

Exam. Code : 121203
Subject Code : 800036

B.A./B.Sc. 3rd Sem. (Batch 2023-26) (CBGS) (Old Syllb.)

MATHEMATICS (Analytical Geometry)

Paper : II

Time Allowed—3 Hours]

[Maximum Marks—75

Note :— Attempt **FIVE** questions in all, selecting at least **ONE** question from each section. The fifth question may be attempted from any section. All questions carry equal marks.

SECTION—A

- I. (a) Find the co-ordinates of the point on transferring the origin to which the equation $x^2 + 3xy + 4y^2 - 4x - 6y + 5 = 0$ does not contain linear terms in x and y . Also find the new equation. 8
- (b) By suitable translation and rotation of axes, remove the terms x , y , and xy from the equation $14x^2 - 4xy + 11y^2 - 36x + 48y + 41 = 0$. 7

- II. (a) Show that the equations $x^2 - 7x + 6 = 0$ and $y^2 - 14y + 40 = 0$ form a parallelogram. Also find the joint equation of its diagonals. 8
- (b) For what values of λ does the equation $12x^2 - 10xy + 2y^2 + 11x - 5y + \lambda = 0$ represent two straight lines? Show that if the equation represents two straight lines, the angle between them is $\tan^{-1} \frac{1}{7}$. 7

SECTION—B

- III. (a) Find the equations of the tangent and normal to $y^2 = 6x$ at the point $\left(\frac{8}{3}, 4\right)$. 8
- (b) Determine whether the line $x - y + 5 = 0$ cuts, touches, or meets the parabola $y^2 = 20x$. 7
- IV. (a) Show that the locus of the middle points of chords of the parabola $y^2 = 4ax$ through the vertex is the parabola $y^2 = 2ax$. 8
- (b) Show that the directrix of the parabola $x^2 + 2xy + y^2 - 4x + 8y - 6 = 0$ is $3x - 3y + 8 = 0$. 7

SECTION—C

- V. (a) Find the equation of the hyperbola such that distance between foci is 16, and whose eccentricity is $\sqrt{2}$. 8
- (b) Find the equation of tangents and normals at the point of the ellipse $5x^2 + 3y^2 = 137$, whose ordinate is 2. 7
- VI. (a) Find the pole of the chord $x - 2y = 1$ w.r.t. the hyperbola $4x^2 - 9y^2 = 12$. 8
- (b) Two tangents are drawn to the ellipse $\frac{x^2}{4} + \frac{y^2}{3} = 1$ from the point $P(-16, 9)$. Find the combined equation of the tangents and the angle between them. 7

SECTION—D

- VII. (a) Prove that the planes $2x - y + z - 4 = 0$, $5x + 7y + 2z = 0$, and $3x + 4y - 2z + 3 = 0$ meet in a point. Find the co-ordinates of their point of intersection. 8
- (b) Find the equation of sphere passing through $(2, 0, 0)$, $(0, 2, 0)$, $(0, 0, 2)$ and having radius as small as possible. 7

VIII.(a) Show that the two circles

$$x^2 + y^2 + z^2 - y + 2z = 0, \quad x - y + z - 2 = 0;$$

$x^2 + y^2 + z^2 + x - 3y + z - 5 = 0, \quad 2x - y + 4z - 1 = 0,$ lie on the same sphere and find its equation. 8

(b) Find the coordinates of the points on the sphere $x^2 + y^2 + z^2 - 4x + 2y = 4$ the tangent planes at which are parallel to the plane $2x - y + 2z = 1.7$

Exam. Code : 121203
Subject Code : 502384

B.A./B.Sc. 3rd Semester (Batch 2024-27/28) (CBGS)
PHYSICS
(Statistical Physics & Thermodynamics)

Time Allowed—3 Hours]

[Maximum Marks—100

Note :— Attempt **FIVE** questions in all, selecting at least **ONE** question from each section. The fifth question may be attempted from any section. All questions carry equal marks.

SECTION—A

1. (a) A dice is thrown once. What is the probability of getting a number less than 3? 6
- (b) Consider the distribution of four distinguishable particles into two equal sized compartments. Determine the least and most probable macrostate. 14
2. (a) Explain briefly (a) macrostate and (b) microstate. 6
- (b) Discuss the distribution of 'n' particles in 'k' compartments of unequal sizes. 14

SECTION—B

3. (a) What will be the dimensionality of phase space corresponding to 2 particles constrained to move :
- (a) in a plane and
 - (b) in space? 8
- (b) Make a detailed comparison of three kinds of statistics. Give one example of a system corresponding to each statistics. 12
4. (a) What is phase space and how is it different from ordinary space? 6
- (b) Starting with the Maxwell-Boltzmann's law of distribution of velocities, obtain an expression for most probable and root mean square velocities of gas molecules. 14

SECTION—C

5. (a) What do you understand by :
- (a) reversible and
 - (b) irreversible process?
- Give an example of each. 5

(b) Explain entropy. Give its statistical definition. Show that when a small amount of heat δQ , is added to a system (keeping volume (V) and number of particles (n) fixed), the change in entropy is $dS = \frac{\delta Q}{T}$.

