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Department of Library

SRTMU, Nanded.

B. Sc. Third Year

5th Semester Examination

November/December 2025

Question Papers

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GA—314—2025

FACULTY OF SCIENCE AND TECHNOLQGY

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(CBCS/New Pattern)

COMPUTER SCIENCE

Paper XII

(Software Engineering)

(Saturday, 13-12-2025) **Time : 10.00 a.m. to 12.00 noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (*i*) Attempt *all* questions.

(*ii*) Assume suitable data if necessary.

1. (*a*) What is software engineering ? Explain in detail software engineering process. 15

Or

(*b*) Explain the elements of analysis model. 8

(*c*) Explain the concept of software architecture. 7

P.T.O.

2. (*a*) Explain in detail prototyping and spiral model. 15

Or

(*b*) Discuss the web application quality attributes. 8

(*c*) What are the primary technical considerations for building a mobile app ? 7

3. Write short notes on (any *two*) : 10

(*a*) Software myths

(*b*) Agility principles

(*c*) Requirement analysis

(*d*) Best practices of mobile app design.

This question paper contains **2** printed pages]

GA—321—2025

FACULTY OF SCIENCE AND TECHNOLOGY

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(CBCS/New Pattern)

COMPUTER SCIENCE

Paper- XIII

(Programming in Visual Basic)

(Tuesday, 16-12-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 Hours *Maximum Marks—40*

N.B. :— (*i*) Attempt *all* questions.

(*ii*) Draw suitable diagrams, if necessary.

(*iii*) Assume suitable data wherever necessary.

1. What is form in V.B. ? Explain form properties in V.B. 15

Or

(*a*) Explain for loop with a suitable example. 8

(*b*) Describe in brief data types used in visual basic. 7

P.T.O.

2. Explain in detail IDE of visual basic. 15

Or

(*a*) Explain If-else statement with example. 8

(*b*) Describe the properties of label button and command button control in V.B. 7

3. Write short notes on the following (any *two*) : 10

(*a*) Array

(*b*) Visual data manager

(*c*) MDI form

(*d*) Designing menu structure in V.B.

This question paper contains 2 printed pages]

GA—67—2025

FACULTY OF SCIENCE AND TECHNOLOGY

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(CBCS/New Pattern)

ZOOLOGY

Paper XIII-D

(Applied Zoology—Environmental Biology-I)

(Thursday, 27-11-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (*i*) Attempt *all* questions.

(*ii*) *All* questions carry equal marks.

(*iii*) Illustrate your answer with suitable labelled digrams wherever necessary.

1. What is ecosystem ? Explain the components of an ecosystem. 15

Or

(*a*) Sulphur cycle 8

(*b*) Explain the structure and composition of soil. 7

P.T.O.

2. Explain the concept and characteristics of biodiversity. 15

Or

(*a*) Give detailed account on management of wildlife. 8

(*b*) Explain the causes for wildlife depletion. 7

3. Attempt any *two* of the following four : 10

(*a*) Food web

(*b*) Chemical properties of water

(*c*) Aim and necessity of wildlife conservation

(*d*) In-situ conservation of biodiversity.

This question paper contains 2 printed pages]

GA—65—2025

FACULTY OF SCIENCE AND TECHNOLOGY

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

ZOOLOGY

Paper XIII-B

[Applied Parasitology-I (Parasitic Protozoa and Platyhelminthes)]

(Thursday, 27-11-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (*i*) Attempt *all* questions.

(*ii*) Draw the diagrams wherever necessary.

1. Describe the morphology, life-cycle and pathogenicity of Giardia intestinalis. 15

Or

(*a*) Explain the morphology and treatment of Balantidium coli. 8

(*b*) Describe the life-cycle and treatment of Sarcocystis cruzi. 7

2. Give an account of the morphology, life-cycle and pathogenicity of Schistosoma haematobium. 15

P.T.O.

Or

(*a*) Describe the life-cycle of Taenia solium. 8

(*b*) Explain the general organization in cestodes. 7

3. Attempt any *two* out of the four : 10

(*a*) Types of host

(*b*) Malaria and its control measures

(*c*) Redia larva

(*d*) Hexacanth larva.

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GA—63—2025

FACULTY OF SCIENCE AND TECHNOLOGY

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(CBCS/New Pattern)

MATHEMATICS

Paper XIII

(Linear Algebra)

(Thursday, 27-11-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (1) *All* questions are compulsory.

(2) Figures to the right indicate full marks.

(3) Illustrate your answers with suitable labelled diagram wherever necessary.

1. Attempt any *one* of the following : 15

(A) Define vector space and prove the following properties : 8

(*a*) $\alpha.0 = 0$ for every scalar 'α'

(*b*) $0.u = 0$ for every $u \in U$

(*c*) $(-1).u = -u$ for every $u \in U$.

P.T.O.

(B) Prove that in a vector space 'V' suppose $\{v_1, v_2, \ldots\ldots, v_n\}$ is an ordered set of vectors with $v_1 \neq 0$. The set is linear dependent iff one of the vectors $v_2, v_3, \ldots\ldots, v_n$ say v_k belongs to the span of $v_1, v_2, \ldots\ldots, v_{k-1}$ *ie* $v_k \in [v_1, v_2, \ldots\ldots, v_{k-1}]$ for some $k = 2, 3, \ldots\ldots, n$. 7

Or

(A) If U and W are two subspaces of a finite dimensional vector space V, then prove that : 8

$$\dim(U + W) = \dim U + \dim W - \dim(U \cap W).$$

(B) Define linear transformation. Prove the following. Let $T : U \to V$ be a linear map, then : 7

(*a*) $T(0_U) = 0_V$

(*b*) $T(-u) = -T(u)$

(*c*) $T(\alpha_1 u_1 + \alpha_2 u_2 + \ldots\ldots + \alpha_n u_n) = \alpha_1 T(u_1) + \alpha_2 T(u_2) + \ldots\ldots + \alpha_n T(u_n)$

2. Attempt any *one* of the following : 15

(A) Prove that every real (complex) vector space of dimension '*p*' is isomorphic to $V_p(V_p^c)$. 8

(B) Let $T : U \to V$ be a linear map $v_0 \neq 0_v$ in V the non-homogeneous equation : 7

(NH) $T(u) = v_0$

and the associated homogeneous equation (H)

$$T(u) = 0_v,$$

then prove the following :

(a) If $v_0 \in R(T)$, then (NH) has no solution for 'u'.

(b) If $v_0 \in R(T)$, then (H) has the trivial solution namely $u - 0_U$ as its only solution the (NH) has unique solution.

Or

(A) Let a linear map $T : p_3 \to p_2$ be defined by : 8

$$T(\alpha_0 + \alpha_1 x + \alpha_2 x^2 + \alpha_3 x^3) = \alpha_3 + (\alpha_2 + \alpha_3)x + (\alpha_0 + \alpha_1)x^2$$

then calculate matrix of 'T' relative to the basis, $B_1 = \{1, (x - 1), (x - 1)^2, (x - 1)^3\}$ and $B_2 = \{1, x, x^2\}$.

