K24U 1625

Reg. No.: .....

Name : .....

Second Semester B.Sc. Degree (CBCSS – OBE-Regular/Supplementary/ Improvement) Examination, April 2024

(2019 Admission Onwards)

COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS

2C02 MAT-BCA : Mathematics for BCA – II

Time : 3 Hours Max. Marks : 40

UNIT – I

Short answer type. Answer **any 4** questions. **Each** question carries **1** mark. **(4×1=4)**

1. Find the value of $f(x, y, z) = \sqrt{x^2 - y^3 + 3z}$ at the point (4, 0, –4).
2. Find $\lim_{(x,y)\to(0,0)} \frac{3x^2 - y^2 + 5}{x^2 + y^2 + 2}$.
3. Evaluate $\int \cos^7 x\,dx$.
4. Define a polar equation.
5. Define Similar Matrices.

UNIT – II

Short essay type. Answer **any 7** questions. **Each** question carries **2** marks. **(7×2=14)**

6. Find the domain and range of the function $f(x, y, z) = \sqrt{x^2 + y^4 + z^6}$.
7. If $f(x, y) = x + y$, find $\frac{\partial f}{\partial x}$ and $\frac{\partial f}{\partial y}$.
8. Use the chain rule to find the derivative of $w = xy$ with respect to θ along the path $x = \cos\theta$, $y = \sin\theta$. What is the derivative's value at $\theta = \frac{\pi}{2}$?
9. Evaluate $\int_0^{\pi/4} \sin^4 2x\,dx$.

P.T.O.

10. Find $\int_0^{\pi/2} \cos^2\theta \, d\theta$.

11. A pyramid 3 m high has a square base that is 3 m on a side. The cross-section of the pyramid perpendicular to the attitude x m down from the vertex is a square x m on a side. Find the volume of the pyramid.

12. Find the area enclosed between $x = 5$, $x = 10$ and $y = x$ and $y = 5 + x$.

13. When can you say that a quadratic form is positive definite ?

14. Find the eigen values of the matrix $\begin{bmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{bmatrix}$

15. Prove that, if B is similar to A, then B has the same eigen values as A.

UNIT – III

Essay type. Answer **any 4** questions. **Each** question carries **3** marks. **(4×3=12)**

16. Show that $f(x,y) = \begin{cases} \dfrac{4x^2y}{x^3+y^3}, & (x,y) \neq (0,0) \\ 0, & (x,y) = (0,0) \end{cases}$ is continuous at every point except the origin.

17. Evaluate $\int_0^{\infty} \dfrac{dx}{(1+x^2)^4}$

18. Find the value of $\int_0^{\pi/2} \cos^3 x \cos 2x \, dx$.

19. The circle $x^2 + y^2 = a^2$ is rotated about the x-axis to generate a sphere. Find its volume.

20. Find the polar coordinates corresponding to the Cartesian coordinate $(-3, \sqrt{3})$.

21. Find a linearly independent eigenvectors of the matrix $\begin{bmatrix} 0 & 16 \\ 4 & 0 \end{bmatrix}$ and diagonalize it.

22. Prove that a square matrix A and its transpose A^T have the same characteristic roots.

UNIT – IV

Long essay type. Answer **any 2** questions. **Each** question carries **5** marks. **(2×5=10)**

23. Verify Euler's theorem on homogeneous functions for the function $u = (x^2 + y^2 + z^2)^{-1/3}$, with $x^2 + y^2 + z^2 \neq 0$.

24. Prove that $\int_0^1 x^{3/2}(1-x)^{3/2}\,dx = \frac{3\pi}{128}$.

25. Evaluate $\iiint_V (x^2 + y^2 + z^2)\,dx\,dy\,dz$ where V is the volume of the cube bounded by the coordinate planes and the planes $x = y = z = a$.

26. Find the characteristic roots of the matrix $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ and then verify Cayley Hamilton theorem. Also express $A^5 - 4A^4 - 7A^3 + 11A^2 - A - 10\,I$ as a linear polynomial in A.

K23U 1998

Reg. No. : .....

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II Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/ Improvement) Examination, April 2023
(2019 Admission Onwards)
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS
2C02 MAT – BCA : Mathematics for BCA – II

Time : 3 Hours

Max. Marks : 40

PART – A

Answer **any 4** questions. **(4×1=4)**

1. Evaluate $\lim_{\substack{x\to 1\\ y\to 1}} \frac{x(y-2)}{y(x-2)}$.
2. Write the reduction formula for $\int \sin^n x\, dx$.
3. State Fubini's theorem.
4. State Cayley-Hamilton theorem.
5. What can you say about the eigenvalues of a triangular matrix ?