15

6. (a) What are the laws of thermodynamics? 6

(b) The efficiency of a Carnot engine is 30%. It is intended to increase its efficiency to 50%. By how much amount the temperature of the source needs to be increased, if the sink is at 300 K? 14

SECTION—D

7. (a) What are isothermal and adiabatic processes? Give an example of each. 5

(b) Obtain Clausius-Clapeyron's equation using appropriate Maxwell's relation. What is its significance? 15

8. (a) Explain the meaning of C_p and C_v . 6

(b) Show that :

$$\left(\frac{\partial S}{\partial P}\right)_T = -\left(\frac{\partial V}{\partial T}\right)_P \text{ and } \left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V \quad 14$$

Exam. Code : 121203

Subject Code : 800035

B.A./B.Sc. 3rd Semester (Batch 2023-26)

(CBGS) (Old Sylb)

MATHEMATICS

Paper-I (Analysis)

Time Allowed—3 Hours]

[Maximum Marks—100

Note :— Attempt **FIVE** questions in all, selecting at least **ONE** question from each section. The fifth question may be attempted from any section. All questions carry equal marks.

SECTION—A

I. (a) By definition, show that $\lim_{n \rightarrow \infty} \frac{3n}{n + 5\sqrt{n}} = 3$. 10

(b) Prove that the sequence $\left\{ \left(1 + \frac{3}{n} \right)^n \right\}$ is monotonically increasing. 10

II. (a) Show that the sequence $\{a_n\}$, where

$a_n = 1 + \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{n}$ does not converge, by showing that it is not a Cauchy sequence. 10

- (b) Prove that the sequence $\left\{ \frac{n^3}{n^3 + 1} \right\}$ is a Cauchy sequence. 10

SECTION—B

- III. (a) Discuss the convergence or divergence of the following series :

$$\frac{2}{1^p} + \frac{3}{2^p} + \frac{4}{3^p} + \frac{5}{4^p} + \dots \quad 10$$

- (b) Show that $\sum_{n=2}^{\infty} \frac{1}{n(\log n)^p}$ is convergent iff $p > 1$. 10

- IV. (a) Examine the convergence or divergence of the series

$$\sum_{n=1}^{\infty} \frac{(n - \log n)^n}{2^n n^n} \text{ using Cauchy's root test.} \quad 10$$

- (b) Show that the following series is conditionally convergent :

$$\sum_{n=1}^{\infty} (-1)^{n-1} \left(\frac{1}{3n-1} \right) \quad 10$$

SECTION—C

- V. (a) Given $f(x) = 1/x^2$ is defined on $[1,4]$, $P_1 = \{1,2,3,4\}$

$$\text{and } P_2 = \left\{ 1, \frac{7}{4}, \frac{5}{2}, \frac{13}{4}, 4 \right\} \text{ are two partitions of } [1,4].$$

$$\text{Verify } L(P_2, f) \leq L(P_1, f). \quad 10$$

- (b) Evaluate integral by calculating upper and lower integrals in the indicated integral :

$$f(x) = \sin x, \left[0, \frac{\pi}{2}\right]. \quad 10$$

- VI. (a) Let f be a function defined on $[0,1]$ by

$$f(x) = \begin{cases} 1 & , x \neq \frac{1}{2} \\ 0 & , x = \frac{1}{2} \end{cases}$$

Show that $f \in R[0,1]$ and $\int_0^1 f(x) dx = 1$. 10

- (b) If $[x]$ stands for integral part of x , then show that

$$\int_1^2 [x^2] dx = 5 - \sqrt{2} - \sqrt{3}. \quad 10$$

SECTION—D

- VII. (a) Examine the convergence of the integral

$$\int_0^{\infty} \frac{dx}{(1+x)^{\frac{2}{3}}}. \quad 10$$

- (b) Show that, $\int_0^{\infty} \left(\frac{1}{1-x} - e^{-x} \right) \frac{1}{x} dx$ is convergent.

10

VIII. (a) Prove that $B(m, n) = \int_0^1 \frac{x^{m-1} + x^{n-1}}{(1+x)^{m+n}} dx$; $m, n > 0$.

10

(b) Evaluate $\frac{6\tau\left(\frac{8}{3}\right)}{5\tau\left(\frac{2}{3}\right)}$.

