K21U 3611

Reg. No. : ....

Name : ....

II Semester B.Sc. Degree (CBCSS – Supple.) Examination, April 2021
(2014 – 2018 Admission)
COMPLEMENTARY COURSE IN MATHEMATICS
2C02 MAT-PH : Mathematics for Physics and Electronics – II

Time : 3 Hours

Max. Marks : 40

SECTION – A

All the **first 4** questions are **compulsory**. They carry **1** mark **each**.

1. What is the area of the surface of a solid obtained on revolving the arc of a curve y = f(x) about x-axis intercepted between x = a and x = b ?

2. What is the value of the integral $\int_0^1 \int_0^1 y \, dy dx$?

3. If $\begin{vmatrix} 1 & x \\ 2 & 2 \end{vmatrix} = 0$, what is the possible value of x ?

4. If $\begin{pmatrix} 1 & 2 \\ x & 3 \end{pmatrix}$ is symmetric, what is the value of x ?

SECTION – B

Answer **any 7** questions from among the questions **5** to **13**. These questions carry **2** marks **each**.

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

6. Find the area of the cardioid $r = a(1 - \cos\theta)$.

7. Find the volume of the solid obtained by revolving one arc of the cycloid $x = a(\theta + \sin\theta)$, $y = a(1 + \cos\theta)$ about the x-axis.

8. If A is a 2 × 2 matrix, show that $A + A^T$ is symmetric.

9. If A is an orthogonal matrix, what we can say about its transpose ? Justify your answer.

10. Row reduce and find the rank of the matrix $A = \begin{pmatrix} 1 & 1 & 2 \\ 2 & 2 & 4 \\ 3 & 3 & 6 \end{pmatrix}$.

11. Give a 2 × 2 matrix with two distinct eigen values. Prove it.

P.T.O.

12. Write the matrix $\begin{pmatrix} 1 & 3 \\ -1 & 4 \end{pmatrix}$ as a sum of a symmetric matrix R and a skew symmetric matrix S.

13. Show that $A = \begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$ satisfies its characteristic equation $(2 - x)(1 - x) = 0$.

SECTION – C

Answer **any 4** questions from among the questions **14** to **19**. These questions carry **3** marks **each**.

14. Evaluate $\int_0^{\pi/4} (\cos 2\theta)^{3/2} \cos\theta \, d\theta$.

15. Find the area of the loop of the curve $x^5 + y^5 = 5ax^2y^2$.

16. The loop of the curve $2ay^2 = x(x - a)^2$ revolves about the straight line $y = a$. Find the volume of the solid generated.

17. Evaluate $\iint xy(x + y)dxdy$ over the area between $y = x^2$ and $y = x$.

18. If A, B are 2×2 matrices of rank 2, show that AB is also of rank 2. Is it true that if A and B are matrices of rank 1, AB is also of rank 1 ? Justify your answer.

19. Prove that the eigen values of a 3×3 upper triangular matrix are the same as its main diagonal elements.

SECTION – D

Answer **any 2** questions from among the questions **20** to **23**. These questions carry **5** marks **each**.

20. Find the area between the curve $x(x^2 + y^2) = a(x^2 - y^2)$ and its asymptote. Also find the area of its loop.

21. Evaluate $\iiint_V (2x + y)dxdydz$, where V is the closed region bounded by the cylinder $z = 4 - x^2$ and the planes $x = 0$, $y = 0$, $y = 2$, $z = 0$.

22. Consider the system

$$x + 2y + 3z = 1$$
$$2x - 3y + 4z = 2$$
$$4x - 6y + az = 2$$

Using row reduction, find for which value of a the system has a unique solution. For which value of a the system has no solution ?

23. Prove that $A = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ is orthogonal. Verify that eigen vectors corresponding to different eigen values are orthogonal.

K21U 3612

Reg. No. : ....

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II Semester B.Sc. Degree (CBCSS – Supple.) Examination, April 2021
(2014-2018 Admission)
COMPLEMENTARY COURSE IN MATHEMATICS
2C02 MAT-CH : Mathematics for Chemistry – II

Time : 3 Hours Max. Marks : 40

SECTION – A

All the **first 4** questions are **compulsory**. They carry **1** mark **each** :

1. Evaluate $\int_0^{\frac{\pi}{2}} \cos^8 x dx$.
2. Find the surface area of the solid generated by revolving about the x-axis, the curve $y = f(x)$ and two ordinates $x = a$ and $x = b$.
3. Give an example of a lower triangular matrix.
4. Evaluate $\begin{vmatrix} \cos\alpha & \sin\alpha \\ \sin\beta & \cos\beta \end{vmatrix}$.

SECTION – B

Answer **any 7** questions from among the questions **5** to **13**. These questions carry **2** marks **each**.