(B) Let 'A' be a square matrix of order 'n' having 'k' distinct eigen values $\lambda_1, \lambda_2, \ldots\ldots, \lambda_k$. Let v_i be an eigen vector corresponding to the eigen value λ_i, $i = 1, 2, \ldots\ldots, k$, then show that the set $\{v_1, v_2, \ldots\ldots, v_k\}$ is linearly independent. 7

3. Attempt any *two* of the following : 10

(A) If 'U' and 'W' are two subspaces of a vector space V, then prove that U + W is subspace of V and U + W = [U ∪ W].

P.T.O.

(B) Let $T : U \to V$ be a linear map, then prove that :

(a) R(T) is a subspace of V

(b) N(T) is a subspace of U.

(C) Let T_1, T_2 be linear maps from U to V, let S_1, S_2 be linear maps from U to W. Let 'p' be a linear map from W to Z, where U, V, W are vector spaces over the same field of scalars, then prove that :

(a) $S_1(T_1 + T_2) = S_1T_1 + S_1T_2$

(b) $(S_1 + S_2)T_1 = S_1T_1 + S_2T_1$.

(D) Let V be a inner product space, then for arbitrary vectors 'u' and v in V prove that :

(a) $|u \cdot v| \leq \|u\| \|v\|$

(b) $\|u + v\| \leq \|u\| + \|v\|$.

This question paper contains 2 printed pages]

GA—322—2025

FACULTY OF SCIENCE AND TECHNOLOGY

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

COMPUTER SCIENCE

Paper XIII (Optional)

(Advanced Java Programming)

(Tuesday, 16-12-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (*i*) *All* questions are compulsory.

(*ii*) Assume suitable data, if necessary.

1. Attempt the following :

(*a*) What is thread ? Explain yield, stop, sleep method with example. 15

Or

(*b*) What is exception handling ? Explain with a suitable example. 7

(*c*) What is error ? Explain types of errors. 8

P.T.O.

2. Attempt the following :

(*a*) How to create executable applet ? Explain designing a web page using applet. 15

Or

(*b*) Write a program in Java to draw circles and ellipses. 7

(*c*) Explain stream classes. 8

3. Write short notes on (any *two*) : 10

(*a*) Implementation of Java program

(*b*) Multiple catch statement

(*c*) Applet tag and running the applet

(*d*) Creation of files in Java.

This question paper contains 2 printed pages]

GA—51—2025

FACULTY OF SCIENCE & TECHNOLOGY

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

ZOOLOGY

Paper-XII

(Ecology and Zoogeography)

(Monday, 24-11-2025) **Time : 10.00 a.m. to 12.00 noon**

Time—2 Hours *Maximum Marks—40*

N.B. :— (i) Attempt *all* questions.

(ii) Draw diagram wherever necessary.

1. What is ecosystem ? Describe in detail the desert ecosystem. 15

Or

(*a*) Energy flow in an ecosystem. 8

(*b*) Mutualism. 7

2. Describe in detail the sources, effects and control measures of water pollution. 15

Or

(*a*) Wind energy. 8

(*b*) Oriental realm. 7

P.T.O.

3. Write notes on any *two* of the following : 10

(*a*) Hydrosphere

(*b*) Competition

(*c*) Aims of wildlife conservation

(*d*) Volant adaptation.

This question paper contains 3 printed pages]

GA—50—2025

FACULTY OF ARTS/SCIENCE

B.A./B.Sc. (Fifth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

MATHEMATICS

Paper XII

(Metric Spaces)

(Monday, 24-11-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (1) *All* questions are compulsory.

(2) Figures to the right indicate full marks.

1. In any metric space (X, d), prove that : 15

(*i*) The union of an arbitrary family of open sets is open.

(*ii*) The intersection of finite number of open sets is open.

Or

(*a*) Prove that continuous image of a compact set is compact. 8

(*b*) Prove that every compact metric space (X, d) is sequentially compact. 7

P.T.O.

2. Let (X, d_1) and (Y, d_2) be any two metric spaces and f is a function from X into Y. Then prove that f is continuous at $a \in X$ if and only if, for every sequence $\{a_n\}$ converging to 'a' we have : 15

$$\lim_{n \to \infty} f(a_n) = f(a).$$

Or

(*a*) Prove that the union of two connected sets, having non-empty intersection, is connected. 8

(*b*) Let A be a connected subset of a metric space X, and let B be a subset of X such that $A \subseteq B \subseteq \bar{A}$ then show that B is also connected. 7

3. Attempt any *two* of the following : 5 each

(*a*) Let (X, d) be any metric space. Show that the function d_1 defined by

$$d_1(x, y) = \frac{d(x, y)}{1 + d(x, y)}, \quad \forall\, x, y \in X$$

is a metric on X.

(*b*) If $f(x) = x^2$, $0 \le x \le \frac{1}{3}$. Then show that f is a contraction mapping on $\left[0, \frac{1}{3}\right]$ with the usual metric d.

(c) Let A be a non-empty compact subset of a metric space (X, d) and let F be a closed subset of X such that $A \cap F = \phi$, then prove that $d(A, F) > 0$.

(d) Discuss the connectedness of a subset :

$$D = \left\{(x, y) \middle| x \neq 0, y = \sin\left(\frac{1}{x}\right)\right\}$$

of the Euclidean space R^2.

This question paper contains 4 printed pages]

GA—80—2025

FACULTY OF SCIENCE AND TECHNOLOGY

B.A./B.Sc. (Third Year) (Fifth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(CBCS/New Pattern)

MATHEMATICS

Paper XIV

(Numerical Analysis)

(saturday, 29-11-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (1) *All* questions are compulsory.

(2) Figures to the right indicate full marks.

(3) Use of non-programmable calculator is allowed.

1. Prove the Newton-Gregory formula for forward interpolation using polynomial in x. 15

P.T.O.

Estimate population for the year 1975, if the population of a country in the decimal census were as under :

Year x	Population y (in lakhs)
1941	46
1951	67
1961	83
1971	95
1981	102

Or

(*i*) Prove that the divided difference are symmetrical in all their arguments, that is the value of any divided difference is independent of the order of the argument. 8

(*ii*) Find $\log_{10} 656$, given that : 7

$\log_{10} 654 = 2.8156$, $\log_{10} 658 = 2.8182$

$\log_{10} 659 = 2.8189$, $\log_{10} 661 = 2.8202$.

2. Prove that trapezoidal rule as a approximate quadrature formula and calculate the approximate value of $\int_0^{\pi/2} \sin x \, dx$ by trapezoidal rule. Given that : 15

$\sin 0 = 0$, $\sin \pi/20 = 0.1564$

$\sin \pi/10 = 0.3090$, $\sin 3\pi/20 = 0.4540$

$\sin \pi/5 = 0.5878$, $\sin \pi/4 = 0.7071$

$\sin 3\pi/10 = 0.8090$, $\sin 7\pi/10 = 0.8910$

$\sin 2\pi/5 = 0.9511$, $\sin 9\pi/20 = 0.9877$

$\sin \pi/2 = 1$.

