K23U 4077

I Semester B.Sc. Degree (C.B.C.S.S. – O.B.E. – Regular/Supplementary/ Improvement) Examination, November 2023
(2019 Admission Onwards)
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS
1C01 MAT – BCA : Mathematics for BCA – I

Time : 3 Hours   Max. Marks : 40

SECTION – A

Questions **1-5** : Answer **any 4** questions. **Each** question carries 1 mark.   **(4×1=4)**

1. What is the derivative of $y = x^5 - x^3 + x$?

2. What is the derivative of $y = a^x$?

3. What do you mean by dual of a statement in Boolean Algebra ?

4. What do you mean by rank of a matrix ?

5. State Rouche's theorem in matrices.

SECTION – B

Questions **6-15** : Answer **any 7** questions. **Each** question carries 2 marks.   **(7×2=14)**

6. Find the derivative of $y = \sec^{-1} x$.

7. If $y = e^{ax} \sin bx$, prove that $y_2 - 2ay_1 + (a^2 + b^2)y = 0$.

8. Find the nth derivative of $y = \cos(ax + b)$.

9. State Leibnitz theorem to find the nth derivative of product of two functions.

10. State any four basic theorems in Boolean Algebra.

11. Let $a, b \in B$, a Boolean Algebra. Prove that $a + b$ is an upper bound for the set $\{a, b\}$.

12. Define normal form of a matrix. Give an example.

13. Find the rank of the matrix $\begin{bmatrix} 1 & 4 & 5 \\ 2 & 6 & 8 \\ 3 & 7 & 22 \end{bmatrix}$.

14. Define an orthogonal matrix. Give an example.

15. Define linear dependence and independence of vectors.

P.T.O.

SECTION – C

Questions **16-22** : Answer **any 4** questions. **Each** question carries **3** marks. **(4×3=12)**

16. Find $\dfrac{dy}{dx}$ when $x = 2\cos t - \cos 2t$, $y = 2\sin t - \sin 2t$.

17. Find $\dfrac{dy}{dx}$ when $x^3 + y^3 = 3axy$.

18. Find the nth derivative of $y = e^x \cos^2 x \sin x$.

19. Find the nth derivative of $y = \dfrac{x}{(x-1)(2x+3)}$.

20. Define Boolean Algebra. Give an example.

21. Using Cramer's rule solve the system of equations :
    $3x + y + 2z = 3$, $2x - 3y - z = -3$, $x + 2y + z = 4$.

22. Find the values of k for which the system of equations
    $(3k - 8)x + 3y + 3z = 0$, $3x + (3k - 8)y + 3z = 0$, $3x + 3y + (3k - 8)z = 0$ has a non-trivial solution.

SECTION – D

Questions **23-26** : Answer **any 2** questions. **Each** question carries **5** marks. **(2×5=10)**

23. If $y^{\cot x} + (\tan^{-1} x)^y = 1$, find $\dfrac{dy}{dx}$.

24. If $y = (\sin^{-1} x)^2$, prove that $(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - n^2 y_n = 0$.

25. State and prove DeMorgan's Law.

26. Reduce the matrix $\begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$ into normal form and hence find its rank.

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(2019 Admission Onwards)
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS
1C01 MAT-BCA : Mathematics for BCA – I

Time : 3 Hours   Max. Marks : 40

SECTION – A

Questions **1 – 5**, answer **any four** questions. **Each** question carries **one** mark.

1. Find the derivative of $\sec^2 x$.

2. Find the derivative of $\tan^{-1}\left(\dfrac{1-\tan x}{1+\tan x}\right)$

3. Write the dual of the following statement :

   $x + (y * z) = (x + y) * (x + z)$

4. Find the rank of the matrix $\begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}$

5. Show that A' is orthogonal if A is orthogonal.

SECTION – B

Questions **6 – 15**, answer **any seven** questions. **Each** question carries **two** marks.

6. Find the derivative of $\log\left(\sqrt{x^2+1}\right)$.

7. Given that $y = 3\sin x - \cos x$. Prove that $y_2 = y$.

8. Find the nth derivative of $\sin(2x)$.

P.T.O.

9. Given that x = cos t, y = sin t. Find $\dfrac{d^2y}{dx^2}$.

10. Prove that in a Boolean algebra B, x″ = x for all x ∈ B.

11. Prove that in a Boolean algebra B, (x * y)′ = 0 if and only if x * y = x.

12. Find the normal form of the matrix $\begin{pmatrix} 1 & -2 & 0 \\ 2 & 1 & 0 \\ 0 & 0 & 0 \end{pmatrix}$

13. Show that the matrix $\begin{pmatrix} \cos t & -\sin t \\ \sin t & \cos t \end{pmatrix}$ is orthogonal for all values of t.

