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VI Semester B.Sc. (NEP) Degree Examination, May/June - 2025

MATHEMATICS

Linear Algebra

Paper: I

(Regular/Repeater)

Time : 2 Hours

Maximum Marks : 60

Instructions to Candidates:

1. Answer any SIX questions from Q. No.1.
2. Answer any THREE questions from Q.No. 2, 3, 4 and 5.
3. Students are allowed to use scientific calculator.

I. Answer any SIX of the following questions.

(6×2=12)

1. a) In a ring $(R, +, \cdot)$ prove that $a \cdot 0 = 0$, $\forall a \in R$ and 'O' is the identity element w.r.t. '+' and '•'.
b) Define principal and maximal Ideals.
c) Define a vector space.
d) Define linear dependence and Independence.
e) Find the linear Transformation $T : R^2 \rightarrow R^2$ such that $T(1, 0) = (1, 1)$ and $T(0, 1) = (-1, 2)$.
f) If $T : V_1(R) \rightarrow V_3(R)$ defined by $T(x) = (x, x^2, x^3)$, verify whether 'T' is Linear or not.
g) If f is homomorphism of $U(F)$ into $V(F)$, then prove that $f(-\alpha) = -f(\alpha)$, $\forall \alpha \in U(F)$.
h) Define Eigen values and Eigen vectors.

II. Answer any THREE of the following questions.

(3×4=12)

2. a) Show that the set of all 2×2 matrices of the form $\begin{bmatrix} 0 & a \\ 0 & b \end{bmatrix}$ where $a, b \in \mathbb{Q}$ (Set of rationals) form a ring under matrix addition and multiplication.

[P.T.O.]



- b) A non-empty subset S of a ring R is a subring of R iff.
- $\forall a, b \in S \Rightarrow a - b \in S$
 - $\forall a, b \in S \Rightarrow ab \in S$
- c) Prove that every field is an integral domain.
- d) Define homomorphism of a ring R into R' . If $f: R \rightarrow R'$ define a homomorphism, then prove that.
- $f(0) = 0'$
 - $f(-a) = -f(a)$
- $\forall a \in R$ where $0'$ is identity in R' .

III. Answer any THREE of the following questions.

(3×4=12)

3. a) The intersection of two subspaces of a vector space V over a field F is a subspace of $V(F)$. But not union.
- b) Express the vector $(2, -1, -8)$ as a linear combination of the vectors $(1, 2, 1)$, $(1, 1, -1)$ and $(4, 5, -2)$.
- c) A subset $S = \{(x_1, x_2, x_3), (y_1, y_2, y_3), (z_1, z_2, z_3)\}$ of $V_3(R)$ is linear dependent

$$\text{iff } \begin{vmatrix} x_1 & x_2 & x_3 \\ y_1 & y_2 & y_3 \\ z_1 & z_2 & z_3 \end{vmatrix} = 0$$

- d) Prove that the set $\{(1, 0, 0), (0, 1, 0), (0, 0, 1)\}$ form the basis of $V_3(R)$.

IV. Answer any THREE of the following questions.

(3×4=12)

4. a) Define $T: V_2(R) \rightarrow V_2(R)$ by $T(x, y) = (3x + 2y, 3x - 4y)$ verify whether T is linear transformation.
- b) If $T: U \rightarrow V$ is a linear Transformation then.
- $T(-\alpha) = -T(\alpha) \quad \forall \alpha \in U$.
 - $T(\alpha_1 x_1 + \alpha_2 x_2 + \dots + \alpha_n x_n) = \alpha_1 T(x_1) + \alpha_2 T(x_2) + \dots + \alpha_n T(x_n) \quad \forall \alpha_i \in F$ and $x_i \in U$.
- c) Find out the matrix of the linear transformation $T: V_2(R) \rightarrow V_3(R)$ defined by $T(x, y) = (-x + 2y, y, -3x + 3y)$ relative to the basics $\beta_1 = \{(1, 1), (-1, 1)\}$ and $\beta_2 = \{(1, 1, 1), (1, -1, 1), (0, 0, 1)\}$.
- d) State and prove Rank-Nullity theorem.



