral molecules?  
b) Differentiate between the following :
  - i) Structural isomers and Stereoisomer
  - ii) Enantiomers and Diastereomers
  - iii) Configuration and Conformation
9. a) Explain the synthesis of any one commonly used drug molecule.  
b) Explain the mechanism of  $S_N1$  reaction.

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Total No. of Pages : 02

Total No. of Questions : 09

B.Tech. (AE/AI/ML/DS/CE/CSE/ME/IT/FT/EEE/AI/(Robotics & Artificial Intelligence/EE/ECE/Internet of Things and Cyber Security including Block Chain Technology) (Sem.-1,2)

Subject Code : BTEE-101-18

M.Code : 75339

Date of Examination: 30-12-2023

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**

I. Answer following questions in brief :

- a) When the entire current flow (let's say  $I$ ) and connected voltage source (let's say  $V$ ) are split into two parallel routes with resistors (let's say  $R_1$  and  $R_2$ ), how do you get the equation for two currents ( $I_1$  and  $I_2$ ).
- b) Define the resonant frequency.
- c) What is the relation between bandwidth and quality factor in RLC series resonant circuit?
- d) Compare active and reactive power use in AC machines.
- e) What is an ideal transformer?
- f) State and explain Ohm's law.
- g) Enumerate the applications of single-phase induction motor.
- h) What is a fuse? Discuss the advantages and disadvantages of a fuse.
- i) Discuss the concept of power factor.
- j) Distinguish the average value from the r.m.s. value.



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## SECTION-B

2. With respect to DC circuit, state and explain Kirchhoff's voltage and current law with the help of a suitable diagram.
3. A coil has a resistance of  $5 \Omega$  and an inductance of  $31.8 \text{ mH}$ . Calculate the current taken by the coil, power factor and average power when connected to  $200\text{V}$ ,  $50 \text{ Hz}$  supply.
4. Explain the construction and working principle of a single-phase induction motor.
5. Describe the efficiency of a transformer and how it can be calculated. Deduce a condition for maximum efficiency.

## SECTION-C

6. Write a short note on :
  - a) Switch Fuse Unit (SFU), and
  - b) Miniature Circuit Breaker (MCB).
7. Explain the principle of operation of transformer. Derive an expression for the e.m.f. of an ideal transformer winding.
8. State and explain Thevenin's theorem. In figure 1, Find the current through the load resistance ( $R_L$ ) using Thevenin's theorem.

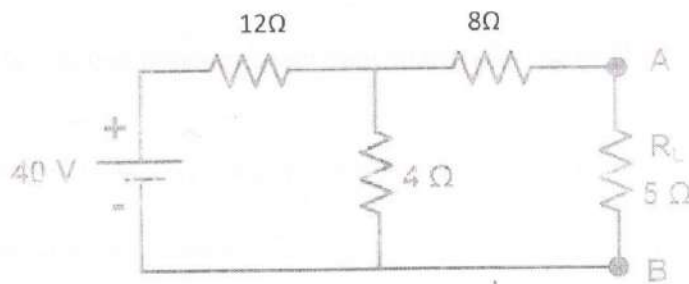


Figure 1

9. Derive an expression for power in a 3-phase star-connected system in term of
  - a) Phase values and
  - b) Line values of voltage and current

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Roll No.

Total No. of Pages : 02

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**B.Tech. (AI&ML / Data Science / Robotics & AI / (Internet of Things and  
Cyber Security including Block Chain Technology)  
/ CE / CSE / EEE / EE / ECE / FT / IT / ME) (Sem.-1,2)  
PROGRAMMING FOR PROBLEM SOLVING**

Subject Code : BTPS-101-18

M.Code : 75346

Date of Examination : 22-12-2023

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**

1) Write briefly :

- a) What is the syntax of nested If statement
- b) What are Local and global variables?
- c) What is a conditional operator in C?
- d) What is a scope of any variable?
- e) What is the structure of a C program?
- f) What are the logical operators available in C?
- g) What is a pointer?
- h) What is format specifier?
- i) How structure is represented?
- j) What is a conditional statement?



