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B.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2018.

First/Third Semester

Mathematics — Allied

ALGEBRA AND DIFFERENTIAL EQUATIONS

(For those who joined in July 2016 onwards)

Time : Three hours

Maximum : 75 marks

SECTION A — ($10 \times 1 = 10$ marks)

Answer ALL questions.

Choose the correct answer.

1. If the roots of the equation $x^3 - 7x^2 + 14x - 8 = 0$ are $\frac{a}{r}$, a , ar then the value of 'a' is _____.
- (a) 8 (b) -8
(c) -2 (d) 2

2. If $f(x) = 0$ is a reciprocal equation of second type and even degree, then _____ is a factor of $f(x)$.

- (a) $x + 1$ (b) $x - 1$
(c) $x^2 - 1$ (d) $x^2 + 1$

3. When the roots of the equation $3x^3 - 10x^2 + 9x + 2 = 0$ are multiplied by 3 the transformed equation is _____.

- (a) $3x^3 - 100x^2 + 900x + 2000 = 0$
(b) $27x^3 - 90x^2 + 27x + 2 = 0$
(c) $3x^3 - 30x^2 + 81x + 54 = 0$
(d) $x^3 - \frac{10}{3}x^2 + 3x + \frac{2}{3} = 0$

4. The negative roots of $f(x) = 0$ are _____.

- (a) positive roots of $f(-x) = 0$
(b) positive roots of $\frac{1}{f(x)} = 0$
(c) positive roots of $-f(x) = 0$
(d) negative roots of $f(-x) = 0$



5. The characteristic equation of the matrix

$$A = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix} \text{ is } \underline{\hspace{2cm}}.$$

- (a) $x^2 = 0$ (b) $x^2 - 1 = 0$
(c) $1 - x^2 = 0$ (d) $x - 1 = 0$

6. The sum of the eigen values of $\begin{bmatrix} \cos \theta & -\sin \theta \\ -\sin \theta & -\cos \theta \end{bmatrix}$ is

$\underline{\hspace{2cm}}.$

- (a) 0 (b) 1
(c) $2\cos \theta$ (d) $\cos^2 \theta$

7. The partial differential equation from $Z = ax + by$ is $\underline{\hspace{2cm}}.$

- (a) $Z = p^2x + q^2y$ (b) $Z = p^2x - q^2y$
(c) $Z = px + qy$ (d) $Z = px - qy$

8. The solution of $p^2 - 3p + 2 = 0$ is $\underline{\hspace{2cm}}.$

- (a) $(y - 2x + c_1)(y + x + c_2) = 0$
(b) $(y - 2x - c_1)(y - x - c_2) = 0$
(c) $(y - 3x - c_1)(y + 3x - c_2) = 0$
(d) $(y - 4x - c_1)(y + 4x - c_2) = 0$

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9. $L[e^{-t}t^3] = \underline{\hspace{2cm}}.$

- (a) $\frac{1!}{(s+1)^4}$ (b) $\frac{2!}{(s+1)^4}$
(c) $\frac{4!}{(s+1)^2}$ (d) $\frac{3!}{(s+1)^4}$

10. $L^{-1}\left[\frac{s}{s^2+9}\right] = \underline{\hspace{2cm}}.$

- (a) $\cos 9t$ (b) $\sin 9t$
(c) $\cos 3t$ (d) $\sin 3t$

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Solve the equation $2x^3 - 11x^2 + 38x - 39 = 0$ if one root is $2 - 3i$.

Or

- (b) Solve the equation $x^3 - 4x^2 - 3x + 18 = 0$, given that two of the roots are equal.

12. (a) Increase the roots of the equation $x^4 - x^3 - 10x^2 + 4x + 24 = 0$ by 2.

Or

- (b) Find by Newton's method, the positive root of $x^3 - 3x + 1 = 0$.

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[P.T.O.]



13. (a) Find the characteristic equation of

$$A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}.$$

Or

- (b) If $A = \begin{bmatrix} 2 & 4 \\ 1 & 1 \end{bmatrix}$, find A^3 and A^{-3} .

14. (a) Solve : $p^2 + px^3 - 2x^2y = 0$.

Or

- (b) Form the partial differential equation by eliminating the arbitrary function 'f' from $lx + my + nz = f(x^2 + y^2 + z^2)$.

15. (a) Find $L[\cos 3t - \cos 2t]$.

Or

- (b) Find $L^{-1}\left[\frac{s-3}{s^2+4s+13}\right]$.

SECTION C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) Show that the roots of the equation $px^3 + qx^2 + rx + s = 0$ are in G.P. if and only if $r^3p = q^3s$.

Or

- (b) Solve : $6x^5 + 11x^4 - 33x^3 - 33x^2 + 11x + 6 = 0$.

17. (a) Solve $x^4 - 12x^3 - 48x^2 - 72x + 35 = 0$ by removing the second term.

Or

- (b) Using Horner's method, find the real root of the equation $x^3 + 6x - 2 = 0$ correct to two decimal places.

18. (a) Find the eigen values and eigen vectors of

$$A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}.$$

Or

- (b) Verify Cayley-Hamilton theorem for

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 1 \\ 1 & 1 & 2 \end{bmatrix} \text{ and also use it to find } A^{-1}.$$



19. (a) Solve : $xyp^2 + (3x^2 - 2y^2)p - 6xy = 0$

Or

(b) Solve : $(x^2 - yz)p + (y^2 - z)q = z^2 - xy$.

20. (a) Find :

(i) $L\left[\frac{1 - \cos t}{t}\right]$

(ii) $L^{-1}\left[\frac{1}{s(s+1)(s+2)}\right]$.

Or

(b) Using Laplace transform solve
 $y'' - 4y' - 5y = te^t$, given that $y(0) = 0$,
 $y'(0) = 0$.