10

Exam. Code : 121203

Subject Code : 502174

B.A./B.Sc. 3rd Semester (Batch 2024-27/28) (CBGS)

COMPUTER SCIENCE

(Computer Oriented Numerical and Statistical Methods)

Time Allowed—3 Hours]

[Maximum Marks—75

Note :— Attempt FIVE questions in all, selecting at least ONE question from each section. The fifth question may be attempted from any section. All questions carry equal marks.

SECTION—A

1. (a) What is the difference between Numerical methods and numerical analysis?
- (b) Which are different types of Errors and their measures?
2. (a) Find a root of the equation $x^3 - 4x - 9 = 0$ using the bisection method.
- (b) Find a root of the equation $x^3 - x - 4 = 0$ between 1 and 2, correct to 3 decimal places using the Newton Raphson method.

SECTION—B

3. (a) Solve the following system of linear equations using Gauss Elimination Method :

$$x + y + z = 3$$

$$2x + 3y + z = 6$$

$$x - y - z = -3$$

- (b) Explain the matrix inversion method.
4. (a) Write the algorithm of Gauss Seidel method.
- (b) Find the inverse of the following matrix using Gauss Jordan Method :

$$\begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 3 \\ 2 & 3 & 1 \end{bmatrix}$$

SECTION—C

5. (a) Evaluate the following by trapezoidal rule taking $n = 4$.

$$\int_0^2 \frac{dx}{1+x^4}$$

- (b) Evaluate the following by using Simpson's 3/8 rule taking $h = 1/6$.

$$\int_0^1 \frac{dx}{1+x^2}$$

6. (a) The following table gives the normal weight of a baby during the first six months of life. Estimate the weight of a baby at the age of 4 months.

Age in Months : 0 2 3 5 6

Weight (in Kg) : 5 7 8 10 12

- (b) What is Interpolation? Write an algorithm of Lagrange Interpolation method.

SECTION—D

7. Which are various measures of Central Tendency? Write their merits and demerits.
8. What is dispersion? Which are various measures of Dispersion?

Exam. Code : 121203

Subject Code : 502182

B.A./B.Sc. 3rd Semester (Batch 2024-27/28) (CBGS)

ECONOMICS

(Indian Economy)

Time Allowed—3 Hours]

[Maximum Marks—100

Note :— Attempt **FIVE** questions in all, selecting at least **ONE** question from each section. The fifth question may be attempted from any section. All questions carry equal marks.

SECTION—A

1. Discuss various features of Indian agriculture. What is its importance in the modern world? 20
2. Critically examine the impact of Green Revolution. Did it lead to sustainable development? Give arguments to support your viewpoint. 20

SECTION—B

3. Write a detailed note on performance of Indian industry since liberalisation. What are the major hurdles in its growth? 20
4. Critically examine the latest industrial policy of India. 20

SECTION—C

5. Discuss the changes in composition of foreign trade in India since liberalization. Has it led to improvement in balance of payments situation of the country? 20
6. Define multinational corporations. What is the impact of MNCs on Indian economy? 20

SECTION—D

7. Discuss the causes and consequences of inflation in India. 20
8. Write a detailed critical note on existing tax structure of India. 20

(Punjabi Version)

ਨੋਟ :— ਹਰੇਕ ਭਾਗ ਵਿੱਚੋਂ ਘੱਟੋ-ਘੱਟ ਇੱਕ ਪ੍ਰਸ਼ਨ ਦੀ ਚੋਣ ਕਰਦੇ ਹੋਏ, ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰੋ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿੱਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ। ਸਾਰੇ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਅੰਕ ਬਰਾਬਰ ਹਨ।

ਭਾਗ—ੳ

1. ਭਾਰਤੀ ਖੇਤੀਬਾੜੀ ਦੀਆਂ ਵੱਖ-ਵੱਖ ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ 'ਤੇ ਚਰਚਾ ਕਰੋ। ਆਧੁਨਿਕ ਸੰਸਾਰ ਵਿੱਚ ਇਸਦੀ ਮਹੱਤਤਾ ਕੀ ਹੈ ? 20
2. ਹਰੀ ਕ੍ਰਾਂਤੀ ਦੇ ਪ੍ਰਭਾਵ ਦੀ ਆਲੋਚਨਾਤਮਕ ਤੌਰ 'ਤੇ ਜਾਂਚ ਕਰੋ। ਕੀ ਇਸਨੇ ਟਿਕਾਊ ਵਿਕਾਸ ਵੱਲ ਅਗਵਾਈ ਕੀਤੀ ? ਆਪਣੇ ਦ੍ਰਿਸ਼ਟੀਕੋਣ ਦਾ ਸਮਰਥਨ ਕਰਨ ਲਈ ਦਲੀਲਾਂ ਦਿਓ। 20

