



35133/42133/A330

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I Semester B.Sc. 3/4 Degree Examination, March - 2022

MATHEMATICS (Optional)

Paper : I : Differential Calculus

(Repeater w.e.f. 2014-15)

Time : 3 Hours

Maximum Marks : 80

Instructions to Candidates :

1. Question Paper contains Three Parts A, B, C.
2. Answer ALL Questions.

PART - A

Answer any TEN of the following :

(10×2=20)

1. a) State multiplicative law & trichotomy law.
b) Prove that $|xy| = |x||y| \forall x, y \in R$.
c) Prove that $f(x) = \begin{cases} 3x+1 & : x \leq 0 \\ x+1 & : x > 0 \end{cases}$ is continuous at $x = 0$
d) State Intermediate value theorem.
e) Find the n^{th} derivative of $\log(ax+b)$
f) Find the n^{th} derivative of $\sin^2 x$
g) Find the n^{th} derivative of $\sin x \cdot \sin 2x$
h) State cauchys mean value theorem.
i) Verify Lagranges mean value theorem for the function $f(x) = e^x$ in $[0,1]$.
j) Expand $\sin x$ by Maclauring theorem.
k) Evaluate $\lim_{x \rightarrow 0} \frac{x - \sin x}{x^3}$
l) Evaluate $\lim_{x \rightarrow 0} \frac{\log \sin x}{\cot x}$.

[P.T.O.]

PART - B

Answer any **FOUR** of the following.

(4×5=20)

2. State and prove Archimedian property for real numbers.
3. Show that $f(x) = \frac{e^{1/x}}{e^{1/x+1}}$ for $x \neq 0$ and $f(0) = 0$ is discontinuoun at $x = 0$.
4. Find the n^{th} derivative of $e^{ax} \cos(bx + e)$
5. State and prove Lagranges Mean value theorem.
6. Verify Cauchy's mean value theorem for the function $f(x) = \sin x$ & $g(x) = \cos x$ in $[a, b]$
7. Evaluate $\lim_{x \rightarrow 0} \left[\frac{1}{x^2} - \frac{1}{\sin^2 x} \right]$.

PART - C

Answer any **FOUR** of the following.

(4×10=40)

8. a) Prove that $|x + y| \leq |x| + |y|$, for all, $x, y \in R$.
b) If $x, y, z \in R$ then $x^2 + y^2 + z^2 \geq xy + yz + zx$
 9. a) If $\lim_{x \rightarrow a} f(x) = l$, $\lim_{x \rightarrow a} g(x) = m$ then prove that $\lim_{x \rightarrow a} [f(x) + g(x)] = l + m$.
b) A function which is continuous on a closed interval attains its bounds at least once in that interval.
 10. a) State and Prove Leibnitz's Theorem for n^{th} derivative of product of two functions.
b) If $y = (\sin^{-1} x)^2$ Prove that $(1 - x^2) y_{n+2} - (2n+1) \times y_{n+1} - n^2 y_n = 0$.
 11. a) State and Prove Taylor's Theorem with Schlomilch Rouches form of Remainder.
b) Expand $\log[\sec x + \tan x]$ by using Maclaurin's Series.
 12. a) Evaluate $\lim_{x \rightarrow 1} \left[\frac{x}{x-1} - \frac{1}{\log x} \right]$
b) Evaluate $\lim_{x \rightarrow 0} \left[\frac{e^x - 2 \cos x + e^x}{x \sin x} \right]$
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I Semester B.Sc. 5 Degree Examination, March - 2022

MATHEMATICS (OPTIONAL)

ALGEBRA AND CALCULUS - I

Paper : MATDSCT 1.1(W.e.f.2020-2021)

(Repeaters)

Time : 3 Hours

Maximum Marks : 80

Instructions to Candidates:

1. Question paper contains 3 parts namely A, B and C.
2. Answer all questions.

PART - A

I. Answer any Ten of the following:

(10×2=20)

1. a) Find the reciprocal determinant of $\begin{vmatrix} 1 & -1 \\ -2 & 3 \end{vmatrix}$.
- b) Define elementary row transformation of a matrix.
- c) Define symmetric and skew - symmetric matrices.
- d) If $a > 0, b > 0$ then prove that $a^2 + b^2 \geq 2ab$.
- e) Find the value of K if $f(x) = \begin{cases} 4x-1 & \text{for } x \leq 1 \\ x+k & \text{for } x > 1 \end{cases}$ is continuous at $x=1$.
- f) State Borel covering theorem.
- g) Evaluate $\lim_{x \rightarrow 0} \frac{a^x - 1}{b^x - 1}$.
- h) If $y = \log(ax + b)$ then find y_n .
- i) Find the n^{th} derivative of $\sin 3x \cdot \cos 2x$.
- j) State cauchy's mean value theorem.
- k) Expand $\cos x$ by maclaurins theorem.
- l) find the value of "c" for $f(x) = x(x-1)$ in $[0, 2]$ by using lagranges mean value theorem.