V. Answer any THREE of the following questions.

(3×4=12)

5. a) Let $V(F)$ be an n -dimensional vector space, then V is isomorphic to R^n , the vector space of all n -tuples of real numbers over the real number field.
- b) If T be a homomorphism of a vector space $V_1(F)$ into a vector space $V_2(F)$. Then the set of all those elements of $V_1(F)$ which correspond to the zero element of $V_2(F)$. [i.e kernel of T] under T , is a subspace of $V_1(F)$.
- c) Let $T: V \rightarrow V$ be a linear operator on a vector space V over F . Then $\lambda \in F$ is an eigen value of T iff the operator $\lambda I - T$ is singular. Also the eigen space of λ will be the null space of $\lambda I - T$.
- d) Find the eigen values and associated non-zero eigen vectors of the matrix

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix}.$$



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VI Semester B.Sc. (NEP) Degree Examination, May/June - 2025

MATHEMATICS

Numerical Analysis - II

Paper : II

(Regular/Repeater)

Time : 2 Hours

Maximum Marks : 60

Instructions to Candidates :

1. Answer any Six questions from Q.No.1.
2. Answer any Three questions from Q.No.'s 2, 3, 4 and 5.
3. Students are allowed to use scientific calculators.

I. Answer any Six of the following.

(6×2=12)

1. a) If 0.182 is the approximate value of $\frac{2}{11}$, find the absolute and relative errors.
b) Explain briefly iteration method to find the real root of $f(x) = 0$.
c) Solve by Gauss-elimination method: $3x - 2y = 5$ and $x + 3y = -2$.
d) Solve using Jacobi iteration method, upto second approximation:
 $10x + y + z = 12$;
 $2x + 10y + z = 13$;
 $2x + 2y + 10z = 14$.
e) With usual notation prove that $E = 1 + \Delta$.
f) Evaluate $\Delta^3(1 + 2x)(1 + 4x)(1 + 6x)$ where $h = 1$.
g) Write the formula to find the first derivative using backward difference.
h) State Weddle's Rule to evaluate $\int_a^b f(x) \cdot dx$.

II. Answer any Three of the following.

(3×4=12)

2. a) Find the real root of $x^3 - 4x - 9 = 0$ in the interval (2, 3), using bisection method in five stages.
b) Find a real root of the equation $x^3 - 2x - 5 = 0$ which lies between 2 and 2.1 correct to three decimal places using Regula-Falsi method.

[P.T.O.]





- c) Derive Newton-Raphson formula

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)} \text{ for } n = 1, 2, 3, \dots$$

- d) Find the root of the equation $x - e^{-x} = 0$ by using secant method, corrected to 4 decimal places.

III. Answer any Three of the following.

(3×4=12)

3. a) Solve using Gauss eliminations method:

$$\begin{aligned}x + 2y + z &= 3; \\2x + 3y + 3z &= 10; \\3x - y + 2z &= 13.\end{aligned}$$

- b) Solve by Gauss-Jordan method:

$$\begin{aligned}x + 2y + z &= 8; \\2x + 3y + 4z &= 20; \\4x + 3y + 2z &= 16.\end{aligned}$$

- c) Explain Jacobi Iteration method to solve the equations:

$$\begin{aligned}a_1x + b_1y + c_1z &= d_1; \\a_2x + b_2y + c_2z &= d_2; \\a_3x + b_3y + c_3z &= d_3.\end{aligned}$$

- d) Solve using Gauss-Seidal method:

$$\begin{aligned}20x + y - 2z &= 17; \\3x + 20y - z &= -18; \\2x - 3y + 20z &= 25.\end{aligned}$$

Carry out three iterations.

IV. Answer any Three of the following.

(3×4=12)

4. a) If $f(x)$ is a polynomial of degree n in x , then prove that $\Delta^n f(x)$ is a constant and $\Delta^{n+1} f(x) = 0$.

- b) Find a polynomial of degree 3 which takes the following values.

x	0	1	2	3
$f(x)$	1	2	1	10

- c) State and prove Newton-Gregory backward interpolation formula.