ਭਾਗ—ਅ

3. ਉਦਾਰੀਕਰਨ ਤੋਂ ਬਾਅਦ ਭਾਰਤੀ ਉਦਯੋਗ ਦੇ ਪ੍ਰਦਰਸ਼ਨ 'ਤੇ ਇੱਕ ਵਿਸਤ੍ਰਿਤ ਨੋਟ ਲਿਖੋ। ਇਸਦੇ ਵਿਕਾਸ ਵਿੱਚ ਮੁੱਖ ਰੁਕਾਵਟਾਂ ਕੀ ਹਨ ? 20

4. ਭਾਰਤ ਦੀ ਨਵੀਨਤਮ ਉਦਯੋਗਿਕ ਨੀਤੀ ਦੀ ਆਲੋਚਨਾਤਮਕ ਤੌਰ 'ਤੇ ਜਾਂਚ ਕਰੋ। 20

ਭਾਗ—ੲ

5. ਉਦਾਰੀਕਰਨ ਤੋਂ ਬਾਅਦ ਭਾਰਤ ਵਿੱਚ ਵਿਦੇਸ਼ੀ ਵਪਾਰ ਦੀ ਬਣਤਰ ਵਿੱਚ ਆਈਆਂ ਤਬਦੀਲੀਆਂ 'ਤੇ ਚਰਚਾ ਕਰੋ। ਕੀ ਇਸ ਨਾਲ ਦੇਸ਼ ਦੇ ਭੁਗਤਾਨ ਸੰਤੁਲਨ ਦੀ ਸਥਿਤੀ ਵਿੱਚ ਸੁਧਾਰ ਹੋਇਆ ਹੈ ? 20
6. ਬਹੁ-ਰਾਸ਼ਟਰੀ ਕਾਰਪੋਰੇਸ਼ਨਾਂ ਨੂੰ ਪਰਿਭਾਸ਼ਿਤ ਕਰੋ। ਭਾਰਤੀ ਅਰਥਵਿਵਸਥਾ 'ਤੇ ਬਹੁ-ਰਾਸ਼ਟਰੀ ਕੰਪਨੀਆਂ ਦਾ ਕੀ ਪ੍ਰਭਾਵ ਹੈ ? 20

ਭਾਗ—ਸ

7. ਭਾਰਤ ਵਿੱਚ ਮਹਿੰਗਾਈ ਦੇ ਕਾਰਨਾਂ ਅਤੇ ਨਤੀਜਿਆਂ 'ਤੇ ਚਰਚਾ ਕਰੋ। 20
8. ਭਾਰਤ ਦੇ ਮੌਜੂਦਾ ਟੈਕਸ ਢਾਂਚੇ 'ਤੇ ਇੱਕ ਵਿਸਤ੍ਰਿਤ ਆਲੋਚਨਾਤਮਕ ਨੋਟ ਲਿਖੋ। 20

(Hindi Version)

ਨੋਟ :- प्रत्येक भाग में से कम से कम एक प्रश्न का चयन करते हुए, कुल पाँच प्रश्न करें। पांचवा प्रश्न किसी भी भाग में से किया जा सकता है। सभी प्रश्नों के समान अंक हैं।

भाग—क

1. भारतीय कृषि की विभिन्न विशेषताओं पर चर्चा कीजिए। आधुनिक विश्व में इसका क्या महत्व है? 20
2. हरित क्रांति के प्रभाव का आलोचनात्मक परीक्षण कीजिए। क्या इससे सतत विकास हुआ? अपने दृष्टिकोण के समर्थन में तर्क दीजिए। 20

भाग-ख

3. उदारीकरण के बाद से भारतीय उद्योग के प्रदर्शन पर एक विस्तृत टिप्पणी लिखिए। इसके विकास में प्रमुख बाधाएँ क्या हैं? 20
4. भारत की नवीनतम औद्योगिक नीति का आलोचनात्मक परीक्षण कीजिए। 20

भाग-ग

5. उदारीकरण के बाद से भारत में विदेशी व्यापार की संरचना में आए परिवर्तनों पर चर्चा कीजिए। क्या इससे देश के भुगतान संतुलन की स्थिति में सुधार हुआ है? 20
6. बहुराष्ट्रीय निगमों को परिभाषित कीजिए। भारतीय अर्थव्यवस्था पर बहुराष्ट्रीय कंपनियों का क्या प्रभाव है? 20

भाग-घ

7. भारत में मुद्रास्फीति के कारणों और परिणामों पर चर्चा कीजिए। 20
8. भारत की मौजूदा कर संरचना पर एक विस्तृत आलोचनात्मक टिप्पणी लिखिए। 20