PART – B

Answer **any 7** questions. **(7×2=14)**

6. Evaluate $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ for $z = x^2 + 3xy + y - 1$.
7. If $z = xe^y + y + 1$, find $\frac{\partial^2 z}{\partial x \partial y}$.
8. Integrate xe^x.
9. Integrate $\cos^3 x \sin x$.
10. Integrate $1 - 6x^2y$ over the rectangle $0 \le x \le 2, -1 \le y \le 1$.

P.T.O.

11. Write an iterated integral for $\iint_R dA$ over the region bounded by $y = \sqrt{x}$, $y = 0$ and $x = 9$ using both vertical and horizontal cross sections.

12. Find the eigenvalues of the matrix $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$.

13. Define similarity of matrices.

14. Find the matrix corresponding to the quadratic form $2xy + 2yz + 2zx$.

15. Prove that any square matrix and its transpose have the same eigenvalues.

PART – C

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

16. If $z = f(x + ct) + \phi(x - ct)$, prove that $\frac{\partial^2 z}{\partial t^2} = c^2 \frac{\partial^2 z}{\partial x^2}$.

17. If $u = \frac{x^3y^3z^3}{x^3 + y^3 + z^3} + \log\left(\frac{xy + yz + zx}{x^2 + y^2 + z^2}\right)$, find the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z}$.

18. If $I_n = \int_0^{\pi/3} \tan^n x \, dx$, show that $(n - 1)(I_n + I_{n-2}) = \left(\sqrt{3}\right)^{n-1}$.

19. Evaluate $\int_0^{\pi/6} \cos^6 3\theta \sin^2 6\theta \, d\theta$.

20. Find the volume of the region bounded by the elliptical paraboloid $z = 10 + x^2 + 3y^2$ and below by the rectangle $0 \le x \le 1$, $0 \le y \le 2$.

21. Evaluate $\int_0^{\sqrt{2}} \int_0^{3y} \int_{x^2+3y^2}^{8-x^2-y^2} dz \, dx \, dy$.

22. Find the eigenvectors of $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$.

PART – D

Answer **any 2** questions. **(2×5=10)**

23. Transform the equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ into polar coordinates.

24. Evaluate $\int_0^a (a^2 + x^2)^{5/2} dx$.

25. Find the average value of F(x, y, z) = xyz throughout the cubical region D bounded by the coordinate planes and the planes x = 2, y = 2 and z = 2 in the first octant.

26. Verify Cayley Hamilton theorem for the matrix $\begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ and hence obtain A^{-1}. Also express $A^5 - 4A^4 - 7A^3 + 11A^2 - A - 10I$ as a linear polynomial in A.

K22U 1299

Reg. No. : .....

Name : .....

II Semester B.Sc. Degree (C.B.C.S.S. – O.B.E. – Regular/Supplementary/ Improvement) Examination, April 2022
(2019 Admission Onwards)
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS
2C02 MAT – BCA : Mathematics for BCA II

Time : 3 Hours Max. Marks : 40

PART – A

Answer **any four** questions. **Each** question carries **1** mark.

1. If z is a homogeneous function of degree n in x and y, then find $x^2\frac{\partial^2 z}{\partial x^2}+2xy\frac{\partial^2 z}{\partial x\partial y}+y^2\frac{\partial^2 z}{\partial y^2}$.

2. Find the value of $\int_0^{\frac{\pi}{2}}\sin x\,dx$.

3. Evaluate $\int\frac{dx}{2x-5}$.

4. Find the Cartesian equation of the polar equation $r = 2$.

5. Calculate the eigenvalues of a diagonal matrix. **(4×1=4)**

PART – B

Answer **any seven** questions. **Each** question carries **2** marks.

6. State Euler's theorem on homogeneous function.

7. Find the value of $\lim_{\substack{x\to 1\\ y\to 2}}\frac{3x^3y}{x^2+2y^2+4}$.

P.T.O.