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**SECTION-B**

- 2) What are the various Control Structures available in C?
- 3) What are the steps in the design of a program? What is an algorithm?
- 4) What are the various types of operators available in C language?
- 5) **Explain the syntax of following in C using example :**
  - a) Union statement
  - b) Switch statement

**SECTION-C**

- 6) Write a program to find the addition of two matrix.
- 7)
  - a) How two dimensional arrays are accessed using pointers?
  - b) What are the various file opening statements available in C?
- 8) A student record consists of the register number (five digit number), name (max. 30 character length), marks in three subjects (max. 100 marks in each subject). Write a C program to process such records for results. Write the assumptions you have made for passing, second class and first class.
- 9) Write a "C" program to find factorial of a given number.

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Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(AE/AIML/DS/CE/CSE/EEE/ECE/EE/FT/IT/ME/ Robotics & Artificial Intelligence/ Internet of Things and Cyber Security including Block Chain Technology) (Sem.- 1,2)

**ENGINEERING GRAPHICS & DESIGN**

Subject Code : BTME101-21

M.Code : 91335

Date of Examination: 15-12-2023

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**

**I. Write short notes on :**

- a) Draw projections of a line inclined to HP and parallel to VP with a suitable freehand drawing. Also, show traces.
- b) Explain the following terms with a suitable drawing: Apex, Slant Height, Base Rim and Generator.
- c) How will you represent Liquid and Concrete on a drawing sheet?
- d) Write the following statement using single stroke capital vertical letters of 12 mm size: "IKGPTU KAPURTHALA".
- e) What do you mean by representative fraction (RF)?
- f) What are right solids and oblique solids? Explain with a suitable freehand drawing.
- g) Explain the types of Dimensions with a suitable drawing.
- h) Show by means of traces, a plane perpendicular to VP and inclined to HP.
- i) Explain with the help of an example the Unidirectional system of placement of dimensions.
- j) Explain any two types of Lines used in Engineering Drawing.





**SECTION-B**

2. A point "G" is 31mm behind VP and 45mm below HP. Draw its projections and find out its shortest distance from the reference line.
3. A line "AB" is contained by a profile plane. Its end "A" is 49 mm in front of VP and 11 mm above HP and end "B" is 7 mm in front of VP and 59 mm above HP. Draw its projection and find TL,  $\theta$ ,  $\phi$ , HT and VT.
4. Line "CD" 72 mm long; has its end "C" both in HP and VP. It is inclined at  $45^\circ$  to the "HP" and  $39^\circ$  to the "VP". Draw its projections when the line is lying in first quadrant.
5. Distance between two railway stations is 360 km, which is represented on a railway map by a line 12 cm long. Construct a Diagonal Scale to read up to single km and indicate distance of 295 km on the scale.

**SECTION-C**

6. A cone of base diameter 50 mm and axis 65 mm long; is lying on HP on a point of its circumference such that its generator is perpendicular to HP. Draw its projections assuming the object lying in first quadrant.
7. A regular pentagonal lamina of side 20 mm, perpendicular to HP and lying on HP on one of its sides. The plane is parallel to VP and 20 mm from VP. Draw its projections and show traces.
8. A right regular hexagonal pyramid side of base 35mm and height 65mm rests on its base on the HP such that one of its base edges is perpendicular to VP. Draw its projections.
9. A cube of 30 mm edge is placed centrally on top of a cylindrical block of diameter 52 mm and 20 mm height. Draw its isometric drawing.

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Total No. of Pages : 02

Total No. of Questions : 09

B.Tech. (AI&ML/AI&DS/CSE(AI&ML)/CSE(DS)/DS/R&AI/CSE(IOT & Cyber Security with block chain Tech./CSE/IT/CE/ME) (Sem.-1,2)

**SEMI-CONDUCTOR PHYSICS**

Subject Code : BTPH-104-18

M.Code : 75360

Date of Examination : 13-12-2023

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**

1. Write briefly :

- a) What do you understand by term density of states?
- b) What do you mean by periodic potential?
- c) What do you mean by effective mass?
- d) What do you understand by a semiconductor?
- e) What is the difference between diffusion and drift of electrons?
- f) What is the basic principle of laser?
- g) Write a short note on Photovoltaic effect.
- h) What do you mean by exciton?
- i) What is Hall mobility?
- j) Write a short note on hot-point probe measurement.



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**SECTION-B**

2. a) What is meant by the free-electrons gas model of metals?  
b) Derive an expression relating Fermi energy and electron concentration.
3. Discuss the Kronig-Penny model and show how it explains the forbidden bands.
4. Discuss in detail the dependence of Fermi level on carrier concentration and temperature.
5. a) What do you mean by metal-semiconductor junction? Discuss in detail Ohmic metal-semiconductor junction in detail.  
b) Explain the mechanism of carrier generation and recombination.