14. Find the value of 'a' such that the rank of the matrix $\begin{pmatrix} 1 & 2 & 0 \\ 2 & a & 0 \\ 0 & 1 & a \end{pmatrix}$ is 2.

15. Does the set of equations 2x + y = 0, x − y = −1 are consistant ? Justify your answer.

SECTION – C

Questions **16 – 22**, answer **any four** questions. **Each** question carries **three** marks.

16. Show that $\dfrac{d}{dx}\left(\tan^{-1}x\right) = \dfrac{1}{1+x^2}$

17. Find $\dfrac{dy}{dx}$, if $y = \dfrac{\sin x + \cos x}{\sin x - \cos x}$.

18. Given that x² + y² + xy + x + y + 1 = 0. Find $\dfrac{dy}{dx}$.

19. Find the nth derivative of cos² (3x).

P.T.O.

20. Prove the following :

   For any x in a Boolean algebra B, x + x = x.

21. Solve the system of equations $x + 2y - z = 3$, $x - z = 1$, $-x + 4y + z = 5$ using Crammer's rule.

22. Show that the vectors $x_1 = (1, 2, 3)$, $x_2 = (2, 1, 3)$, $x_3 = (1, -2, 3)$ are linearly independent.

SECTION – D

Questions **23 – 26**, answer **any two** questions. **Each** question carries **five** marks.

23. If $y = e^{m\cos^{-1}x}$, prove that $(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - (n^2 + m^2)y_n = 0$.

24. Find $\dfrac{dy}{dx}$ for the following :

   a) $y = x^x + (\sin x)^x$

   b) $y = \log(1 + \sin x)$.

25. If $x + y = 1$ and $x.y = 0$ in a Boolean Algebra B, prove that $y = x'$.

26. Test for consistency of the system of linear equations and solve them if consistant :

   $x - y = 0$, $x + z = 2$, $x + y + z = 3$.

K21U 6804

Reg. No. : ....

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I Semester B.Sc. Degree (CBCSS – O.B.E. – Regular/Supplementary/ Improvement) Examination, November 2021
(2019 Admission Onwards)
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS
1C01 MAT-BCA : Mathematics for BCA I

Time : 3 Hours

Max. Marks : 40

PART – A

Answer **any 4** questions from this Part. **Each** question carries **1** mark.

1. Derive the derivative of tan x.

2. Find the derivative of $\sin^{-1}\left(\dfrac{2x}{1+x^2}\right)$.

3. Write the dual of the following statement.

   $a + a'b = a + b$.

4. If the rank of the matrix $\begin{bmatrix} 1 & 2 \\ 3 & \lambda \end{bmatrix}$ is 1, find λ.

5. If A is an orthogonal square matrix, then prove that $|A| = \pm 1$.

PART – B

Answer **any 7** questions from this Part. **Each** question carries **2** marks.

6. Find the derivative of $\sqrt{\sin\sqrt{x}}$.

7. If $y = \sin^{-1}x$, prove that $(1 - x^2)\, y_2 - 2xy_1 = 0$.

8. Find the nth derivative of $e^{2x} \sin x \sin 2x$.

P.T.O.

9. If $x = \frac{1}{2}\left(t + \frac{1}{t}\right)$, $y = \frac{1}{2}\left(t - \frac{1}{t}\right)$, find $\frac{d^2y}{dx^2}$.

10. Prove that in a Boolean algebra B, $a + 1 = 1$ for all $a \in B$.

11. Show that the power set of $A = \{a, b\}$ is a Boolean algebra.

12. Solve the system of equations $x + y + z = 3$, $2x + 4y - z = 0$, $x - 3y + 2z = 5$.

13. Find value of a and b, if $A = \frac{1}{\sqrt{2}}\begin{bmatrix} a & 1 \\ b & -1 \end{bmatrix}$ is orthogonal.

14. Determine the rank of the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 3 & 2 \\ 1 & 1 & 4 \end{bmatrix}$.

15. Test for consistency the equations $x + y + z = 2$, $x + 2y + 3z = 4$, $x + 3y + 4z = 5$.

PART – C

Answer **any 4** questions from this Part. **Each** question carries **3** marks.