Or

(*i*) Prove the Stirling interpolation formula. 8

(*ii*) Apply Bessel's formula to obtain y_{25}. Given that : 7

$y_{20} = 2854$, $y_{24} = 3162$, $y_{28} = 3544$, $y_{32} = 39992$.

3. Attempt any *two* of the following : 10

(*i*) Prove that :

$$e^x = \left(\frac{\Delta^2}{E}\right) e^x \cdot \frac{Ee^x}{\Delta^2 e^x}.$$

(*ii*) Estimate the missing term in the following table :

x	y
0	1
1	3
2	9
3	—
4	81

P.T.O.

(*iii*) Find the minimum value of y from the table :

x	y
0	0
1	0.25
2	0
3	2.25
4	16.00
5	56.25

(*iv*) Use Picard's method of successive approximation to $\frac{dy}{dx} = x + y$ with the boundary condition $y = 1$ when $x = 0$. Compute three iterations only.

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GA—78—2025

FACULTY OF SCIENCE AND TECHNOLOGY

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

MATHEMATICS

Paper-XIV

(Operation Research)

(Saturday, 29-11-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 Hours *Maximum Marks—40*

N.B. :— (1) *All* questions are compulsory.

(2) Figures to the right indicate full marks.

1. Write the major steps for mathematical formulation of a linear programming problem. Also, formulate the following problem for maximizing the profit.

The manager of an oil refinery must decide on the optimum mix of two possible blending process of which the input and output production runs are as follows : 15

Process	Input		Output	
	Crude A	Crude B	Gasoline X	Gasoline Y
1	6	4	6	9
2	5	6	5	5

P.T.O.

The maximum amounts available of crudes A and B are 250 units and 200 units respectively. Market demand shows that at least 150 units of gasoline X and 130 units of gasoline Y must be produced. The profits per production run from process 1 and process 2 are Rs. 4 and Rs. 5 respectively. Formulate the problem.

Or

(A) Explain the term unbounded solution and show that the following L.P.P. has unbounded solution using graphical method : 8

Maximize : $z = 6x_1 + x_2$,

Subject to constraints :

$$2x_1 + x_2 \geq 3,$$

$$x_1 - x_2 \geq 0 \text{ and}$$

$$x_1, x_2 \geq 0.$$

(B) Reduce the following L.P.P. to its standard form : 7

Maximize : $z^* = 3x_1 + 4x_2 + 6x_3$

Subject to constraints :

$$2x_1 + x_2 + 2x_3 \geq 6,$$

$$3x_1 + 2x_2 = 8,$$

$$7x_1 - 3x_2 + 5x_3 \geq 9;$$

$x_1 \geq 0$, $x_2 \geq 0$ and x_3 unrestricted in sign.

2. Define basic feasible solution and prove that, let an L.P.P. have a basic feasible solution. If we drop one of the basic vectors and introduce a non-basis vector in the basis set, then the new solution obtained is also a basic feasible solution. 15

Or

(A) A company manufacturing air-coolers has two plants located at Hyderabad and Mumbai with a capacity of 300 units and 100 units per week respectively. The company supplies the air-coolers to its four showrooms situated at Bangalore, Chennai, Delhi and Ernakulam which have a maximum demands of 85, 150, 150 and 55 units respectively. Due to differences in raw materials cost and transportation cost, the profit per unit in rupees differs which is shown in the table given below :

City	Bangalore	Chennai	Delhi	Ernakulam
Hyderabad	110	90	75	55
Mumbai	65	50	80	45

Plan the production programme so as to maximize the profit. The company may have its production capacity at both plants partly or wholly unused. Formulate the above problem as an L.P.P. 8

P.T.O.

(B) A company wishes to assign 3 jobs to 3 machines in such a way that each job is assigned to some machine and no machine works on more than one job. The cost of assigning job i to machine j is given by the matrix below (ijth entry) : 7

$$\text{Cost matrix} : \begin{bmatrix} 8 & 7 & 6 \\ 5 & 7 & 8 \\ 6 & 8 & 7 \end{bmatrix}$$

Draw the associated network. Also, formulate the network L.P.P.

3. Attempt any *two* of the following : 5 each

(A) What are the components of an L.P.P. ? Explain them in brief.

(B) The set of feasible solutions to an L.P.P. is a convex set.

(C) Obtain all the basic solutions to the following system of linear equations :

$$x_1 + 2x_2 + x_3 = 4$$

$$2x_1 + x_2 + 5x_3 = 5.$$

(D) Prove that, a necessary and sufficient condition for the existence of a feasible solution to the general transportation problem is that :

$$\sum_{i=1}^{m} a_i = \sum_{j=1}^{n} b_j = \lambda (\text{say}).$$

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GA—79—2025

FACULTY OF SCIENCE AND TECHNOLOGY

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

MATHEMATICS

Paper XIV(B)

(Mechanics-I)

(saturday, 29-11-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (1) *All* questions are compulsory.

(2) Attempt either (A) *or* (B) for Question Nos. **1** and **2**.

(3) Figures to the right indicate full marks.

1. (A) State and prove law of the parallelogram of forces. Find the resultant of two forces whose magnitude are 8 kg and 7 kg respectively at an angle of 60°. 15

Or

(B) Attempt the following :

(*a*) Prove that the necessary and sufficient condition for a system of forces acting on a particle to be in equilibrium is that the

P.T.O.

algebraic sum of the resolved part of given forces along any three non-coplanar direction must separately vanish. 8

(*b*) Two forces whose magnitude are p and $p\sqrt{2}$ act on a particle in direction inclined at an angle of 135° to each other. Find the magnitude and direction of the resultant. 7

2. (A) Prove that vector moment of the resultant couple of two couples acting upon a rigid body is the sum of vector moment of the given couples. Find the vector moment of a force $\bar{F}$ of magnitude 10 units acting at a point (1, 2, 3) in the direction of vector $2i + j + 2k$. 15

Or

(B) Attempt the following :

(*a*) Show that the sum of vector moment of a system of forces acting on a particle about any point equals to the vector moment of their resultant about the same point. 8

(*b*) Three forces of magnitude P, Q, R acting on a particle are in equilibrium and the angle between P and Q is double the angle between P and R, show that $R^2 = Q(Q - P)$. 7

3. Attempt any *two* of the following : 5 each

(*a*) Find the magnitude and direction of the resultant $\vec{R}$ when two forces $\bar{P}$ and $\bar{Q}$ act along the same straight line and in the same direction.

(*b*) Three like parallel forces of magnitude P, Q and R act at the corners of a triangle ABC. If their resultant passess through incentre of Δ ABC, then :

$$\frac{P}{a} = \frac{Q}{b} = \frac{R}{c}.$$

(*c*) A force $\bar{F}$ of magnitude 8 units acts at a point P(2, 3, 4) along the line :

$$\frac{x-2}{3} = \frac{y-3}{4} = \frac{z-4}{5}.$$

Find the moment of force $\bar{F}$ about *x*-axis.