- d) Using Lagrange's interpolation formula find $f(10)$ from the following data.

x	5	6	9	11
y	12	13	14	16

V. Answer any Three of the following.

(3×4=12)

5. a) Find $f'(1.5)$ and $f''(1.5)$ from the following table:

x	1.5	2.0	2.5	3.0	3.5	4.0
y	3.375	7.000	13.625	24.000	38.875	59.000

- b) State and prove 'General Quadrature Formula'.
- c) Evaluate $\int_0^1 e^x \cdot dx$ approximately in steps of 0.2 using Trapezoidal rule.
- d) State and prove Simpson's $\left(\frac{1}{3}\right)^{rd}$ rule to evaluate $\int_a^b f(x) \cdot dx$.



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VI Semester B.Sc. (NEP) Degree Examination, May/June - 2025

CHEMISTRY (DSC)

Paper : I

(Regular, Repeater)

Time : 2 Hours

Maximum Marks : 60

Instructions to Candidates:

1. All questions are compulsory.
2. Draw neat diagrams and give equations wherever necessary.

1. Answer any SIX questions.

(6×2=12)

- a. Account the colour property of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ ion by CFT.
- b. Mention two factors affecting the stability of metal complexes.
- c. What is isoelectric point? How amino acid exist at isoelectric point.
- d. How proteins are classified based on their function?
- e. State Stark. Einstein's law of photochemical equivalence.
- f. Define quantum yield.
- g. Mention the region and criteria for NMR spectra.
- h. Write the Lux- Flood Concept of acid and base.

2. Answer any THREE questions.

(3×4=12)

- a. Write the salient features of crystal field theory.
- b. Account the magnetic property of following ions by CFT.
 - i) $[\text{CoF}_6]^{3-}$
 - ii) $[\text{Fe}(\text{CN})_6]^{4-}$
- c. Calculate the CFSE of following.
 - i) d^5 System in strong ligand field octahedral complex.
 - ii) d^6 System in weak ligand field tetrahedral complex.
- d. Explain in brief the factors affecting the magnitude of $10Dq$.

[P.T.O.]





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(3×4=12)

3. Answer any THREE questions.

- a. How D-Arabinose is converted into D-Glucose by killiani synthesis.
- b. Explain the conversion of Fructose to Glucose.
- c. How vitamins are classified? Mention the deficiency diseases of vitamins A, C, D.
- d. Write about the following.
 - i) Peptides and peptide bond.
 - ii) Tertiary structure of proteins.

4. Answer any THREE questions.

(3×4=12)

- a. Discuss the application of phase rule to water system with a phase diagram.
- b. State and explain Beer-Lambert's law. Mention its limitations.
- c. Write about the following.
 - i) Eutectics/Eutectic mixtures.
 - ii) Chemiluminescence
- d. What is critical solution temperature? Explain the variation of mutual solubility of phenol-water system.

5. Answer any THREE questions.

(3×4=12)

- a. What is nuclear shielding? Explain it with reference to acetylene.
- b. Explain the spin-spin splitting in PMR spectra of ethyl bromide.
- c. Explain the Bronsted-lowry theory of acid and base with examples. Mention its limitation.
- d. What are detergents? Give their classification with examples.



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VI Semester B.Sc. (NEP) Degree Examination, May/June - 2025

CHEMISTRY (DSC)

Paper : II

(Regular/ Repeater)

Time : 2 Hours

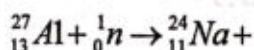
Maximum Marks : 60

Instructions to Candidates:

1. All questions are compulsory.
2. Draw neat diagrams and give equations wherever necessary.

1. Answer any SIX questions.**(6×2=12)**

- a. Identify the particle and the types of nuclear reaction.



- b. What are non-aqueous solvents? Give two examples.

- c. What is retrosynthesis?

- d. What is wolff rearrangement? Give its equation.

- e. What is wave particle duality?

- f. What are parallel reactions? Give example.

- g. Write the structure and use of Novocaine.

- h. What are antipyretics? Give examples.

2. Answer any THREE questions.**(3×4=12)**

- a. Write briefly about the following of a nuclear reactor.

i) Moderator

ii) Control rods

iii) Coolent

iv) Fuel material

- b. Explain the following with examples.

i) Nuclear fission

ii) Nuclear fusion.

[P.T.O.]



- c. Write about the following.
- Applications of radioisotopes in medical field.
 - Carbon dating.
- d. Explain the structure and functions of haemoglobin.