**SECTION-C**

6. What do you mean by Einstein coefficients? Derive the Einstein coefficients describing the probabilities of stimulated absorption and stimulated emission.
7. a) What is population inversion? How is it achieved?  
b) What do you mean by phonon? Discuss Drude model.
8. How Hall mobility can be measured using four-point probe and van der Pauw method?
9. a) Write a note on capacitance-voltage measurements.  
b) How can we extract different parameters from I-V characteristics of diode?

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Roll No.

Total No. of Pages : 02

Total No. of Questions : 09

B.Tech. (CE/CSE/ME/AE) (Sem.-1,2)

**ELECTROMAGNETISM**

Subject Code : BTPH-103-18

M.Code : 75357

Date of Examination : 12-12-2023

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**

**1. Write briefly :**

- a) Write the basic differential equations of electrostatic field and potential. Explain why these are called basic equations?
- b) The electric potential at any point in x-y plane is given by  $V = -Axy$  where A is a constant. Find the magnitude of electric field at a distance r from the origin.
- c) The electric field due to two unknown point charges is zero midway between them. What do you conclude about the signs of the charges and their magnitudes?
- d) State and explain uniqueness theorem.
- e) What is Curie temperature?
- f) What is vector potential?
- g) What is skin depth? What is the value of skin depth for a perfect conductor?
- h) Good conductors are good reflectors. Comment.
- i) State Faraday's law of electromagnetic induction. Write it in differential form.
- j) Light is mostly characterised by electric field vector even though it has magnetic field vector also. Why?



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### SECTION-B

2. Prove that potential due to electric dipole, having dipole moment  $\vec{p}$  and located at origin, at any point is  $V = V = \frac{\vec{p} \cdot \vec{r}}{4\pi\epsilon_0 r^3}$ , where  $\vec{r}$  is the position vector of observation point.
3. Why electric field inside a dielectric decreases due to polarization? Show that  $\vec{D} = \epsilon_0 \vec{E} + \vec{P}$ .
4. Define Biot-Savart's law. Using Biot-Savart's law prove that magnetic monopoles do not exist.
5. Explain the term hysteresis and prove that hysteresis loss per cycle is equal to  $1/47\pi$  times the area of  $\vec{B} - \vec{H}$  loop.

### SECTION-C

6. Deduce Faraday's law of electromagnetic induction in the form  $\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$ . Discuss the physical meaning of this equation.
7. State and prove Poynting theorem. Discuss physical meaning of each term involved in expression.
8. Derive the wave equation of electromagnetic waves in free space. Show that the speed of waves is equal to the speed of light in free space.
9. Explain reflection and transmission of an em waves incident normally on a plane between media of impedances  $Z_1$  and  $Z_2$ . Find out expression for reflection and transmission Coefficients.

**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**

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Roll No.

Total No. of Pages : 02

Total No. of Questions : 09

B.Tech. (ECE) / (CSE) (Sem.-1,2)  
**SEMI-CONDUCTOR AND OPTOELECTRONICS PHYSICS**

Subject Code : BTPH-105-18

M.Code : 75363

Date of Examination : 09-12-2023

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**

1. Write briefly :

- a) What are the basic assumptions of free electron gas model?
- b) What do you mean by knee voltage in p-n junction diode?
- c) What do you mean by occupation probability?
- d) What is the importance of carrier generation and recombination in semiconductors?
- e) What do you understand by the term density of states?
- f) What is non-radiative recombination mechanism in semiconductors?
- g) What do you mean by temporal coherence?
- h) What is the working principle of light emitting diodes?
- i) What do you understand by resistivity?
- j) What is the working principle of semiconductor LASER?



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### SECTION-B

2. What do you mean by Fermi energy? Obtain an expression for the Fermi energy of a free electron gas in three dimensions.
3. Explain the periodicity character of the potential in crystals. State and prove Bloch theorem in this reference.
4. What is the difference between intrinsic and extrinsic semiconductors? Discuss in detail the dependence of Fermi level on carrier concentration and temperature.
5. a) What do you mean by metal-semiconductor junction? Discuss in detail Schottky metal-semiconductor junction.  
b) Explain the mechanism of diffusion and drift of charge carries in detail.