8. Evaluate $\int_0^1 \frac{2x}{1+x^2} dx$.
9. What is the reduction formula for $\int \tan^n x \, dx$?
10. Evaluate $\int x \cos x \, dx$.
11. Find the value of $\int_1^2 \int_0^4 xy \, dy \, dx$.
12. Sketch the region of integration $0 \leq x \leq 3$, $0 \leq y \leq 2x$.
13. Define eigenvectors.
14. What is meant by similarity of matrices ?
15. Find the matrix corresponding to the quadratic form $3x^2 + 5y^2 + 3z^2 - 2yz + 2zx - 2xy$. **(7×2=14)**

PART – C

Answer **any four** questions. **Each** question carries **3** marks.

16. Find the value of $\frac{du}{dt}$, given $u = y^2 - 4ax$, $x = at^2$ and $y = 2at$.
17. Evaluate $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ if $z = x^2y - x \sin xy$.
18. Find the value of $\int_0^1 \frac{x^5}{\sqrt{1-x^2}} dx$.
19. Evaluate $\int_{-1}^1 \int_0^1 \int_0^2 (x+y+z) \, dx \, dy \, dz$.
20. Find a polar equation for the circle $(x-3)^2 + (y+1)^2 = 4$.
21. Calculate the eigenvalues and eigenvectors of the matrix $\begin{bmatrix} 10 & 3 \\ 4 & 6 \end{bmatrix}$.
22. Classify the nature of a quadratic form X^TAX. **(4×3=12)**

PART – D

Answer **any two** questions. **Each** question carries **5** marks.

23. If $u = \sin^{-1}\left(\frac{x^2+y^2}{x+y}\right)$, prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \tan u$.

24. Integrate $\frac{x+1}{(x-1)^2(x+2)^2}$ with respect to x.

25. Calculate $\int\int f(x, y)\, dA$ over $R : 0 \le x \le 2, -1 \le y \le 1$, where $f(x, y) = 100 - 6x^2y$.

26. Using Cayley Hamilton theorem find the inverse of the matrix $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$. Also express $A^5 - 4A^4 - 7A^3 + 11A^2 - A - 10I$ as a linear polynomials in A.

(2×5=10)

K21U 3474

Reg. No. : .....

Name : .....

II Semester B.Sc. Degree (CBCSS – OBE – Reg./Sup./Imp.) Examination, April 2021
(2019 Admission Onwards)
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS
2C02 MAT-BCA : Mathematics for BCA II

Time : 3 Hours Max. Marks : 40

PART – A

Answer **any four** questions. **Each** question carries **1** mark.

1. Calculate $\lim_{\substack{x\to 1\\ y\to 2}} \left(\frac{2x^2y}{x^2+y^2+1} \right)$.
2. Show that $\int_0^{\frac{\pi}{2}} \cos^7 x \, dx = {}^{16}/_{35}$.
3. Evaluate $\int \frac{dx}{3x-4}$.
4. Find the Cartesian equation of the polar equation $r \sin \theta = 3$.
5. If $\lambda_1, \lambda_2, \ldots, \lambda_n$ are the eigen values of a matrix A, then find the eigen values of A^m, where m is a positive integer. **(4×1=4)**

PART – B

Answer **any seven** questions. **Each** question carries **2** marks.

6. State Euler's theorem on homogeneous function.
7. Determine whether the function $z = ax^2 + 2hxy + by^2$ is homogeneous or not. If homogeneous write the degree.
8. Evaluate $\int xe^x \, dx$.
9. Find the reduction formula for $\int \tan^n x \, dx$.
10. Calculate $\int_0^{\frac{\pi}{2}} \frac{\cos x}{1+\sin^2 x} dx$.

P.T.O.

11. Find the value of $\int_0^2 \int_{-1}^1 (x - y)\, dy\, dx$.
12. Find a polar equation for the circle $x^2 + (y - 2)^2 = 4$.
13. Define eigen vectors.
14. Find the matrix corresponding to the quadratic form $2x_1x_2 + 2x_1x_3 - 2x_2x_3$.
15. What is meant by similarity of matrices ? **(7×2=14)**

PART – C

Answer **any four** questions. **Each** question carries **3** marks.