16. Derive the derivative of $\cos^{-1} x$.

17. Find $\frac{dy}{dx}$, if $y = \dfrac{x^{\frac{1}{2}}(1 - 2x)^{\frac{2}{3}}}{(2 - 3x)^{\frac{3}{4}}(3 - 4x)^{\frac{4}{5}}}$.

18. If $x^3 + y^3 = 3axy$, prove that $\dfrac{d^2y}{dx^2} = -\dfrac{2a^2xy}{(y^2 - ax)^3}$.

19. Find the nth derivative of $\dfrac{1}{x^2 + a^2}$ in terms of r and θ.

20. State and prove absorption laws.

21. Find the value of λ and μ so that the system of equations $4x + 5y + 6z = 16$, $x - 5z = -9$, $x + 2y + \lambda z = \mu$ has (i) no solution, (ii) unique solution, (iii) infinite number of solutions.

22. Are the vectors $x_1 = (1, 3, 4, 2)$, $x_2 = (3, -5, 2, 2)$, $x_3 = (2, -1, 3, 2)$, linearly independent ? If so, express one of these as a linear combination of the others.

PART – D

Answer **any 2** questions from this Part. **Each** question carries **5** marks.

23. Find the derivatives of the following.

    a) $y = \dfrac{x \sin^{-1} x}{\sqrt{1-x^2}}$.

    b) $x^{\tan x} + (\sin x)^{\cos x}$.

24. If $y = e^{a \cos^{-1} x}$, prove that $(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - (a^2 + n^2)y_n = 0$. Further, find $(y_n)_0$.

25. Show that the following statements are equivalent in a Boolean algebra.

    a) $a + b = a$

    b) $a * b = b$

    c) $a + b = 1$

    d) $a * b' = 0$.

26. a) Using Gauss-Jordan method find the inverse of the matrix $\begin{bmatrix} 1 & 2 \\ 1 & 3 \end{bmatrix}$.

    b) Solve by Cramer's rule the system of equations $4x + 5y + 6z = 16$, $x - 5z = -9$, $x + 2y + 3z = 7$.

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Reg. No. : ....

Name : ....

K20U 3326

I Semester B.Sc. Degree CBCSS (OBE) Reg./Sup./Imp.
Examination, November 2020
(2019 Admn. Onwards)
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS
1C01MAT-BCA : Mathematics for BCA – I

Time : 3 Hours

Max. Marks : 40

PART – A

Questions **1 – 5**. Answer **any 4** questions. **Each** question carries **1 mark**.

1. Define equivalent matrices.

2. Write the nth derivative of $\sin(ax + b)$.

3. Define linear dependence.

4. Find the derivative of $\sin^3 x$.

5. State complement laws in Boolean algebra.

PART – B

Questions **6 – 15**. Answer **any 7** questions. **Each** question carries **2 marks**.

6. Solve $2x + 3y = 5$.
   $3x - 2y = 1$ using Cramer's rule.

7. Show that the vectors $(1, 3, 4, 2)$, $(3, -5, 2, 2)$ and $(2, -1, 3, 2)$ are linearly dependent.

8. Define subalgebra. Give an example.

9. Find the derivative of $\sqrt{\sec(2x+3)}$.

10. Find the derivative of $\tan x . \tanh x$.

11. Find the nth derivative of $\dfrac{x^2 + 3x + 3}{x + 1}$.

12. Find the rank of matrix $\begin{bmatrix} 1 & 3 \\ 1 & -4 \\ -1 & 3 \end{bmatrix}$ by reducing it to normal form.

13. If $x^2 + y^2 = 1$ find $\dfrac{d^2y}{dx^2}$.

P.T.O.

14. State De Morgan's laws in Boolean algebra.

15. State Leibnitz's theorem for n^{th} derivatives.

PART – C

Questions **16 – 22**. Answer **any 4** questions. **Each** question carries **3** marks.

16. Find the rank of $\begin{bmatrix} 3 & -1 & 2 \\ -6 & 2 & 4 \\ -3 & 1 & 2 \end{bmatrix}$.

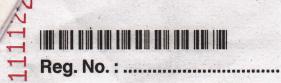17. Find the nth derivative of $\dfrac{x}{x^2 - 1}$.