### SECTION-C

6. a) Discuss stimulated emission, absorption and spontaneous emission in detail.  
b) Derive the Einstein coefficients describing the probabilities of stimulated absorption and stimulated emission.
7. a) What is population inversion? How is it achieved?  
b) Write a note on Fermi's golden rule.
8. a) Discuss van der Pauw method for resistivity measurement in detail.  
b) Discuss Hot-point probe measurement method.
9. a) Write a note on capacitance-voltage measurements.  
b) How can we extract different parameters from I-V characteristics of diode?

**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**

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02

Total No. of Pages :

Total No. of Questions : 09

B.Tech. (CSE/ECE/ME) (Sem.-1, 2)

**ENGINEERING CHEMISTRY**

Subject Code : BTCH-101

M.Code : 54093

Date of Examination : 09-12-2023

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C Each.

**SECTION-A**

1. Answer briefly :

- a) Define the line width and intensity of spectral line.
- b) Explain the term semiconductors with examples.
- c) Define Green chemistry.
- d) Explain the term nanoscale.
- e) What are the primary raw materials?
- f) What do you mean by first generation petrochemicals?
- g) What are rules for molecules show IR activity?
- h) Define the Primary photochemical reactions.
- i) Define the bathochromic shift.
- j) What are optical sensors?



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### SECTION-B

2. Explain the electronic transitions.
3. Explain the Spin-Spin coupling.
4. Explain the Tacticity of Polymers.
5. Explain the self-assembling materials.

### SECTION-C

6. Difference between Primary and Secondary photochemical reactions.
7. What are the applications of IR spectroscopy?
8. Explain the Natural Gas treatment Processes.
9. Determination of molecular weight using number average method.

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Roll No.

Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(CSE,EE,ECE,ME,EEE) (Sem.-1,2)  
**ELEMENTS OF MECHANICAL ENGINEERING**

Subject Code : BTME 101

M.Code : 54101

Date of Examination : 02-01-2024

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**

1. Answer briefly :

- a) Define "intensive" and "extensive" thermodynamic properties.
- b) Distinguish between open and closed thermodynamic system.
- c) What do you mean by non-flow processes? Give example.
- d) Discuss the concept of control volume.
- e) Distinguish between heat pump and refrigerator.
- f) Discuss the concept of "regeneration" in gas power cycles.
- g) List some important applications of I.C. Engines.
- h) Discuss the concept of "hardness" as a material property.
- i) Name some common examples of non-ferrous metals.
- j) Define centroid with a suitable example.



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### SECTION-B

2. a) **Explain the following terms :** i) State, ii) Process, and iii) Cycle  
b) The properties of a closed system change following the relation between pressure and volume as  $PV = 3.0$  where P is in bar, V is in  $m^3$ . Calculate the work done when the pressure increases from 1.5 bar to 7.5 bar.
3. 0.44 kg of air at  $180^\circ\text{C}$  expands adiabatically to three times its original volume and during the process, there is a fall in temperature to  $15^\circ\text{C}$ . The work done during the process is 52.5 kJ. Calculate specific heats at constant pressure and volume.
4. a) State Clausius and Kelvin-Planck statements of second law of thermodynamics and prove their equivalence.  
b) State and prove Clausius inequality.
5. a) Define entropy and prove that it is property of a system.  
b) State and explain principle of increase of entropy.

### SECTION-C

6. Draw Otto cycle and derive its air standard efficiency and mean effective pressure.
7. a) **Explain the following properties of Engineering materials :**  
i) Strength, ii) Brittleness, iii) Toughness, and iv) Weldability.  
b) What do you mean by composite materials? Distinguish between fibre reinforced and metal matrix composites.
8. a) Find the moment of inertial of a semi circle about its diametrical axis.  
b) Find the centroid of a quarter of a circle.
9. Explain the construction and working of four stroke petrol engine.

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Sem. 2

(Dec - Jan) (2023 - 24)

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Roll No.

Total No. of Pages : 02

Total No. of Questions : 09

B.Tech. (Mechanical Engg.) (Sem.-2)