3. Answer any **THREE** questions.

(3×4=12)

- Write the retrosynthesis of 4-methoxy acetophenone.
- Discuss the mechanism of Bayer-Villiger rearrangement reaction.
- What is Beckman rearrangement? Write its mechanism.
- Discuss the constitution of citral.

4. Answer any **THREE** questions.

(3×4=12)

- Write about photoelectric effect and photoelectric equation.
- Explain briefly the transition state theory of reaction rates.
- Write about the following.
 - Lindemann hypothesis of unimolecular reaction.
 - Opposing reactions.
- Write about the following.
 - Emulsions.
 - Surfactants.

5. Answer any **THREE** questions.

(3×4=12)

- Write the synthesis of paludrine.
- Write the following.
 - Advantages of organic reagents over inorganic reagents.
 - Structure and use in inorganic analysis of 8-hydroxyquinoline.
- Write about the following.
 - Requirements of an ideal drug.
 - Structure and bonding in zeise's salt.
- Discuss the 18 electron rule for following.
 - [Fe(Co)₃]
 - [Ni(Co)₄]



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VI Semester B.Sc. (NEP) Degree Examination, May/June - 2025

PHYSICS

Elements of Condensed Matter and Nuclear Physics

Paper : I

Time : 2 Hours

Maximum Marks : 60

Instructions to Candidates :

1. Calculators may be allowed for solving problems.
2. Write intermediate steps.
3. Give Physical meaning for Symbols and notations.
4. Use of logarithmic tables is allowed.

Answer any Six of the following questions

(6×2=12)

1. a) Define Unit Cell.
b) What is Hall effect?
c) What is Saturation magnetization?
d) What is Seebeck effect?
e) What is radioactivity?
f) Define Mass defect.
g) What is Compton Scattering?
h) What is pair production?

Answer 'a' and 'b' OR 'c' and 'd' of the following questions.

2. a) State Brag's law. Derive an expression for interplanar spacing. (8)
b) X-rays of wavelength 1.45 \AA makes a glancing angle of 16° in the first order when diffraction occurs for NaCl crystal. Find the interplanar spacing and hence find the glancing angle for second order diffraction. (4)

(OR)

- c) Derive an expression for electrical conductivity and hence verify Ohm's law. (8)
d) Explain the salient features of Einstein's theory of Specific heat of Solid. (4)

[P.T.O.]





Answer 'a' and 'b' OR 'c' and 'd' of the following questions.

3. a) Give Langevin's theory of diamagnetism. (8)
b) Distinguish between diamagnetic and paramagnetic substances. (4)

(OR)

- c) Derive Claussius Mossotti equation. (8)
d) State and explain Peltier effect. (4)

Answer 'a' and 'b' OR 'c' and 'd' of the following questions.

4. a) Explain in brief intrinsic properties of the nucleus. (8)
b) What is binding energy? Explain the importance of binding energy curve. (4)

(OR)

- c) Explain Gamow's theory of alpha decay. (8)
d) The activity of a radioactive sample drops to $\frac{1}{14}$ of its initial value in 60 minutes. Calculate the half life. (4)

Answer 'a' and 'b' OR 'c' and 'd' of the following questions.

5. a) Derive Semi-empirical mass formula. (8)
b) Explain the Salient features of liquid drop model of a nucleus. (4)

(OR)

- c) Explain the construction and working of Cyclotron. (8)
d) What is nuclear reactor? Explain the functions of moderator and control rods in nuclear reactor. (4)

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VI Semester B.Sc. (NEP) Degree Examination, May/June - 2025

PHYSICS - II

Electronic Instrumentation and Sensors

Time : 2 Hours

Maximum Marks : 60

Instructions to Candidates :

1. Use of calculators is allowed for calculations.
2. Write the intermediate steps wherever necessary.

Answer any Six of the following.

(6×2=12)

1.
 - a. Define voltage regulation and write its formula.
 - b. What is an electric fuse?
 - c. What is signal generator?
 - d. What are active filters?
 - e. Write two basic characteristics of electrical transducers.
 - f. Define gauge factor.
 - g. State Dirichlet's conditions.
 - h. Find the Laplace transform of e^{at} .