(*d*) If the resultant R divides the angle between the two forces P and Q in the ratio 1 : 2, then prove that :

$$R = \frac{P^2 - Q^2}{Q}.$$

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GA—66—2025

FACULTY OF SCIENCE AND TECHNOLOGY

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

ZOOLOGY

Paper XIII-C

[Applied Zoology (Entomology-I)]

(Thursday, 27-11-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (*i*) Attempt *all* questions.

(*ii*) Illustrate your answer with suitable labelled digrams wherever necessary.

1. Explain in detail methods of insect collection, preservation of insects. 15

Or

(*a*) Describe digestive system of Cockroach. 8

(*b*) Explain male reproductive system of Cockroach. 7

P.T.O.

2. Explain in detail salient fetures with suitable example of order Odonata. 15

Or

(*a*) Explain types of metamorphosis in insect. 8

(*b*) Hormonal control of metamorphosis in insects. 7

3. Attempt any *two* of the following : 10

(*a*) Agricultural entomology

(*b*) Sexual dimorphism in cockroach

(*c*) Silver fish

(*d*) Effect of light on insect life.

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GA—04—2025

FACULTY OF SCIENCE

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(CBCS/ New Pattern)

CHEMISTRY

(Organic and Inorganic Chemistry-XII)

(Friday, 14-11-2025) **Time : 10.00 a.m. to 12.00 noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (*i*) Attempt *all* questions.

(*ii*) Figures to the right indicate full marks.

1. Solve any *three* of the following : 3×5=15

(*a*) Explain Ionization and Hydrate isomerism with example.

(*b*) Write the IUPAC names of the following complexes :

(*i*) $[Cr(NH_3)_6]^{3+}$

(*ii*) $[Pt(NH_3)_6Cl_4]$

(*iii*) $[Fe(CO)_5]$

(*iv*) $[Ni(DMG)_2]$

(*v*) $[Co(NH_3)_4(H_2O)Cl]Cl_2$.

P.T.O.

(*c*) Give the symptoms of cancer disease and discuss the treatment on it.

(*d*) Define EAN. Calculate EAN of the central metal ion in the following complexes :

(*i*) $K_4[Fe(CN)_6]$

(*ii*) $[Cu(CN)_4]^{3-}$.

(*e*) Write a note on imaging agent.

2. Solve any *three* of the following : 3×5=15

(*a*) Give preparation of thiophene from :

(*i*) *n*-Butane

(*ii*) Acetylene.

What is the action of the following on thiophene ?

(*i*) Halogenation

(*ii*) Reduction

(*iii*) *n*-Butyl Lithium.

(*b*) Define drugs. Explain the terms Antifungals, Antimalarials, Antipyretics and Antidiabetics.

(*c*) Discuss the chemical constitution of nicotine.

(*d*) How will you prepare pyridine from :

(*i*) Acetylene

(*ii*) β-Picoline

What is the action of the following reagents on pyridine ?

(*i*) H_2SO_4

(*ii*) KOH

(*iii*) Br_2/Charcoal

(*e*) Define dyes. Give qualities of good dye.

3. Solve any *two* of the following : 2×5=10

(*a*) What are Vitamins ? Give the classifications of vitamins with examples. (Fat soluble)

(*b*) What are pesticides ? Give synthesis and uses of :

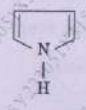
(*i*) Alachlor

(*ii*) Chloranil.

P.T.O.

(*c*) Predict the products :

(*i*)  $+ 2H_2 \xrightarrow{\text{Raney Ni}}$?

(*ii*)  $+ SO_3 \xrightarrow{\text{Pyridine}}$?

(*iii*)  $+ HNO_3 \xrightarrow{\text{Acetic anhydride}}$?

(*iv*)  $+ CHCl_3 + KOH_{(aq.)} \xrightarrow{\Delta}$?

(*v*)  $+ KOH \xrightarrow{\Delta}$?

(*d*) Give the synthesis and uses of the following drugs :

(*i*) Paracetamol

(*ii*) Benzocaine.

This question paper contains 3 printed pages]

GA—10—2025

FACULTY OF SCIENCE

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

CHEMISTRY

Paper-XIII

(Physical and Inorganic Chemistry)

(Monday, 17-11-2025) **Time : 10.00 a.m. to 12.00 noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

(*iii*) Use of logarithmic table and calculator is allowed.

1. Answer any *three* of the following : 15

(*a*) Define metal carbonyl and discuss its types.

(*b*) Give preparations and properties of Nickel tetracarbonyl.

(*c*) Write notes on :

(*i*) Transition metal organometallic compounds and

(*ii*) Electron defficient organometallic compounds.

(*d*) Give preparation, properties (*two* each) and structure of ferrocene.

(*e*) Draw and discuss structure of organolithium compound.

P.T.O.

2. Solve any *three* of the following : 15

(*i*) The distribution of benzoic acid between H_2O and C_6H_6, the following data were obtained :

H_2O	1.5×10^{-2}	1.9×10^{-2}	2.89×10^{-2}
C_6H_6	0.242	0.410	0.907

Determine molecular complexicity of acid in C_6H_6.

(*ii*) Derive an expression for rate of third order reaction.

(*iii*) Explain types of electronic transition with examples and labelled diagram.

(*iv*) The pure rotational spectra of HI molecule consists of series of equidistant lines with a spacing of 14 cm^{-1}. Calculate bond length of HI molecule. (Reduced mass = 1.64×10^{-24}).

(*v*) Discuss energy levels of simple harmonic oscillator in vibrational spectra and show that only one spectra is obtained for any trnasitions.

3. Answer any *two* of the following : 10

(*a*) Derive an expression $I = \mu r^2$ for diatomic rigid rotator.

(*b*) Explain Raman effect on the basis of concept of polarizability of molecule.

(*c*) Give the Kinetics of opposing reaction.

(*d*) Write notes on :

(*i*) Solvent extraction

(*ii*) Liquid-liquid chromatography.

This question paper contains 2 printed pages]

GA—11—2025

FACULTY OF SCIENCE

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(CBCS/New Pattern)

CHEMISTRY

Paper-XIII

(Physical and Inorganic Chemistry)

(Monday, 17-11-2025) **Time : 10.00 a.m. to 12.00 noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (*i*) Attempt *all* questions.

(*ii*) Use of logarithmic table and non-programmable calculator is allowed.

1. Answer any *three* of the following : 3×5=15

(*a*) Explain polymerization of CrO_4^{2-}.

(*b*) Draw the structure of W^{6+} octahedral heteropoly anion.

(*c*) Explain the structure of isopoly anions of Mo^{6+}

(*d*) Draw and explain the structure of $Os(CO)_4$.

(*e*) Define Isolobal Fragments and explain P_4 fragment.

P.T.O.