5. Find the value of $\int_0^3 \sqrt{\frac{x^3}{3-x}}\, dx$.
6. Find the whole area included between the curve $x^2y^2 = a^2(y^2 - x^2)$ and its asymptotes.
7. Evaluate $\int_0^{\frac{\pi}{2}} \sin^5 x \cos^6 x dx$.
8. Find the area of the surface generated by resolution of an arc of $y = c \cosh \frac{x}{c}$ about the x-axis.
9. Evaluate $\int_0^{\pi}\int_0^{x} \sin y \, dy dx$.
10. Find the Jacobian $\frac{\partial(x,y)}{\partial(u,v)}$ where $x = u - uv$ and $y = uv$.
11. Find the rank and basis for the row space of $A = \begin{bmatrix} 6 & 0 & -3 & 0 \\ 0 & -1 & 0 & 5 \\ 2 & 0 & -1 & 0 \end{bmatrix}$.

P.T.O.

12. Prove that $A = \begin{bmatrix} 0 & 0 & -1 \\ 0 & -1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$ is orthogonal.

13. Given $A = \begin{bmatrix} 1 & 2 \\ 1 & 1 \end{bmatrix}$, using Cayley Hamilton theorem find A^2.

SECTION – C

Answer **any 4** questions from among the questions **14** to **19**. These questions carry **3** marks **each**.

14. Find the whole length of the curve $x^2(a^2 - x^2) = 8a^2y^2$.
15. Find the volume of the solid obtained by revolving one arc of the cycloid $x = a(\theta + \sin\theta)$, $y = a(1 + \cos\theta)$ about the x-axis.
16. Using Gauss-Jordan elimination, find the inverse of $A = \begin{bmatrix} -1 & 1 & 2 \\ 3 & -1 & 1 \\ -1 & 3 & 4 \end{bmatrix}$.
17. Using Cramer's rule, solve $2x - y = 5.15$, $3x + 9y = 6.15$.
18. Identify the conic section is given by the quadratic form $Q = 3x_1^2 + 22x_1x_2 + 3x_2^2 = 0$.
19. Given $A = \begin{bmatrix} 1 & 2 \\ 1 & 1 \end{bmatrix}$, using Cayley Hamilton theorem find A^3.

SECTION – D

Answer **any 2** questions from among the questions **20** to **23**. These questions carry **5** marks **each**.

20. Find the intrinsic equation of the astroid $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$, when S is measured from the cusp on the x-axis.
21. Find the volume of the solid obtained by revolving $r^2 = a^2\cos 2\theta$ about the initial line.
22. Solve the system of equations :
    $3x - 2y + z = 13$
    $-2x + y + 4z = 11$
    $x + 4y - 5z = -31$.
23. Diagonalize $A = \begin{bmatrix} -1 & 2 & -2 \\ 2 & 4 & 1 \\ 2 & 1 & 4 \end{bmatrix}$.

15/9/22

K22U 1294

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-PH : Mathematics for Physics – II

Time : 3 Hours Max. Marks : 40

UNIT – I

Short answer type. Answer **any 4** questions.

1. Find $\frac{\partial z}{\partial x}$ if $z = \cos(x^3y) + 2x^2y^2$.
2. Find the characteristic polynomial of $A=\begin{bmatrix} 1 & 2 \\ 4 & 3 \end{bmatrix}$.
3. Evaluate $\int_0^{\frac{\pi}{2}} \sin x \cos x \, dx$.
4. Find the area bounded by $y = 2x^3$, x axis and the line $x = 3$.
5. State Cayley – Hamilton theorem. **(4×1=4)**

UNIT – II

Short essay type. Answer **any 7** questions.

6. Evaluate $\lim_{(x,y)\to(0,0)} \frac{x^2-y^2}{x+y}$.
7. Evaluate $\int \cos^3 x \, dx$.
8. If $u = x^3y^4$, $x = t^3$, $y = 2t$, find $\frac{du}{dt}$.
9. Evaluate $\int_0^1 \frac{2x-4}{\sqrt{1+x^2}} dx$.

P.T.O.

10. Evaluate $\int \cos^4 x \sin^3 x \, dx$.

11. Write the reduction formula for $\int \tan^n x \, dx$.

12. Find the area between y = 4x and $y = x^2$.

13. Find the volume of the solid generated by revolving $y = x^{\frac{1}{2}}$, $0 \le x \le 4$ about X axis.

14. Find the eigen value of $\begin{bmatrix} 3 & 3 \\ 4 & 1 \end{bmatrix}$.

15. Reduce the matrix $A = \begin{bmatrix} 2 & 5 \\ 0 & 6 \end{bmatrix}$ to the diagonal form.

16. Reduce the quadratic form 5xy + 2yz + zx into canonical form. (7×2=14)

UNIT – III

Essay type. Answer **any 4** questions.