18. If $(1 - x^2)\, y_2 - xy_1 - a^2 y = 0$ prove that
$(1 - x^2)\, y_{n+2} - (2n + 1)\, xy_{n+1} - (n^2 + a^2)y_n = 0$.

19. Define dual of a statement. State and prove principle of duality.

20. Find $\dfrac{\partial y}{\partial x}$ if $x = a[\cos t + \log\tan(t/2)]$, $y = a\sin t$.

21. For the matrix $A = \begin{bmatrix} 1 & -1 & -1 \\ 1 & 1 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ find two non-singular matrices P and Q such that
PAQ is in normal form.

22. Find the derivative of $\tan^{-1}\left(\dfrac{2x}{1 - x^2}\right)$ with respect to $\sin^{-1}\left(\dfrac{2x}{1 + x^2}\right)$.

PART – D

Questions **23 – 26**. Answer **any 2** questions. **Each** question carries **5** marks.

23. Using partition method find the inverse of $\begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$.

24. If $y = e^{a\sin^{-1}x}$, show that $(1 - x^2)\, y_{n+2} - (2n+1)xy_{n+1} - (n^2 + a^2)y_n = 0$.

25. Define Boolean algebra and give two examples.

26. Differentiate $[x^{\tan x} + \sin x^{\cos x}]$.

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Reg. No. : ....

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K19U 3326

I Semester B.Sc. Degree (CBCSS(OBE) - Regular)
Examination, November - 2019
(2019 Admissions)
Complementary Elective Course in MATHEMATICS
1C01MAT-BCA : MATHEMATICS FOR BCA 1

Time : 3 Hours   Max. Marks : 40

Part - A
(Questions 1 - 5)

Answer any **Four** questions. Each Question carries **1** mark.

1. Find the derivative of $\dfrac{\sin x}{\cos x}$.

2. If A is an orthogonal matrix then Show that $A^{-1} = A^1$.

3. State Rouche's theorem.

4. State involution law, in Boolean Algebra.

5. Write the nth derivative of ax+b.

Part - B
(Questions 6-15)

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

6. Test the consistency of the following system of equations

   $2x+6y+11 = 0$

   $6x+20y-6z+3 = 0$

   $6y-18z+1 = 0$

P.T.O.

7. Find the inverse of the matrix $\begin{bmatrix} 1 & 3 \\ -1 & 2 \end{bmatrix}$.

8. Give example for two isomorphic Boolean algebras.

9. Find the derivative of $\tan^{-1}(\sin x)$.

10. Find the nth derivative of $\sin x \cdot \cos x$.

11. Show that the transformation

$$Y_1 = 2x_1 + x_2 + x_3$$
$$Y_2 = x_1 + x_2 + 2x_3$$
$$Y_3 = x_1 - 2x_3 \qquad \text{is regular.}$$

12. If $xy = 1$ find $\dfrac{d^2y}{dx^2}$.

13. State Demorgan's laws in Boolean algebra.

14. Find the derivative of $\dfrac{x^2+1}{x^2-1}$.

15. Find the derivative of x^2 using first principles.

Part - C

(Questions 16-22)

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

16. Solve the system of equations

$$3x+y+2z = 3$$
$$2x-3y-z = -3$$
$$x+2y+z = 4$$

by Cramer's rule

17. Find the nth derivative of $x^2\cos x$.

18. If $y=\sin(m\sin^{-1}x)$ prove that $(1-x^2)y_{n+2} - 2(n+1)xy_{n+1} - (m^2 - n^2)y_n = 0$.

19. Define dual of a statement. State and prove principle of duality.

20. Find $\dfrac{\partial y}{\partial x}$ if $x = a\cos^3 t$, $y = a\sin^3 t$.

21. For the matrix $A = \begin{bmatrix} 1 & 2 & 3 & -2 \\ 2 & -2 & 1 & 3 \\ 3 & 0 & 4 & 1 \end{bmatrix}$ find two nonsingular matrices P and Q

such that PAQ is in normal form.

22. Find the derivative of $\sin^{-1}\left(\dfrac{2x}{1-x^2}\right)$ with respect to $\tan^{-1}x$.

Part - D

(Questions 23-26)

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

23. Using partition method find the inverse of $\begin{bmatrix} 3 & 2 & 4 \\ 2 & 1 & 1 \\ 1 & 3 & 5 \end{bmatrix}$.

24. Find the nth derivative of $\dfrac{x}{(x-1)(2x+3)}$.

25. Define Boolean algebra and sub algebra. Give an example.

26. Differentiate $\dfrac{x^{\frac{1}{2}}(1-2x)^{\frac{2}{3}}}{(2-3x)^{\frac{3}{4}}(3-4x)^{\frac{4}{5}}}$.

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