2. Answer any *three* of the following : 3×5=15

(*a*) Describe vapour pressure of ideal solution using suitable diagram.

(*b*) Derive an expression for entropy change of mixing for an ideal solution.

(*c*) Explain paramagnetic, diamagnetic and ferromagnetic substance with suitable examples.

(*d*) Derive the Ilkovic equation for the diffusion current in a polarographic cell.

(*e*) Discuss the advantages and disadvantages of dropping mercury electrode.

3. Answer any *two* of the following : 2×5=10

(*a*) Discuss the variation of vapour pressure of completely miscible liquids pairs with composition.

(*b*) Describe temperature dependence of Vapour pressure of a solution.

(*c*) Describe Guoy's method for measurement of magnetic susceptibility. Give advantages and disadvantages of Guoy's method.

(*d*) Discuss the application of Polarography in :

(*i*) Determination of Diffusion Coefficients of Electroactive Species.

(*ii*) Determination of Stability constant of metal ion complex.

This question paper contains 2 printed pages]

GA—22—2025

FACULTY OF SCIENCE

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

PHYSICS

Paper XII

(Quantum Mechanics)

(Wednesday, 19-11-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (1) *All* questions are compulsory.

(2) Each symbol have their own usual meaning.

(3) (*a*) Charge of electron, $e = 1.6 \times 10^{-19}$ C

(*b*) Mass of electron, $m = 9.1 \times 10^{-31}$ kg

(*c*) Planck's constant, $h = 6.6205 \times 10^{-34}$ Js.

1. State and explain Compton effect. Derive an expression for Compton shift. 15

Or

(*a*) Deduce Schrodinger's equation in time independent form. 8

(*b*) Explain Eigen values and Eigen functions. 7

P.T.O.

2. Discuss energy of particle in a one-dimensional box and calculate the energies for first three states for L = 1 Å, $n = 1$, $n = 2$, $n = 3$ with net labelled diagram. 15

Or

(*a*) What is quantum number ? Explain total quantum number. 8

(*b*) Explain orbital quantum number. 7

3. Write short notes on (any *two*) : 10

(*a*) Uncertainty principle

(*b*) Expectation values

(*c*) Particle in a box momentum quantization

(*d*) Spin quantum number.

X315YDE88C8X315YDE88C8X315YDE88C8X315YDE88C8

This question paper contains 2 printed pages]

GA—21—2025

FACULTY OF SCIENCE

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

BOTANY

Paper–XII

(Cell and Molecular Biology)

(Wednesday, 19-11-2025) **Time : 10.00 a.m. to 12.00 noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (*i*) Attempt *all* questions.

(*ii*) Illustrate your answers with suitable labelled diagrams wherever necessary.

1. Describe the ultrastructure and functions of Nucleus. 15

Or

Describe in brief :

(*a*) Structure and functions of typical chromosome. 8

(*b*) Cell cycle. 7

P.T.O.

2. What is nucleic acid ? Describe structure of DNA. 15

Or

Describe in brief :

(*a*) Seymour Benzer's view of gene. 8

(*b*) Amniocentesis. 7

3. Write short notes on any *two* of the following : 10

(*a*) Significance of mitosis

(*b*) Functions of Golgi Complex

(*c*) m-RNA

(*d*) Phenylketonuria.

This question paper contains 2 printed pages]

GA—35—2025

FACULTY OF SCIENCE

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

PHYSICS

Paper-XIII

(Solid State Physics)

(Friday, 21-11-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— Attempt *All* questions.

1. Derive the packing fraction of HCP, FCC and BCC structures. 15

Or

(*a*) Determine the specific heat of monoatomic, diatomic and triatomic gases. 8

(*b*) Derive expression for specific heat using classical theory of lattice heat capacity. 7

2. Discuss Drude-Lorentz theory. Derive expression for electrical and thermal conductivity and prove Wiedemann-Franz law. 15

P.T.O.

Or

(*a*) Describe Rotating crystal method with neat labelled diagrams. 8

(*b*) Explain the formation of Ionic bond along with its physical properties. 7

3. Write short notes on any *two* : 10

(*a*) Rotation symmetry

(*b*) van der Waals bond

(*c*) Assumption of Einstein's theory of heat capacity

(*d*) Electrical conductivity and Ohm's law.

This question paper contains **2** printed pages]

GA—32—2025

FACULTY OF SCIENCE AND TECHNOLOGY

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

BOTANY

Paper XIII

(Plant Pathology—I)

(Friday, 21-11-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (1) Attempt *All* questions.

(2) Illustrate your answers with suitably labelled diagrams wherever necessary.

1. Explain in detail factors affecting disease development in plants. 15

Or

Write on :

(*a*) Grain smut of Jowar. 8

(*b*) Green ear of Bajra. 7

2. Describe in detail symptoms, causal organisms, disease cycle and control measures of white rust of mustard. 15

P.T.O.

Or

Write on :

(*a*) Koch's Postulates. 8

(*b*) Isolation of Plant Pathogens. 7

3. Attempt any *two* of the following : 10

(*a*) Pure culture technique

(*b*) Mycotoxins in Pathogenesis

(*c*) Anthracnose of Mango

(*d*) Sigatoka disease of banana.

X315Y2759D0X315Y2759D0X315Y2759D0X315Y2759D0

Shri Kumarswami Mahavidyalaya, Ausa

Department of Library

SRTMU, Nanded.

B. Sc. Third Year

6th Semester Examination

November/December 2025

Question Papers

This question paper contains 3 printed pages]

GA—03—2025

FACULTY OF SCIENCE

B.Sc. (Third Year) (Sixth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(CBCS/New Pattern)

CHEMISTRY

Paper–XV

(Physical & Inorganic Chemistry)

(Thursday, 13-11-2025) **Time : 10.00 a.m. to 12.00 noon**

Time—2 Hours *Maximum Marks*—40

N.B. :— (*i*) Attempt *all* questions.

(*ii*) Use of logarithmic table and non-scientific calculator is allowed.

1. Answer any *three* of the following : 3×5=15

(*a*) Discuss the biological role of sodium and potassium ions.

(*b*) What is porphyrene ? Draw the structure of heme.

(*c*) Give the synthesis of diborane and write *four* properties of diborane.

(*d*) Write the properties and structure of dodeca carborane.

(*e*) Give any *two* preparations of Metalloborane.

P.T.O.

2. Answer any *three* of the following : 3×5=15

(*a*) How will you determine pH of unknown solution using quinhydrone electrode ?

(*b*) Explain the construction and working of calomel electrode. Explain its superiority over SHE.

(*c*) Derive Gibbs–Duhem equation.

(*d*) The equilibrium constant of reaction doubles on raising the temperature from 35°C to 45°C. Calculate ΔH° for the reaction. (R = 8.314 $JK^{-1}mol^{-1}$).

(*e*) Describe the determination of molecular weight of a solute from elevation in boiling point.

3. Answer any *two* of the following : 2×5=10

(*a*) What are concentration cells ? Derive the equation for EMF of concentration cell without transport.