[P.T.O.]



PART - B

II. Answer any Four of the following.

(4×5=20)

2) Prove that
$$\begin{vmatrix} x & a & a & a \\ a & x & a & a \\ a & a & x & a \\ a & a & a & x \end{vmatrix} = (x+3a)(x-a)^3.$$

3) If $x, y, z \in \mathbb{R}$ then show that $x^2 + y^2 + z^2 \geq xy + yz + zx$.

4) State and prove Intermediate value theorem.

5) If $\lim_{x \rightarrow a} f(x) = l$ and $\lim_{x \rightarrow a} g(x) = m$ Then prove that $\lim_{x \rightarrow a} [f(x) \cdot g(x)] = l \cdot m$

6) Find the n^{th} derivative of $e^{ax} \cdot \cos(bx+c)$.

7) Verify cauchy's mean value theorem for the functions $f(x) = e^x$ and $g(x) = e^{-x}$ in $[a, b]$.

PART - C

III. Answer any Four of the following.

(4×10=40)

8) a) Prove that the rank of matrix is equal to rank of its a transposed matrix.

b) Find the rank of matrix $A = \begin{vmatrix} 6 & 1 & 3 & 8 \\ 4 & 2 & 6 & -1 \\ 10 & 3 & 9 & 7 \\ 16 & 4 & 12 & 15 \end{vmatrix}$ by reducing it to normal form.

9) a) Prove that $|x+y| \leq |x| + |y| \forall x, y \in \mathbb{R}$.

b) Examine the continuity of $f(x) = \begin{cases} x \cdot \sin\left(\frac{1}{x}\right), & \text{when } x \neq 0 \\ 0, & \text{when } x = 0 \text{ at } x = 0. \end{cases}$

10) a) If $f(x)$ is continuous in $[a, b]$ then it is bounded in that interval.



- b) Evaluate $\lim_{x \rightarrow \pi} \frac{\log \sin x}{\log \sin 2x}$.
- 11) a) State and prove Leibnitz's theorem for the n^{th} derivative of the product of two functions.
- b) If $y = (\sin^{-1} x)^2$ then prove that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - n^2y_n = 0$
- 12) a) State and prove Taylor's theorem with Schlomilch and Rouches form of remainder.
- b) Expand $\tan^{-1} x$ by using Maclaurin series up to the terms containing x^5 .
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35124/42124/A240

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I Semester B.Sc. 3/4 Degree Examination, March - 2022

CHEMISTRY (Optional)

(Old Syllabus)

(Repeater)

Time : 3 Hours

Maximum Marks : 80

Instructions to Candidates :

1. *ALL Questions are Compulsory.*
2. *Answer ALL questions in the Same Answer Book.*
3. *Draw Neat Labelled Diagrams and Equations wherever necessary.*

SECTION - A

I. Answer any TEN of the following.

(10×2=20)

1.
 - a) State two limitations of Bohr's Theory.
 - b) What is Covalent Bond?
 - c) Write the significant figures of the following numbers.
 - i) 7.80×10^{10}
 - ii) 457.76
 - d) Define Indicator. Which Indicator is used for the titration of Na_2CO_3 against HCl.
 - e) Define the Term Recrystallization.
 - f) Write the Four types of electronic transitions of UV Spectroscopy.
 - g) What are Azeotropic mixtures? Give an example.
 - h) Give Law of Corresponding States.
 - i) State Nernst Distribution Law.
 - j) Write the electronic configuration of Copper (At.No. 29).
 - k) What are Andrew's Brotherton?
 - l) Draw chari and boat forms of Cyclohexane.

[P.T.O.]



SECTION - B

II. Answer any FOUR of the following.

(4×5=20)

2. Explain the formation of H_2 molecule on the basis of VBT.
3. Write the significance of four quantum numbers.
4. What is Complexometric titration? Explain in brief the estimation of Zinc using EDTA.
5. Define the term conformation and explain conformation analysis of ethane molecule.
6. Explain the terms
 - a) Bathochromic Shift.
 - b) Hypochromic Shift.
7. Describe the Nicotin-Water System with neat diagram.