**MATHEMATICS-II**

Subject Code : BTAM-203-18

M.Code : 76256

Date of Examination : 08-12-2023

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**

**1. Answer briefly :**

- a) Define integrating factor. Is it unique for a given differential equation? Dec-2023
- b) Give Bernoulli's equation. Explain in brief method to solve it.
- c) Solve  $ye^{xy} dx + (xe^{xy} + 2y) dy = 0$ .
- d) Solve in series the differential equation  $\frac{d^2 y}{dx^2} - y = 0$ .
- e) Solve  $\frac{d^2 y}{dx^2} + \frac{1}{x} \frac{dy}{dx} = 0$ .
- f) Show that an analytic function with constant modulus is constant function.
- g) Find the transformation which maps the points  $-1, i, 1$  of the  $z$ -plane onto  $1, i, -1$  of the  $w$ -plane, respectively.
- h) State Liouville's theorem.
- i) Evaluate  $\int_C \frac{z^2 - 2z + 1}{(z-1)^2} dz$ , where  $C$  is  $|z| = 2$ .
- j) Find the Laurent's series expansion of  $f(z) = \frac{z}{(z^2 - 1)(z^2 + 4)}$  in the region  $|z| < 2$ .



WS)

### SECTION-B

2. a) Solve  $\tan y \frac{dy}{dx} + \tan x = \cos y \cos^2 x$ .  
b) Solve  $(xy^3 + y)dx + 2\{x^2y^2 + x + y^4\}dy = 0$ .
3. a) Solve  $y - 2px = \tan^{-1}(xp^2)$ .  
b) Solve  $y = 2px + y^2p^3$ .
4. Using the method of variation of parameters, solve  $\frac{d^2y}{dx^2} + 4y = \tan 2x$ .
5. Solve  $x^2 \frac{d^2y}{dx^2} + 4x \frac{dy}{dx} + 2y = e^x$ .

### SECTION-C

6. If  $f(z)$  is a regular function of  $z$ , prove that  
$$\left( \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} \right) |f(z)|^2 = 4|f'(z)|^2$$
7. Find the harmonic conjugate and the analytic function whose imaginary part is  $e^{-x}(x \cos y + y \sin y)$ .
8. State Cauchy Residue theorem. Hence evaluate  $\int_C \frac{z \cos z}{(z - \pi/2)^3} dz$ , where  $C$  is  $|z-1|=1$ .
9. Evaluate:  $\int_0^\infty \frac{\cos ax}{x^2 + 1} dx$ .

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Total No. of Pages : 02

Total No. of Questions : 09

**B.Tech. (CSE/EE/ECE/ME/IT) (Sem.-2)**  
**ENGINEERING MATHEMATICS – II**

Subject Code : BTAM-102

M.Code : 54092

Date of Examination : 12-12-2023

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**

1. Answer briefly :

- a) Find the general value of  $(-1)^{\frac{1}{4}}$ .
- b) Check whether the given equation  $(x^2 - ay)dx = (-y^2 + ax)dy$  is exact and obtain the general.
- c) If  $A = \begin{bmatrix} -5 & 4 \\ 3 & 2 \end{bmatrix}$ . Hence find  $A^{-1}$ .
- d) State Gauss Test.
- e) Find the particular integral of  $y''' - y'' + 4y' - 4y = \sin 3x$ .
- f) Solve  $(2x - y)dx = (x - y)dy$
- g) Find the general solution of  $4\frac{d^2y}{dx^2} + \frac{dy}{dx} + 2y = 0$
- h) Examine the convergence of the series  $\sum_{n=1}^{\infty} \frac{1}{n} \sin \frac{1}{n}$ .
- i) Examine the vectors for Linear dependence  $X_1 = (3, 1, -4)$ ,  $X_2 = (2, 2, -3)$ ,  
 $X_3 = (0, -4, 1)$



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j) State De-Moivre's theorem.

**SECTION-B**

- 2. Solve  $(2y^2 + 4x^2y)dx + (4xy + 3x^3)dy = 0$ .
- 3. Solve  $[(3x + 2)^2 D^2 + 3(3x + 2)D - 36]y = 3x^2 + 4x + 1$ .
- 4. Solve the equation  $L \frac{d^2q}{dt^2} + R \frac{dq}{dt} = E_0 \sin \omega t$ , where L, R,  $E_0$  are constants and discuss the case when  $t$  increases indefinitely.
- 5. Solve the differential equation  $\frac{d^2y}{dx^2} - 6 \frac{dy}{dx} + 13y = e^{3x} \sin 4x$ .

**SECTION-C**

- 6. Find the modulus and argument of  $(1+i)^{1-i}$
- 7. Find the eigen value and the eigen vector of the matrix  $\begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$ .
- 8. a) Test the convergence of  $1 + \frac{(1+\alpha)}{(1+\beta)} + \frac{(1+\alpha)(1+2\alpha)}{(1+\beta)(1+2\beta)} + \frac{(1+\alpha)(1+2\alpha)(1+3\alpha)}{(1+\beta)(1+2\beta)(1+3\beta)} + \dots$
- b) Test the convergence of  $\sum_{n=2}^{\infty} \frac{1}{\log(\log n)^n}$ .