Answer 'a' and 'b' OR 'c' and 'd' of the following.

2.
 - a. With a neat diagram, explain the working of a π section filter. (8)
 - b. Find I_{DC} and I_{rms} in a bridge rectifier if the load resistance is $2 K\Omega$ and peak voltage across the secondary is 220V. Neglect the diode resistances. (4)

(OR)

 - c. Explain how you can generate Lissajous figures with two waves having same frequency. What are the conditions for Lissajous figures to be
 - i) a circle
 - ii) a straight line(8)
 - d. What is a storage oscilloscope? How does it differ from CRO? (4)

[P.T.O.]





Answer 'a' and 'b' OR 'c' and 'd' of the following.

3. a. With a neat block diagram, explain the working of a square wave generator. (8)
- b. With a neat circuit diagram, explain triangular waveform generator. (4)
- (OR)
- c. State and prove fundamental theorem of filters. (8)
- d. Mention four applications of active filters. (4)

Answer 'a' and 'b' OR 'c' and 'd' of the following.

4. a. What is the principle of a strain gauge? Explain the bonded wire type, foil type and semiconductor type strain gauges. (8)
- b. Differentiate between active and passive transducers. Give one example of each. (4)
- (OR)
- c. Explain the construction and working of photodiode. (8)
- d. Give the applications of Piezoelectric transducer. (4)

Answer 'a' and 'b' OR 'c' and 'd' of the following.

5. a. Derive expressions for Fourier co-efficients. (8)
- b. Prove that $\int_{-\pi}^{\pi} \sin 2x \sin 3x = 0$. State whether $\sin 2x$ and $\sin 3x$ are orthogonal. (4)
- (OR)
- c. Find the Laplace transform of $\sin at$ and $\cos at$. (8)
- d. Write the differences between Laplace and Fourier transform. (4)

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**Sixth Semester B.Sc. (NEP) Degree Examination,
August/September, 2024**

(Regular)

PHYSICS**Paper - I Elements of Condensed Matter and Nuclear Physics**

Time : 2 Hrs

Max. Marks : 60

Instructions to Candidates:

- 1) Calculators may be allowed for solving problems.
- 2) Write intermediate steps.
- 3) Give physical meaning for symbols and notations.

1. Answer any SIX of the following questions.**(2x6=12)**

- a) What is Primitive cell?
- b) State Weidman - Franz Law.
- c) Define Magnetic susceptibility.
- d) What is critical temperature?
- e) Define nuclear charge density.
- f) Define half - life and mean - life of radioactive element.
- g) What is pair production?
- h) What is controlled chain reaction?

Answer a and b OR c and d for all the following questions.

2. a) What is Bravais lattice ? Explain the seven types of crystal system.
- b) Calculate the interplanar spacing for a 321 plane in a simple cubic lattice, whose lattice constant is 4.2×10^{-10} m.

8+4**OR**

- c) Give Einstein theory of specific heat of solids.
- d) What is Hall effect ? Mention the applications of Hall effect.
3. a) Give Langevin theory of diamagnetism.
- b) Write a note on hard and soft magnetic materials.

8+4**8+4****OR**

- c) Derive Clausius Mossotti equations.
- d) State and explain Seebeck effect.

8+4

4. a) Explain constituents of nucleus and their intrinsic properties.
b) What is binding energy? Explain the importance of binding energy curve. 8+4

OR

- c) Give Gamow's theory of α - decay.
d) The activity of a radioactive sample drops to $\frac{1}{16}$ th of its initial value in 80 minutes, What is the half-life. 8+4
5. a) Explain semiempirical mass formula on the basis of liquid drop model.
b) What is nuclear reactor? Explain the parts of the nuclear reactor. 8+4

OR

- c) Describe the construction and working of GM-counter.
d) The frequency of the oscillating potential difference applied to the dees of a cyclotron is 7×10^6 Hz, determine the magnetic flux density necessary to accelerate protons.
Given $M_p = 1.6 \times 10^{-27}$ Kg $e = 1.6 \times 10^{-19}$ C

8+4

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**Sixth Semester B.Sc. (NEP Regular) Degree Examination,
August / September, 2024**