(*b*) Explain variation of chemical potential with pressure.

(*c*) Derive Vant-Hoff's isotherm.

(*d*) 1.02 g of urea when dissolved in 98.5 g of certain solvent decreases its freezing point by 0.211 K. 1.609 g of unknown compound when dissolved in 86 g of the same solvent depresses the freezing point by 0.34 K. Calculate the molar mass of the unknown compound. (Molar Mass of urea = 60 g mol^{-1})

This question paper contains 2 printed pages]

GA—07—2025

FACULTY OF SCIENCE AND TECHNOLOGY

B.Sc. (Third Year) (Sixth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(CBCS/New Pattern)

PHYSICS

Paper-XIV

(Atomic, Molecular and Nuclear Physics)

(Saturday, 15-11-2025) **Time : 10.00 a.m. to 12.00 noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (*i*) *All* questions are compulsory.

(*ii*) Figure to the right indicate full marks.

(*iii*) *All* symbols have their usual meanings.

1. Describe Raman effect in detail with the help of schematic representations. 15

Or

(*a*) Explain anomalous Zeeman effect in detail. 8

(*b*) Write a note on any *four* quantum numbers associated with vector atom model. 7

P.T.O.

2. Explain in detail Nuclear Fission, product of Fission reaction and energy released while fission process. 15

Or

(*a*) Describe synchrotron with neat labelled diagram. 8

(*b*) Write a note on needs of particle accelerators. 7

3. Write short notes on any *two* of the following : 10

(*a*) The Pauli's exclusion principle

(*b*) Raman effect

(*c*) Linear accelerator

(*d*) Conservation Laws.

X315Y1B39EBX315Y1B39EBX315Y1B39EBX315Y1B39EB

This question paper contains 2 printed pages]

GA—27—2025

FACULTY OF SCIENCE

B.Sc. (Third Year) (Sixth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

ZOOLOGY

Paper XIV

(Ethology, Biometry and Bioinformatics)

(Thursday, 20-11-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (1) Attempt *all* questions.

(2) Illustrate your answers with suitable labelled diagrams wherever necessary.

1. Describe inborn or stereotyped animal behaviour — Taxis and Instincts with examples. 15

Or

(*a*) Describe protective and warning colouration. 8

(*b*) Describe auditory communication. 7

2. Discuss computer and their application in Biology. 15

P.T.O.

Or

(*a*) Describe Pie diagram with example. 8

(*b*) Describe types of classification of chronological and qualitative data. 7

3. Attempt any *two* out of four : 10

(*a*) Imprinting acquired animal behaviour

(*b*) Tactile communication

(*c*) Median Central Tendency

(*d*) Search Engines.

This question paper contains **3** printed pages]

GA—26—2025

FACULTY OF SCIENCE

B.Sc. (Third Year) (Sixth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

MATHEMATICS

Paper XV

(Complex Analysis)

(Thursday, 20-11-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (1) *All* questions are compulsory.

(2) Figures to the right indicate full marks.

1. Derive the Cauchy-Riemann equations in Cartesian form. Also verify Cauchy-Riemann equation for the function $f(z) = z^2$. 15

Or

(*a*) Let C denote a contour of length L, and suppose that a function $f(z)$ is piecewise continuous on C. If M is a non-negative constant such that : 8

$$|f(z)| \leq M$$

for all z on C at which $f(z)$ is defined then prove that :

$$\left|\int_C f(z)dz\right| \leq ML.$$

P.T.O.

(*b*) Find the value of the integral 7

$$I = \int_C \bar{z}\,dz$$

where C is the right-hand half

$$z = 2e^{i\theta}\left(\frac{-\pi}{2} \leq \theta \leq \frac{\pi}{2}\right)$$

of the circle $|z| = 2$ from $z = -2i$ to $z = 2i$.

2. Explain the method to find nth roots of non-zero complex number z_0. Also find the square roots of $\sqrt{3} + i$. 15

Or

(*a*) State and prove Liouville's theorem. 8

(*b*) State Cauchy integral formula in terms of nth derivative of $f(z)$. Also evaluate : 7

$$\int_C f(z)dz$$

where C is the positively oriented unit circle $|z| = 1$ and $f(z) = e^{2z}$.

3. Attempt any *two* of the following :

(*a*) Show that a set S is open if and only if each point in S is an interior point. 5

(*b*) If $f(z) = u(x, y) + iv(x, y)$ is an analytic in a domain D, then prove that its component functions u and v are harmonic in D. 5

(c) If $W(t)$ is a piecewise continuous complex valued function defined on an interval $a \leq t \leq b$, then prove that : 5

$$\left| \int_a^b W(t)\,dt \right| \leq \int_a^b |W(t)|\,dt.$$

(d) Evaluate : 5

$$\int_C f(z)\,dz$$

where C is the positively oriented circle $|z| = 2$ and $f(z) = \frac{z}{9 - z^2}$.

This question paper contains **2** printed pages]

GA—42—2025

FACULTY OF SCIENCE & TECHNOLOGY

B.Sc. (Third Year) (Sixth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

ZOOLOGY

Paper XV

(Applied Zoology—Aquaculture)

(Saturday, 22-11-2025) **Time : 10.00 a.m. to 12.00 noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (*i*) Attempt *all* questions.

(*ii*) Illustrate your answers with suitable labelled diagrams wherever necessary.

1. Explain in detail Polyculture. 15

Or

(*a*) Pen Culture 8

(*b*) Industrial effluents. 7

2. Explain freshwater prawn culture. 15

Or

(*a*) Types of weeds 8

(*b*) Physical properties of water. 7

P.T.O.

3. Attempt any *two* of the following : 10

(*a*) Scope and importance of aquaculture

(*b*) Composition of sewage

(*c*) Role of Larvivorous fishes

(*d*) Types of mariculture.

This question paper contains **2** printed pages]

GA—41—2025

FACULTY OF SCIENCE AND TECHNOLOGY

B.Sc. (Third Year) (Sixth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(CBCS/New Pattern)

MATHEMATICS

Paper XVI

(Integral Transforms)

(Saturday, 22-11-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (1) *All* questions are compulsory.

(2) Figures to the right indicate full marks.

1. If $L[f(t)] = F(s)$, then prove that, 15

$$L\left[t^n f(t)\right] = (-1)^n \frac{d^n}{ds^n}\left[F(s)\right].$$

Also, find the Laplace transform of $t^2 \cos at$.

Or

(*a*) Find the inverse Laplace transform of $\frac{s}{4s^2 - 25}$. 8

(*b*) Find the inverse Laplace transform of $\frac{1}{s\left(s^2 + 1\right)}$. 7

P.T.O.

2. Using Laplace transforms, solve the differential equations : 15

$$(D + 1)y_1 + (D - 1)y_2 = e^{-t}$$

$$(D + 2)y_1 + (D + 1)y_2 = e^{t}$$

where $D = \frac{d}{dt}$ and $y_1(0) = 1$, $y_2(0) = 0$.