17. If $u = \frac{x}{x+z} + \frac{y}{y+x} + \frac{z}{z+y}$, find $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z}$.

18. Find the value of $\frac{du}{dt}$ given that u = y – 2ax + 2, $x = at^3$, y = at.

19. Evaluate $\int \sec^4 x \, dx$.

20. Find the area of surface generated by revolving $y = x^2$, $0 \le x \le 3$ about X axis.

21. Find the length of the cardioid $r = 2 - 3\cos\theta$.

22. Find the eigen vector of $A = \begin{bmatrix} 4 & 3 \\ 2 & 2 \end{bmatrix}$.

23. Verify Cayley Hamilton theorem for $A = \begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix}$. (4×3=12)

UNIT – IV

Long essay type. Answer **any 2** questions.

24. Find $\int_0^{\pi/2} x \sin^6 x \cos^4 x \, dx$.

25. If $\phi(n) = \int_0^{\pi/4} \tan^n x \, dx$, show that $\phi(n) + \phi(n-2) = \frac{1}{n-1}$ and deduce the value of $\phi(5)$.

26. Find the area of the region in the plane enclosed by the cardioid $r = 2(1 - \cos\theta)$.

27. Reduce the quadratic form $2x^2 + 4y^2 + 2z^2 - 5yz + 4zx - 3xy$ to the canonical form and specify the matrix of transformation. **(2×5=10)**

K22U 1295

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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 – CH : Mathematics for Chemistry – II

Time : 3 Hours Max. Marks : 40

PART – A

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

1. Let $u(x, y) = \frac{1}{x^2+xy+y^2}$. Write the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$.

2. Evaluate $\int_0^{\frac{\pi}{2}} \sin^3 x \, dx$.

3. Graph the set of points whose polar co-ordinates satisfy $-3 \le r \le 2$ and $\theta = \frac{\pi}{4}$.

4. Find the value of the integral $\int_0^1\int_1^2\int_0^3 4 \, dxdydz$.

5. If λ is an eigenvalue of the matrix A, prove that λ^2 is an eigenvalue of A^2.

PART – B

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

6. Find the limit of $\frac{x(y-1)}{y(x-1)}$ when x and y tends to 1, if it exists.

7. If $u = x^2 + y^2 + z^2$, $x = e^t$, $y = e^t\sin t$ and $z = e^t\cos t$, prove that $\frac{du}{dt} = 4e^{2t}$.

P.T.O.

8. Show that $\int_0^{\pi} \sin^7(x/2)\,dx = \frac{32}{35}$.

9. Evaluate $\int_0^{\pi} \sin^6\theta \cdot \cos^4\theta\, d\theta$.

10. Find the area of the region bounded by the parabola $y = 2 - x^2$ and the line $y = -x$.

11. Find all polar co-ordinates of the point $P(3, \pi/6)$.

12. Find the perimeter of the circle $x^2 + y^2 = a^2$ using polar co-ordinates.

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

14. Find the average value of $f(x, y) = x\cos(xy)$ over the rectangle $R : 0 \le x \le \pi, 0 \le y \le 1$.

15. Find all characteristic values of the matrix $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$. Hence find the characteristic vector associated with any one characteristic value.

PART – C

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

16. If $u = \sin^{-1}\left(\frac{\sqrt{x} - \sqrt{y}}{\sqrt{x} + \sqrt{y}}\right)$, show that $\frac{\partial u}{\partial x} = -\frac{y}{x}\frac{\partial u}{\partial y}$.

17. If $u = e^{x^2+y^2}$, show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 3u\log u$.

18. Using reduction formula, evaluate $\int \tan^4 x\, dx$.

19. Evaluate $\int_0^a \frac{x^7}{\sqrt{a^2 - x^2}}\, dx$.

20. Evaluate $\iint xy\, dx\, dy$ over the positive quadrant of the circle $x^2 + y^2 = a^2$.

21. Verify Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ and hence find its inverse.

22. Find the nature of the quadratic form $3x^2 + 5y^2 + 3z^2 - 2yz + 2zx - 2xy$.

PART – D

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

23. If $u = x\log(xy)$, where $x^3 + y^3 + 3xy = 1$, find $\frac{dy}{dx}$ and hence find $\frac{du}{dx}$.

24. Evaluate $\int_0^1 x^{3/2}(1-x)^{3/2}\,dx$.

25. Find the area of the region R enclosed by the parabola $y = x^2$ and the line $y = x + 2$ using double integrals. Graph the required area.

26. Find the characteristic values and characteristic vectors of the matrix

$$A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}.$$