9. Determine the values of a and b for which the system has

$$\begin{bmatrix} 3 & -2 & 1 \\ 5 & -8 & 9 \\ 2 & 1 & a \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} b \\ 3 \\ -1 \end{bmatrix}$$

- a) a unique solution
- b) no solution,
- c) infinitely many solutions.

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Total No. of Pages : 02

**B.Tech. (CS&E, EE, ME) (Sem.-2)**  
**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**  
Subject Code : BTEE-101  
M.Code : 54097  
Date of Examination : 13-12-2023

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**



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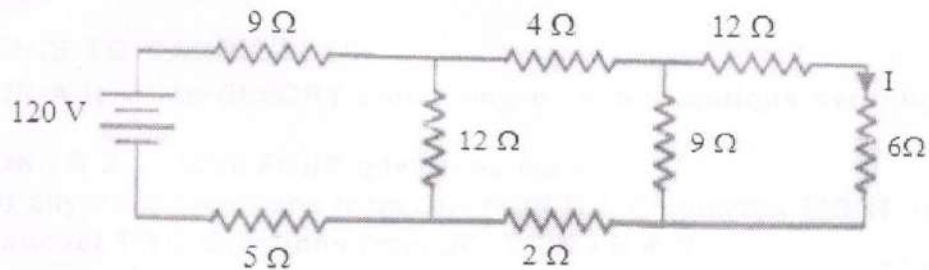
**1. Answer briefly :**

- a) What do you mean by Electric Potential? State its SI units.
- b) Out of a 60W bulb and 100W bulb, which one will have a smaller resistance value? Explain in detail.
- c) What do you mean by Form Factor? Calculate its value using formula.
- d) Calculate the current passing through a ring shaped air cored coil Ampere-turns are 4800 and number of turns of coil are 800.
- e) Classify DC Generators as per method of their field excitation.
- f) What are Constant Losses in a DC Machine?
- g) What is a Strain Gauge? State its Gauge Factor.
- h) What do you mean by Forbidden Energy Gap? State the values of Forbidden Energy Gap of Conductors, Insulators and Semi-Conductors.
- i) Solve the following : i)  $(FA69)_{16} = (?)_8$ , ii)  $(1011010)_2 = (?)_{10}$
- j) Explain the formation of T Flip Flop from JK Flip Flop. State its truth table.



**SECTION-B**

2. An ac has a frequency 50 Hz and rms current 25 amp. Write equation of instantaneous current and find
  - a) Current at time 0.0025 seconds
  - b) Time at which current is 14.14 amp.
3. Find the current I in the following circuit :



4. Explain in detail construction and working of a Single Phase Transformer with primary to secondary ration as  $N_1 : N_2$  respectively.
5. Discuss in detail the  $N-I_a$  and  $T-I_a$  characteristics of Shunt DC Motor.

**SECTION-C**

6. Write a note on parallel plate Capacitive Transducers.
7. Explain in detail the operation of A/D converter for Voltage to Time conversion.
8. Explain working of a Full Wave Bridge Rectifier using suitable waveforms.
9. Discuss in detail the working of R-S Flip Flop using NAND Gates only.

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Total No. of Pages : 03

Total No. of Questions : 09

B.Tech. (Automation & Robotics/CSE/EEE/EE/IT/ECE) (Sem.-2)

**MATHEMATICS-II**

Subject Code : BTAM202-18

M.Code : 91958

Date of Examination : 11-12-2023

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**

1. Write short notes on :

- a) Eliminate the constants to obtain the differential equation of the equation:

$$y = e^x (a \cos x + b \sin x).$$

- b) Under what conditions on  $a, b, c, d$  the differential equation  $(a \sinh x \cos y + b \cosh x \sin y) dx + (c \sinh x \cos y + d \cosh x \sin y) dy = 0$  is exact?

- c) Solve  $(y - xp)(p - 1) = p$ , where  $p = \frac{dy}{dx}$ .

- d) Solve  $x \frac{dy}{dx} - y - 2x^3 = 0$ .

- e) Form partial differential equation for  $z = (x + a)(y + b)$ .

- f) Solve  $r + s = 0$ , where  $r = \frac{\partial^2 z}{\partial x^2}, s = \frac{\partial^2 z}{\partial x \partial y}$ .