Or

State and prove Fourier integral theorem. 15

3. Attempt any *two* of the following : 10

(*a*) Find the Laplace transform of $\cos^2 t$.

(*b*) Find the inverse transforms of $\frac{1}{s^2 - 9s + 6}$.

(*c*) Using the Laplace transform, find the solution of the initial value problem $y'' + 25y = 10 \cos 5t$, where $y(0) = 2$, $y'(0) = 0$.

(*d*) Find the Fourier cosine transform of $f(x) = e^{-2x} + 4e^{-3x}$.

This question paper contains 2 printed pages]

GA—17—2025

FACULTY OF SCIENCE

B.Sc. (Third Year) (Sixth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(CBCS/New Pattern)

PHYSICS

Paper-XV(A)

(Digital and Communication Electronics)

(Tuesday, 18-11-2025) **Time : 10.00 a.m. to 12.00 noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

(*iii*) Use non-programmable calculator.

1. State rules and laws of Boolean algebra. 15

Or

(*a*) Discuss binary and decimal number systems in detail. 8

(*b*) Explain gray and Excess 3 codes. 7

P.T.O.

2. Explain : 15

(1) Tunned Radio Frequency (TRF) receiver

(2) Superheterodyne receiver

Or

(*a*) Define frequency modulation and obtain an expression for frequency modulated wave. 8

(*b*) What is principle of demodulation ? Discuss linear diode detector. 7

3. Write short notes on (any *two*) : 10

(*a*) Octal number system

(*b*) Universal properties of NAND gate

(*c*) Types of modulation

(*d*) Essentials of A.M.

X3I5YF91814X315YF91814X315YF91814X315YF91814

This question paper contains 2 printed pages]

GA—58—2025

FACULTY OF SCIENCE

B.Sc. (Third Year) (Sixth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(CBCS/New Pattern)

MATHEMATICS

Paper XVII

(Elementary Number Theory)

(Tuesday, 25-11-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 Hours *Maximum Marks—40*

N.B. :— (1) *All* questions are compulsory.

(2) Figures to the right indicate full marks.

1. Prove that for integers a, b, c 15

(*i*) if $a|b$ and $b \neq 0$, then $|a| \leq |b|$

(*ii*) if $a|b$ and $a|c$, then $a|(bx + cy)$ for arbitrary integers x and y.

Also, by using Mathematical induction establish the result

$$1^2 + 2^2 + 3^2 + \ldots\ldots + n^2 = \frac{n(2n+1)(n+1)}{6}.$$

P.T.O.

Or

(*a*) Prove that if p_n is the nth prime number, then $p_n \leq 2^{2^{n-1}}$ and if p is a prime and $p|a_1a_2 \ldots\ldots a_n$, then $p|a_k$ for some k, $1 \leq k \leq n$. 8

(*b*) Prove that there is an infinite number of primes. 7

2. Let $n > 1$ be fixed and a, b, c, d be arbitrary integers prove that : 15

(*i*) if $a \equiv b(\text{mod } n)$ and $c \equiv d(\text{mod } n)$, then $a + c \equiv b + d(\text{mod } n)$ and $ac \equiv bd(\text{mod } n)$.

(*ii*) if $a \equiv b(\text{mod } n)$, then $a^k \equiv b^k(\text{mod } n)$ for any positive integer k.

(*iii*) if $a \equiv b(\text{mod } n)$, then $b \equiv c(\text{mod } n)$, then $a \equiv c(\text{mod } n)$.

Or

(*a*) Prove that the quadratic congruence $x^2 + 1 \equiv 0(\text{mod } p)$, where p is an odd prime, has a solution if and only if $p \equiv 1(\text{mod } 4)$. 8

(*b*) If p is a prime prove that $(p - 1)! \equiv -1(\text{mod } p)$. 7

3. Attempt any *two* of the following : 10

(*a*) If $a|c$ and $b|c$ with $gcd(a, b) = 1$, then prove that $ab|c$.

(*b*) By using the Sieve of Eratosthenes find all primes not exceeding 100.

(*c*) Show that there are an infinite number of primes of the form $4n + 3$.

(*d*) Show that if p and q are distinct primes with $a^p \equiv a(\text{mod } q)$ and $a^q \equiv a(\text{mod } p)$, then $a^{pq} \equiv a(\text{mod } pq)$.

This question paper contains 2 printed pages]

GA—57—2025

FACULTY OF ARTS/SCIENCE

B.A./B.Sc. (Third Year) (Sixth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

MATHEMATICS

Paper XVII

[Mechanics-II (Dynamics)]

(Tuesday, 25-11-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (1) *All* questions are compulsory.

(2) Figures to the right indicate full marks.

1. State Newton's Laws of Motion and discuss its deductions. 15

Or

(*a*) A bullet of mass m moving with velocity v strikes the block of mass M of thickness a. Find the resistance of the block, supposed to be uniform, if the bullet can penetrate through the distance α_{12}. If the block is free to move, through what distance the bullet penetrates, the resistance remaining the same. 8

P.T.O.

(*b*) A particle of mass m moving with velocity $\vec{v}$ picks up a mass M at rest. Find the velocity of the combined mass, the kinetic energy of the combined mass and the loss in K.E. 7

2. Define particle and velocity. And find the components of velocity and acceleration along rectangular Cartesian axis. 15

Or

(*a*) Define projectile, Horizontal range of projectile, Time of flight, Highest point of trajectory. 8

(*b*) Find the vertex and the Latus rectum of the parabola. 7

3. Attempt any *two* of the following : 10

(*i*) Prove the relation $t_1 \cdot t_2 = 2R/g$.

(*ii*) Find the work done by the Force $\vec{F} = 2xi + 2yj$ in moving a particle from P(1, 2) to Q(3, 2).

(*iii*) A particle of mass 0.1 lb has the velocity $2i + 3j$ ft/sec at $t = 2$ sec. It is subjected to a force $3t^2i + \cos(\pi t)j$. Find the impulse of the force over the interval $2 \leq t \leq 3$. Also find the velocity at $t = 3$ sec.

(*iv*) Prove that the acceleration of a point moving in a plane curve with uniform speed is $\rho\psi^2$.

This question paper contains 2 printed pages]

GA—07—2025

FACULTY OF SCIENCE AND TECHNOLOGY

B.Sc. (Third Year) (Sixth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(CBCS/New Pattern)

PHYSICS

Paper-XIV

(Atomic, Molecular and Nuclear Physics)

(Saturday, 15-11-2025) **Time : 10.00 a.m. to 12.00 noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (*i*) *All* questions are compulsory.

(*ii*) Figure to the right indicate full marks.

(*iii*) *All* symbols have their usual meanings.

1. Describe Raman effect in detail with the help of schematic representations. 15

Or

(*a*) Explain anomalous Zeeman effect in detail. 8

(*b*) Write a note on any *four* quantum numbers associated with vector atom model. 7

P.T.O.

