

**FIRST SEMESTER B.C.A. DEGREE EXAMINATION, NOVEMBER 2021**

(CUCBCSS-UG)

**CC17U BCA1 C01 - MATHEMATICAL FOUNDATIONS OF COMPUTER APPLICATIONS**

(Complementary Course)

(2017, 2018 Admissions - Supplementary/Improvement)

Time: 3.00 Hours

Maximum: 80 Marks

**Part A**Answer *all* questions. Each question carries 1 mark.1. Check whether the matrix  $\begin{pmatrix} 3 & 4 \\ -2 & 2 \end{pmatrix}$  is singular or not.2. Find the characteristic polynomial of the matrix  $\begin{pmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{pmatrix}$ 

3. Define symmetric matrix.

4. Find the eigen values of the matrix  $\begin{pmatrix} -2 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & 3 \end{pmatrix}$ 5. If  $\vec{a} = 2\hat{i} + 3\hat{j} - 4\hat{k}$  and  $\vec{b} = -\hat{i} + 4\hat{k}$ , find  $\vec{a} \cdot \vec{b}$ .6. Evaluate the limit  $\lim_{x \rightarrow 3} x^2 - 5x + 1$ .7. Find  $\frac{dy}{dx}$  if  $y = \sin(x^2 + 3)$ .8. Evaluate the integral  $\int \frac{x^3 - 3x + 1}{x} dx$ .9. Evaluate  $\int_0^{\frac{\pi}{4}} \cos x dx$ .

10. State First Fundamental Theorem of calculus.

**(10 × 1 = 10 Marks)****Part B**Answer *all* questions. Each question carries 2 marks.11. Find the inverse of the matrix  $\begin{pmatrix} 2 & -8 \\ -1 & 5 \end{pmatrix}$ 12. Find the determinant of the matrix  $\begin{pmatrix} 3 & -2 & 4 \\ 1 & 1 & 5 \\ 2 & -1 & 4 \end{pmatrix}$ 13. Find  $\frac{dy}{dx}$  if  $x^2 + 2x + 3y + 2 = 10$ .14. Find  $f'(-2)$ , if  $f(x) = x^2 e^{2x}$ .15. Evaluate the integral  $\int x e^{x^2} dx$ .**(5 × 2 = 10 Marks)**

### Part C

Answer any **five** questions. Each question carries 4 marks.

16. Find  $2A - 3B$ , if  $A = \begin{pmatrix} 7 & -2 & 1 \\ 2 & 3 & -4 \end{pmatrix}$  and  $B = \begin{pmatrix} 2 & -4 & 3 \\ 5 & 1 & -1 \end{pmatrix}$ .

17. Find the rank of the matrix  $\begin{pmatrix} 2 & 3 & 4 \\ 3 & 1 & 2 \\ -1 & 2 & 2 \end{pmatrix}$

18. Solve the following system of equations using Gauss-Jordan method.

$$\begin{aligned} 2x - 3y &= 3 \\ 4x - 2y &= 10 \end{aligned}$$

19. Evaluate  $\lim_{h \rightarrow 0} \frac{\sqrt{2+h} - \sqrt{2}}{h}$ .

20. Differentiate  $\frac{1}{x}$  from first principle.

21. Find  $\frac{dy}{dx}$ , if  $\sin^2 x + \cos^2 y = 1$ .

22. Evaluate the integral  $\int \frac{x}{(x+1)(x+2)} dx$ .

23. Evaluate the integral  $\int \frac{\sin(\tan^{-1}(x))}{1+x^2} dx$ .

**(5 × 4 = 20 Marks)**

### Part D

Answer any **five** questions. Each question carries 8 marks.

24. (i) If  $A = \begin{pmatrix} 6 & 9 \\ 2 & 3 \end{pmatrix}$  and  $B = \begin{pmatrix} 2 & 6 & 0 \\ 7 & 9 & 8 \end{pmatrix}$ , find  $AB$ .

(ii) If  $B = \begin{pmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{pmatrix}$ , find  $B + B^T$ .

25. Solve the following system of equations using Gauss elimination method.

$$\begin{aligned} x + y + z &= 3 \\ x + 2y + 3z &= 4 \\ x + 4y + 9z &= 6 \end{aligned}$$

26. Find  $A^{-1}$ , if  $A = \begin{pmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{pmatrix}$

27. Prove that the determinant of the matrix  $A = \begin{pmatrix} -a^2 & ab & ac \\ ba & -b^2 & bc \\ ca & cb & -c^2 \end{pmatrix}$  is  $4a^2b^2c^2$ .

28. Find the eigen values and eigen vectors of the matrix  $\begin{pmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{pmatrix}$

29. (i) Find all derivatives of  $y = x^4 + 5x^2 + 4x - 11$ .

(ii) Differentiate  $\frac{e^x}{\sin 2x}$  with respect  $x$ .

30. (i) Evaluate the integral  $\int (4x+2)\sqrt{x^2+x+1} dx$ .

(ii) Evaluate the integral  $\int \sin^3 x \cos^2 x dx$ .

31. (i) Evaluate the integral  $\int \frac{x^2+1}{x^2-5x+6} dx$

(ii) Evaluate the integral  $\int x^2 e^x dx$ .

**(5 × 8 = 40 Marks)**

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