- g) What are the advantages of Bisection method?



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- h) Discuss the order of convergence of Regula-Falsi method.
- i) Write down the formulas for Euler's modified method.
- j) Write down the equation of one-dimensional heat equation.

### SECTION-B

- 2. a) Solve  $\sec^2 x \tan y dx + \tan x \sec^2 y dy = 0$ .
- b) Solve  $(3x^2 y^3 e^y + y^3 + y^2) dx + (x^3 y^3 e^y - xy) dy = 0$ .
- 3. a) Solve  $y + px = p^2 y^4 = 0$ , where  $p = \frac{dy}{dx}$ .
- b) Solve  $x \frac{dy}{dx} + y = y^2$ .
- 4. a) Solve  $px + qy = 5z$ , where  $p = \frac{\partial y}{\partial x}$ ,  $q = \frac{\partial z}{\partial y}$ .
- b) Solve  $4r - 12s + 9t = 0$ , where  $r = \frac{\partial^2 z}{\partial x^2}$ ,  $s = \frac{\partial^2 z}{\partial x \partial y}$ ,  $t = \frac{\partial^2 z}{\partial y^2}$ .
- 5. Solve  $r - 2p + q = 0$  by method of separation of variables, where  $p = \frac{\partial z}{\partial x}$ ,  $q = \frac{\partial z}{\partial y}$ ,  $r = \frac{\partial^2 z}{\partial x^2}$ .

### SECTION-C

- 6. Use Bisection method to solve  $x^3 + x^2 + x + 7 = 0$  correct to three decimal places.
- 7. Evaluate  $\int_0^\pi t \sin t dt$  using Trapezoidal rule taking 4 intervals.

8. Given  $\frac{dy}{dx} + x^2 y - 1$  and  $y(0) = 1$ . Find  $y(0.1)$  by Taylor's series method correct to four decimal places.

9. Solve  $\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$  subject to the following two simultaneous conditions :

a)  $u(0, t) = 0$   $u(1, t); t > 0$ , and

b)  $\frac{\partial u}{\partial t}(x, 0) = 0$ ,  $u(x, 0) = \sin^3 \pi x$  for all  $x \in [0, 1]$ .

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Total No. of Pages : 03

Total No. of Questions : 09

B.Tech.(AE/CSE/ME) (Sem.-2)

**MATHEMATICS-II**

Subject Code : BTAM203-18

M.Code : 91959

Date of Examination : 08-12-2023

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**



I. Write short notes on :

- a) Form a differential equation for the given family of curve  $y = ae^{3x} + be^{-x}$  by eliminating arbitrary constants  $a$  and  $b$ . DCC-2023
- b) Find the general solution of  $(x+2)\frac{dy}{dx} = x^2 + 4x - 9$ .
- c) For what value of  $k$ , the differential equation  $\left(1 + e^{\frac{kx}{y}}\right) dx + e^{\frac{x}{y}} \left(1 - \frac{x}{y}\right) dy = 0$  is exact.
- d) Obtain general solution of differential equation  $y = xy' + (y')^2$ , where  $y' = dy/dx$ .
- e) Solve  $x^2 \frac{d^2y}{dx^2} + 4x \frac{dy}{dx} + 2y = 0$ .
- f) Determine the poles of the function  $f(z) = \frac{z^2}{(z-1)^2(z+2)}$ .
- g) What do you mean by Mobius transformation?

h) Show that an analytic function with constant real part is constant.

i) Evaluate  $\int_0^{1+i} (x^2 - iy) dz$  along the straight line  $y = x$ .

j) Show that for  $|z + 1| < 1$ ,  $z^{-2} = 1 + \sum_{n=1}^{\infty} (n+1)(z+1)^n$ .

### SECTION-B

2. a) Solve  $y' + 4xy + xy^3 = 0$ , where  $y' = \frac{dy}{dx}$ .

b) Solve the initial value problem  $e^x (\cos y dx - \sin y dy) = 0$ ;  $y(0) = 0$ .

3. a) Solve  $\left( xy^2 - e^{x^3} \right) dx - x^2 y dy = 0$ .

b) Solve  $yp^2 + (x - y)p = x$ , where  $p = \frac{dy}{dx}$ .

4. Using method of variation of parameters, solve  $y'' - 2y' + y = e^x \log x$  where  $y'' = \frac{d^2 y}{dx^2}$ ,  $y' = \frac{dy}{dx}$ .