2. Explain in detail Nuclear Fission, product of Fission reaction and energy released while fission process. 15

Or

(*a*) Describe synchrotron with neat labelled diagram. 8

(*b*) Write a note on needs of particle accelerators. 7

3. Write short notes on any *two* of the following : 10

(*a*) The Pauli's exclusion principle

(*b*) Raman effect

(*c*) Linear accelerator

(*d*) Conservation Laws.

This question paper contains 2 printed pages]

GA—06—2025

FACULTY OF SCIENCE AND TECHNOLOGY

B.Sc. (Third Year) (Sixth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

BOTANY

Paper–XIV

(Genetics and Plant Breeding)

(Saturday, 15-11-2025) **Time : 10.00 a.m. to 12.00 noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (*i*) Attempt *all* questions.

(*ii*) Figures to the right indicate full marks.

(*iii*) Draw well labelled diagrams wherever necessary.

1. What is supplementary gene interaction ? Describe with suitable example. 15

Or

Write notes on :

(*a*) Allopolyploidy with reference to hexaploid wheat. 8

(*b*) Sex-linked inheritance of colour blindness in man. 7

P.T.O.

2. What is Hybridization ? Describe various steps in Hybridization. 15

Or

Write notes on :

(*a*) Mutational breeding with reference to groundnut. 8

(*b*) Advantages and disadvantages of plant introduction and acclimatization. 7

3. Write short notes on (any *two*) : 10

(*a*) Sex determination in Birds

(*b*) Down's syndrome

(*c*) Objectives of plant breeding

(*d*) Male sterility.

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This question paper contains **2** printed pages]

GA—317—2025

FACULTY OF SCIENCE AND TECHNOLOGY

B.Sc. (Third Year) (Sixth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

COMPUTER SCIENCE

Paper XV

(Relational Database Management System)

(Friday, 12-12-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (*i*) *All* questions are compulsory.

(*ii*) Assume suitable data, if necessary.

1. What is database system ? Explain in detail database system applications. 15

Or

(*a*) Explain in detail database schema. 8

(*b*) Explain structure of relational databases. 7

P.T.O.

2. What is normal forms ? Explain in detail. 15

Or

(*a*) Explain basic structure of SQL quries. 8

(*b*) Describe join expressions in detail. 7

3. Write short notes on any *two* : 10

(*a*) Database users

(*b*) Keys

(*c*) Features of good relational design

(*d*) Views.

This question paper contains **2** printed pages]

GA—311—2025

FACULTY OF SCIENCE AND TECHNOLOGY

B.Sc. (Third Year) (Sixth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(CBCS/New Pattern)

COMPUTER SCIENCE

Paper XIV

(Software Testing)

(Wednesday, 10-12-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (*i*) Attempt *all* questions.

(*ii*) Assume suitable data, if necessary.

1. What is software testing ? Explain validation testing and system testing. 15

Or

(*a*) What is software quaity ? Explain McColl's quality dimensions. 8

(*b*) What is software quality assurance ? Explain elements of SQA. 7

P.T.O.

2. Discuss the software testing fundamentals and distinguish between white box and black box testing. 15

Or

(*a*) What is web app testing ? Discuss the errors in web app environment. 8

(*b*) Explain web app testing process. 7

3. Write short notes on (any *two*): 10

(*a*) Formal technical review

(*b*) Strategic issues of testing

(*c*) Control structure testing

(*d*) Testing guidelines for mobile apps.

This question paper contains 2 printed pages]

GA—02—2025

FACULTY OF SCIENCE

B.Sc. (Third Year) (Sixth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

CHEMISTRY

Paper–XIV-A2

(Organic & Inorganic Chemistry)

(Tuesday, 11-11-2025) **Time : 10.00 a.m. to 12.00 noon**

Time—2 Hours *Maximum Marks—40*

N.B. :— (*i*) Attempt *all* questions.

(*ii*) Figures to the right indicate full marks.

1. Answer any *three* of the following : 3×5=15

(*a*) Give the classification of polymer on the basis of composition

(*b*) What is degree of polymerisation ? Explain with examples.

(*c*) Give the preparation and properties of silicones.

(*d*) Discuss the properties of single-walled carbon nanotubes.

(*e*) What is nano-cluster ? How can metal-clusters produced ?

P.T.O.

2. Answer any *three* of the following : 3×5=15

(*a*) Discuss manufacturing of cane sugar.

(*b*) What are the bi-products of alcohol industry ?

(*c*) Write the classification of fibre.

(*d*) What are agrochemicals ? Give the advantages of nitrogenous fertilizers.

(*e*) What are biocatalytic reactions.

3. Solve any *two* of the following : 2×5=10

(*a*) Describe the manufacturing of ethyl alcohol from molasses.

(*b*) Give the objects of sizing, sizing ingredients and their functions.

(*c*) Give any *seven* principles of green chemistry.

(*d*) Give synthesis and uses of :

(*i*) Ethophan

(*ii*) Monochrotophos.

This question paper contains **3** printed pages]

GA—56—2025

FACULTY OF SCIENCE

B.Sc. (Third Year) (Sixth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

MATHEMATICS

Paper XVII-A

(Topology)

(Tuesday, 25-11-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 Hours *Maximum Marks—40*

N.B. :— (1) Attempt either (A) *or* (B) for Question Nos. **1** and **2**.

(2) *All* symbols carry usual meaning.

(3) Figures to the right indicate full marks.

1. (A) Define a basis for a topology on X. If X is any set, show that the collection of all one point subsets of X is a basis for the discrete topology on X. 15

P.T.O.

Or

(B) Attempt the following :

(*i*) Define open map. Show that the projection mappings $\pi_1 : X \times Y \to X$ and $\pi_2 : X \times Y \to Y$ are open. 8

(*ii*) Define subspace topology. If A is a subspace of X and B is a subspace of Y, then prove that the product topology on $A \times B$ is the same as the topology $A \times B$ inherits as subspace of $X \times Y$. 7

2. (A) Let X be a topological space. Then show that the following conditions holds : 15

(1) ϕ and X are closed

(2) Arbitrary intersection of closed sets are closed

(3) Finite union of closed sets are closed.

Or

(B) Attempt the following :

(*i*) Let $f : A \to X \times Y$ be given by the equation $f(a) = (f_1(a), f_2(a))$. Then show that the function f is continuous if and only if the functions $f_1 : A \to X$ and $f_2 : A \to Y$ are continuous. 8

(*ii*) Define connected sets. Prove that image of a connected space under continuous map is connected. 7

3. Attempt any *two* : 5 each

(*i*) Show that the topologies R_l and R_k are strictly finer than the standard topology on R.

(*ii*) Show that a subspace of a Hausdorff space is Hausdorff.

(*iii*) Define homeomorphism. Show that the function $f : R \to R$ given by $f(x) = 3x + 1$ is a homeomorphism.

(*iv*) Define compact set. Show that the subspace

$$X = \{0\} \cup \{1/n \mid n \in Z_+\}$$

of R is compact.