SECTION - C

III. Answer any FOUR of the following.

(4×10=40)

8.
 - a) Explain Bohr-Sommerfeld model of an Atom.
 - b) Write a note on errors in Quantitative analysis.
 9.
 - a) Explain Stability of Cycloalkanes using Baeyer's Strain Theory.
 - b) Explain the chemical method for the determination of the configuration of maleic acid and Fumaric Acid.
 10.
 - a) Explain the Optical Isomerism of Lactic Acid.
 - b) Explain Steam Distillation in the Purification of Organic Compounds.
 11.
 - a) State the Law of Corresponding States and derive reduced equation of State using Vander Waal's equation.
 - b) Explain the following terms:
 - i) Critical Temperature
 - ii) Critical Volume
 - iii) Critical Pressure
 12.
 - a) Calculate the pH of ammonium acetate solution given that $K_a = 1.175 \times 10^{-3}$ and $K_b = 1.8 \times 10^{-5}$.
 - b) Give Principle of UV Spectroscopy and mention the few applications of UV Spectroscopy.
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44024/A0240

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I Semester B.Sc.5 (CBCS) Degree Examination, March - 2022

CHEMISTRY(OPTIONAL)

(Repeaters)

Time : 3 Hours

Maximum Marks : 80

Instructions to Candidates:

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

I. Answer any **Ten** Questions.

(10×2=20)

- 1) State Heisenberg's uncertainty principle.
- 2) Name the series of lines appear in the hydrogen spectrum
- 3) Write the electronic Configuration of $Cr(Z=24)$.
- 4) Calculate the bond order in O_2 molecule.
- 5) What are the factors influencing the formation of covalent bond ?
- 6) What is hybridisation ?
- 7) What is electromeric effect ?
- 8) State Huckel's rule.
- 9) What are electrophiles ? Give two examples.
- 10) Give the methods of purification of liquids.
- 11) Calculate the angle strain in cyclopropane
- 12) What are distereoisomers ? Give an example.

II. Answer any **Three** of the following.

(3×5=15)

- a) Explain Bohr's theory of atomic model.
- b) What are quantum numbers ? Give the significance of quantum numbers.

[P.T.O.]



- c) Explain Pauli's exclusion principle and Hund's rule for filling electrons in orbitals.
- d) Explain the shapes of s, p and d atomic orbitals.

III. Answer any Three Questions.**(3×5=15)**

- a) Mention the salient features of MOT.
- b) Explain the 'Born-Haber' cycle for the formation of sodium chloride.
- c) Explain the geometry of PCl_5 on the basis of hybridisation.
- d) Give the comparison of VBT and MOT.

IV. Answer any Three Questions.**(3×5=15)**

- a) What are dienes? Give the Classification of dienes with examples.
- b) What are carbanions? Explain their stability.
- c) Explain the preparation of alkenes by.
 - i) dehydration of alcohols.
 - ii) dehydrohalogenation of alkyl halides.
- d) What is ozonolysis? Explain the ozonolysis of 2-butene.

V. Answer any Three Questions**(3×5=15)**

- a) What is chromatography? Explain the column chromatography.
 - b) Explain the rules for assigning the R and S notations.
 - c) What are cycloalkanes? Explain Sachse-Mohr theory of strainless rings.
 - d) Explain the following with examples.
 - i) Enantiomers
 - ii) Epimers
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44035/A0350

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I Semester B.Sc. 5 (CBCS) Degree Examination, March - 2022

PHYSICS

(Repeater)

Time : 3 Hours

Maximum Marks : 80

Instructions to Candidates:

1. Calculators can be used for solving problems.
2. Write intermediate steps during problem solving.

PART-A

Answer any Ten questions of the following.

(10×2=20)

1. i) What is centre of mass ?
ii) What is elastic collision ?
iii) A torque of 20Nm is applied on a wheel, initially at rest. Calculate the angular momentum of the wheel after 3 seconds.
iv) State Newton's law of gravitation.
v) Define radius of gyration.
vi) State and explain Hook's law.
vii) What is Cantilever ?
viii) The Poisson's ratio and rigidity modulus of material of wire are 0.285 and $3.5 \times 10^{10} \text{ N/m}^2$ respectively. calculate the Young's Modulus of the material of wire.
ix) Define Inertial frame of reference.
x) Give fundamental postulates of special theory of relativity.
xi) Calculate the energy of rest mass of electron in ev. Given rest mass of Proton = $1.67 \times 10^{-27} \text{ kg}$.
xii) Write expression for escape velocity.

[P.T.O.]