5. Solve  $(1 - 6x) \frac{dy}{dx} = y$  in power series.

### SECTION-C

6. Use residue theorem to evaluate  $\int_0^{2\pi} \frac{d\theta}{5 - 4 \sin \theta}$ .

7. Show that the function  $f(z) = |z|^2$  is continuous everywhere but nowhere differentiable except at origin.

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8. Find the mobius transformation which maps the points  $z=1, i, -1$  into the points  $w=i, 0, -i$ . Hence find the image of  $|z|<1$  under this transformation.

9. Expand  $\frac{1}{(z+1)(z+3)}$  as a Laurent series valid for :

a)  $1 < |z| < 3$

b)  $|z| > 3$ .

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Total No. of Pages : 02

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B.Tech. (AIML/DS/CSE/IT/Robotics & Artificial Intelligence/Internet of Things and Cyber Security including Block Chain Technology (Sem.-2)

**MATHEMATICS – II**

Subject Code : BTAM-204-18

M.Code : 91960

Date of Examination : 18-12-2023

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**

I. Write short notes on :

- a) Find the mean of the square of first 10 natural numbers.
- b) Define Karl Pearson's  $\beta$  and  $\gamma$  coefficients.
- c) An urn contains 7 red and 4 blue balls. Two balls are drawn at random with replacement. Find the probability of getting 2 red balls.
- d) Prove that for Binomial distribution, variance is always less than mean.
- e) State any two properties of Poisson distribution.
- f) If the regression coefficient of X on Y is  $\frac{1}{6}$  and that of Y on X  $-\frac{1}{2}$ . What is the value of correlation coefficient between X and Y.
- g) Explain the following, with example: Simple and Composite hypothesis.
- h) A sample of 400 male students is found to have a mean height of 67.47 inches. Can it be reasonably regarded as sample from a large population with mean height 67.39 inches and S.D. 1.30 inches?
- i) Define Chi-square ( $\chi^2$ ) test.
- j) State any two applications of  $t$ -test.



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### SECTION-B

2. Find the missing information (x, y and z) from the following data:

|                    | Group I | Group II | Group III | Combined    |
|--------------------|---------|----------|-----------|-------------|
| Number             | 50      | x        | 90        | 200         |
| Standard Deviation | 6       | 7        | z         | $\sqrt{60}$ |
| Mean               | 113     | y        | 115       | 116         |

3. Calculate Karl Pearson's coefficient of skewness from the following data:

|                 |     |     |     |    |    |    |    |    |    |
|-----------------|-----|-----|-----|----|----|----|----|----|----|
| Marks above     | 0   | 10  | 20  | 30 | 40 | 50 | 60 | 70 | 80 |
| No. of students | 150 | 140 | 100 | 80 | 80 | 70 | 30 | 14 | 0  |

4. Calculate the Rank - coefficient of correlation from the following data :

|          |     |     |     |    |    |    |     |    |    |     |
|----------|-----|-----|-----|----|----|----|-----|----|----|-----|
| X-Series | 112 | 106 | 109 | 84 | 95 | 95 | 117 | 97 | 95 | 115 |
| Y-Series | 70  | 68  | 80  | 65 | 71 | 60 | 77  | 68 | 63 | 75  |

5. Determine the regression equation of Y on X by the method of least squares from the data given as :

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| X | 5 | 8 | 7 | 6 | 4 |
| Y | 3 | 4 | 5 | 2 | 1 |

### SECTION-C

6. In an examination taken by 500 candidates, the mean and S.D. of marks obtained are 40% and 10%. Assuming Normal distribution find :

- a) How many will pass, if 50% is fixed as minimum?
- b) How many students have scored marks above 60%?

7. Fit a second-degree parabola to the following data

|   |     |     |     |     |     |     |     |
|---|-----|-----|-----|-----|-----|-----|-----|
| x | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 |
| y | 1.1 | 1.3 | 1.6 | 2.0 | 2.7 | 3.4 | 4.1 |

8. The guaranteed average life of a certain type of bulbs is 1000 hours with a S.D of hours. It is decided to sample the output so as to ensure that 90% of the bulbs do not fall short of the guaranteed average by more than 2.5%. What must be the minimum size of the sample?

9. Compute the value of students  $t$  for the value in a sample of size eight consisting of -4, -2, -2, 0, 2, 2, 3 and 3 taking the population mean at zero.

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