16. If $u = x \log(xy)$ where $x^3 + y^3 + 3xy = 1$, find $\frac{du}{dx}$.
17. Verify $\frac{\partial^2 z}{\partial y \partial x} = \frac{\partial^2 z}{\partial x \partial y}$ when $z = x^3 + y^3 - 3axy$.
18. Evaluate $\int_0^a \frac{x^4}{\sqrt{a^2 - x^2}}\, dx$.
19. Find the value of $\int_0^2 \int_0^2 \int_0^2 xyz\, dx\, dy\, dz$.
20. Sketch the region of integration $y^2 \le x \le 4$, $-2 \le y \le 2$.
21. Prove that eigen values of a diagonal matrix are just the diagonal elements of the matrix.
22. Classify the nature of a quadratic form X^TAX. **(4×3=12)**

PART – D

Answer **any two** questions. **Each** question carries **5** marks.

23. Show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 2u \log u$ where $\log u = \frac{x^3 + y^3}{3x + 4y}$.
24. Integrate $\frac{x^2 + x + 1}{(x + 1)^2 (x + 2)}$ with respect to x.
25. Calculate $\iint f(x, y)\, dA$ over $R : 0 \le x \le 1, 0 \le y \le 2$, where $f(x, y) = 6y^2 - 2x$.
26. Verify Cayley Hamilton theorem for the matrix $A = \begin{bmatrix} 2 & 2 & 0 \\ 2 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$. **(2×5=10)**

K20U 0474

Reg. No. : .....

Name : .....

II Semester B.Sc. Degree (CBCSS (OBE) – Regular) Examination, April 2020
(2019 Admission)
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS
2C02 MAT – BCA : Mathematics for BCA II

Time : 3 Hours Max. Marks : 40

PART – A

Answer **any four** questions. **Each** question carries **1** mark.

1. Define homogeneous function of degree n in x and y.
2. Calculate the value of $\int_0^{\frac{\pi}{2}} \sin^7 x \, dx$.
3. Evaluate $\int \frac{1}{x} dx$.
4. Find the Cartesian equation of the polar equation $r \cos \theta = -4$.
5. What is the product of eigen values of a matrix A ? **(4×1=4)**

PART – B

Answer **any seven** questions. **Each** question carries **2** marks.

6. State Euler's theorem on homogeneous function.
7. Find the first order partial derivatives of $z = x^3 + y^3 - 3axy$.
8. Evaluate $\int_0^{\frac{\pi}{2}} \frac{\cos x}{1+\sin^2 x} dx$.
9. What is the reduction formula for $\int \tan^n x \, dx$?
10. Evaluate $\int xe^x \, dx$.
11. Evaluate $\int_1^2 \int_0^4 2xy \, dy \, dx$.
12. Find a polar equation for the circle $x^2 + (y-3)^2 = 9$.

P.T.O.

13. Define eigen vectors.

14. Find the matrix corresponding to the quadratic form $x_1^2 + 2x_1x_2 + 2x_1x_3 - 2x_2x_3$.

15. What is meant by similarity of matrices ? **(7×2=14)**

PART – C

Answer **any four** questions. **Each** question carries **3** marks.

16. Given $u = \sin\left(\frac{x}{y}\right)$, $x = e^t$ and $y = t^2$, find $\frac{du}{dt}$ as a function of t.

17. Find the value of $\int_0^1 x^2(1-x^2)^{\frac{3}{2}}\,dx$.

18. Evaluate $\int \frac{dx}{x^2+2x+2}$.

19. Calculate $\int_0^1\int_0^1\int_0^1 (x^2+y^2+z^2)\,dz\,dy\,dx$.

20. Sketch the region of integration $-1 \le x \le 2$, $x - 1 \le y \le x^2$.

21. Prove that eigen values of a diagonal matrix are just the diagonal elements of the matrix.

22. Classify the nature of a quadratic form X^TAX. **(4×3=12)**

PART – D

Answer **any two** questions. **Each** question carries **5** marks.

23. If $u = \sin^{-1}\left(\frac{x^2+y^2}{x+y}\right)$, prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \tan u$.

24. Evaluate $\int \frac{1}{x^3(x-1)^2(x+1)}\,dx$.

25. Calculate $\iint f(x, y)\,dA$ over $R : 0 \le x \le 2, -1 \le y \le 1$, where $f(x, y) = 100 - 6x^2y$.

26. Using Cayley Hamilton theorem, show that $A^3 - 6A^2 + 11A - 61 = 0$, where

$$A = \begin{bmatrix} 1 & 1 & 2 \\ 0 & 2 & 2 \\ -1 & 1 & 3 \end{bmatrix}$$ and hence find A^{-1}. **(2×5=10)**