PART - B

Answer Question No.2 or Question No.3

2. a) Derive an expression for velocity of rocket. (10)
- b) A steel ball of 1kgs moving with velocity of 12m/s strikes 5kg block, which is initially at rest. The collision is elastic. find the speed of the ball and the speed of the block after collision. (5)

(OR)

3. a) Derive an expression for final velocities in case of elastic Collision in one dimension. (10)
- b) A mass of 10,000 kg moving with speed of 15m/s strikes stationary mass of same value. After collision masses get coupled & move together what is their common speed? (5)

PART - C

Answer Question No.4 or Question No.5

4. a) State and prove Kepler's 3rd law of planetary motion.
- b) Escape velocity of the earth is 11.2km/s find the escape velocity of planet whose radius is twice & mass is thrice to that of the earth.

(OR)

5. a) Derive an expression for Moment of Inertia of rectangular lamina.
(i) About an axis through its centre and parallel to its plane and.
(ii) About an axis perpendicular to its plane.
- b) A circular ring has moment of inertia $30 \times 10^{-3} \text{ kgm}^2$ about centre of gravity and perpendicular to its plane. Find the M.I. of the ring about the diameter.

PART - D

Answer Question No.6 or Question No.7

6. a) Derive the relation connecting between Young's modulus, Bulk modulus, and modulus of rigidity. (10)
- b) Calculate young's modulus of material. Given $K = 1.5 \times 10^{11} \text{ N/m}^2$; $\eta = 4.34 \times 10^{-10} \text{ Nm}^{-2}$

(OR)



(3)

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- 7) a) Obtain an expression for Young's Modulus of a beam supported at its ends and loaded at the middle.
- b) A metal rod of length 1m and breadth 0.03m and thickness 2.5mm is clamped at one end and loaded at free end with 3kg. Calculate the depression produced. Given $Y = 4 \times 10^{11} \text{ N / m}^2$

PART - E

Answer Question No.8 or Question No.9.

- 8) a) Describe with neat diagram Michelson Morley experiment and give the concept of negative result (10)
- b) How fast would a rocket have to go relative to an observer for its length to be contracted to 75% of its length at rest. (5)

(OR)

- 9) a) Derive Einstein's mass - energy relation (10)
- b) Find the velocity at which the mass of the particle is double than its rest mass. (5)
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42135/35135/A350

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I Semester B.Sc.4 (Non-CBCS) Degree Examination, March - 2022

PHYSICS

(Repeaters)

Time : 3 Hours

Maximum Marks : 80

Instructions to Candidates:

1. Calculators can be used to solve problems.
2. Write intermediate steps during problem solving.

PART - A

Answer any Ten questions of the following.

1. a) Define simple Harmonic motion.
b) What is elastic collision.
c) State Kepler's second law of planetary motion.
d) Define angular momentum.
e) State the theorem of parallel axis.
f) What is compound pendulum ?
g) Define Poisson's ratio.
h) Write the relation connecting Y , K , and η elastic constants.
i) What is the effect of impurities on surface tension of a liquid.
j) Define coefficient of viscosity of a liquid.
k) Calculate the orbital velocity of a satellite moving close to the earth. Given radius of the earth is 6400 km and value of g is 9.8 ms^{-2} .
l) Calculate the bending moment of a bar of Young's modulus $20 \times 10^{10} \text{ N/m}^2$, geometric moment of inertia $4 \times 10^{-3} \text{ kgm}^2$ and bending radius 2m.

[P.T.O.]

**PART - B**

Answer any **Four** of the following.

2. Derive an expression for the total energy of a particle executing S.H.M.
3. State and explain theorem of perpendicular axis.
4. Derive an expression for the excess of pressure inside the soap bubble.
5. The escape velocity of the earth is 11.2 kms^{-1} find the escape velocity on a planet whose radius is thrice that of the earth and whose mass is twice that of the earth.
6. A metal disc of mass 1kg and radius 10cm is suspended horizontally by a vertical wire of length 50cm and radius 0.5mm. If the system executes 25 torsional oscillations in two minutes calculate the rigidity modulus of the material of the wire.
7. Calculate the surface tension of water if it rises to a height of $0.5 \times 10^{-2} \text{ m}$ in a capillary tube of radius 3mm. Density of water is 1000 kg/m^3 and angle of contact for water is zero.

PART - C

8. State the principle of rocket. Derive an expression for the final velocity of the single stage rocket.
 9. Derive an expression for the time period of light spiral spring.
 10. Describe an experiment to determine the moment of inertia of flywheel.
 11. Define neutral surface. Derive an expression for the bending moment.
 12. Derive Poiseuille's formula for the flow of viscous fluid through a narrow tube.
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