**CHEMISTRY
Paper II : Chemistry (DSC)**

Time : 2 Hrs

Max. Marks : 60

Instructions:

- 1. All questions are compulsory.**
- 2. Draw neat diagrams and give equations wherever necessary.**

SECTION - AI. Answer **any SIX** questions:**(6x2=12)**

- Mention the role of coolant and control rods in nuclear reactor.
- Write the biological role of potassium.
- What are Synthons ? Give example.
- What is Favorskii rearrangement ? Give equation.
- What is consecutive reaction ? Give example.
- What is photoelectric effect ?
- What type of reagent is Barfoed reagent ? Mention its use.
- Write the structure of 8-hydroxyquinoline and its use in inorganic analysis.

2. Answer **any THREE** questions:**(3x4=12)**

- Explain the following with example:
 - Nuclear fission
 - Nuclear fusion
- Write about the following:
 - Carbon dating
 - Applications of radioisotopes
- Write the structure and functions of chlorophyll.
- What are non-aqueous solvents ? Write the properties of solvents.

3. Answer **any THREE** questions:

(3x4=12)

- What is retrosynthesis ? Write the retrosynthesis of the benzocaine.
- Write the mechanism of Wagner - Meerwein rearrangement.
- What is Fries rearrangement ? Write its mechanism.
- Write the synthesis of citral.

4. Answer **any THREE** questions:

(3x4=12)

- Derive the Finstein's photoelectric equation.
- Derive rate constant expression of unimolecular (Linde-mann hypothesis) reaction rates.
- Discuss the Kinetics of parallel reactions.
- What are emulsions ? Write their types and properties.

5. Answer **any THREE** questions:

(3x4=12)

- Write the synthesis of Novocaine.
- Explain the following with example:
 - Antipyretics
 - Antimalariels
- Write about the following:
 - Advantages of organic reagents over inorganic reagents.
 - Dimethyl glyoxime structure and use in inorganic analysis.
- Discuss the 18 electron rule for $[\text{Fe}(\text{CO})_5]$ and $[\text{Mn}(\text{CO})_5]$.

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**Sixth Semester B.Sc. (NEP) Degree Examination,
August/September, 2024**

(Regular)

PHYSICS**Paper - II Electronic in Instrumentation & Sensors**

Time : 2 Hrs

Max. Marks : 60

Instructions to Candidates:

- 1) Calculation can be done using calculators.
- 2) Write the intermediate steps wherever necessary.
- 3) Give physical meaning of each symbol used.

1. Answer any SIX of the following questions.**(2x6=12)**

- a) What are the characteristics of AC power?
- b) What is filter circuit?
- c) What is mention the types of circuit breakers?
- d) Draw the nature of Sine wave Square wave.
- e) Define Transducer.
- f) Define gauge factor of transducer.
- g) State Dirichlet principle.
- h) Find the Laplace transform of e^{at}

2. Answer a and b OR c and d of the following.

- a) With the help of neat diagram explain working of full wave rectifier. **08**
- b) Mention the difference between L-section and π section filters. **04**

OR

- c) Explain with block diagram the functioning of CRO. **08**
- d) Mention the advantages and disadvantages of rectifier type voltmeter. **04**

3. Answer a and b OR c and d of the following.

- a) Describe square generator with a neat labeled diagram. **08**
- b) Mention difference between active and passive filters. **04**

OR

- c) State and prove fundamental theorem of filters. **08**
- d) What are Oscillators ? Briefly explain the types of Oscillators. **04**

4. Answer a and b OR c and d of the following.

- | | |
|---|----|
| a) Explain unbonded resistance wire strain gauge. | 08 |
| b) List the basic characteristics of transducers. | 04 |

OR

- | | |
|--|----|
| c) Explain construction and working of Piezoelectric transducer. | 08 |
| d) Mention the features and applications of Thermo couple sensors. | 04 |

5. Answer a and b OR c and d of the following.

- | | |
|--|----|
| a) State & explain linearity and change scale property of fourier transform. | 08 |
| b) Find fourier transform of $\frac{1}{t}$. | 04 |

OR

- | | |
|---|----|
| c) State and prove convolution theorem for Laplace transform. | 08 |
| d) Find the L.T. of {sinat}. | 04 |
