# Assignment 2

EE24BTECH11002 - Agamjot Singh

SECTION - B JEE MAIN/AIEEE

20) Let $a, b, c$ be such that $b(a + c) \neq 0$ if

$$\begin{vmatrix} a & a+1 & a-1 \\ b & b+1 & b-1 \\ c & c-1 & c+1 \end{vmatrix} +$$

$$\begin{vmatrix} a+1 & b+1 & c-1 \\ a-1 & b-1 & c+1 \\ (-1)^{n+2}a & (-1)^{n+1}b & (-1)^n c \end{vmatrix} = 0$$

, then the value of $n$ is: (2009)

a) any even integer
b) any odd integer

c) any integer
d) zero

21) The number of $3 \times 3$ non-singular matrices with four entries as 1 and all other entries as 0, is (2010)

a) 5
b) 6

c) atleast 7
d) less than 4

22) Let $\mathbf{A}$ be a $2 \times 2$ matrix with non-zero entries and let $\mathbf{A}^2 = \mathbf{I}$, where $\mathbf{I}$ is $2 \times 2$ identity matrix. Define
$Tr(\mathbf{A})$- sum of diagonal elements of $\mathbf{A}$ and
$|\mathbf{A}|$ - determinant of matrix $\mathbf{A}$.
**Statement - 1:** $Tr(\mathbf{A}) = 0$.
**Statement - 2:** $|\mathbf{A}| = 1$

(2010)

a) Statement - 1 is true, Statement - 2 is true; Statement - 2 is **not** a correct explanation for Statement-1.
b) Statement - 1 is true, Statement - 2 is false.
c) Statement - 1 is false, Statement - 2 is true.
d) Statement - 1 is true, Statement - 2 is true; Statement - 2 is a correct explanation for Statement-1.

23) Consider the system of linear equations;

$$x_1 + 2x_2 + x_3 = 3$$
$$2x_1 + 3x_2 + x_3 = 3$$
$$3x_1 + 5x_2 + 2x_3 = 1$$

(2010)

a) exactly 3 solutions
b) a unique solution
c) no solution
d) infinite number of solutions

24) The number of values of k for which the linear equations $4x + ky + 2z = 0$, $kx + 4y + z = 0$ and $2x + 2y + z = 0$ possess a non zero solution is (2011)

a) 2
b) 1
c) zero
d) 3

25) Let $\mathbf{A}$ and $\mathbf{B}$ be two symmetrix matrices of order 3.
**Statement - 1:** $\mathbf{A}(\mathbf{BA})$ and $(\mathbf{AB})\mathbf{A}$ are symmetric matrices.
**Statement - 2:** $\mathbf{AB}$ is symmetric matrix if matrix multiplication of $\mathbf{A}$ with $\mathbf{B}$ is commutative.

a) Statement - 1 is true, Statement - 2 is true; Statement - 2 is **not** a correct explanation for Statement-1.

b) Statement - 1 is true, Statement - 2 is false.

c) Statement - 1 is false, Statement - 2 is true.

d) Statement - 1 is true, Statement - 2 is true; Statement - 2 is a correct explanation for Statement-1.

26) Let

$$A = \begin{pmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 3 & 2 & 1 \end{pmatrix}$$

If $\mathbf{u_1}$ and $\mathbf{u_2}$ are column matrices such that

$$\mathbf{Au_1} = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$$

and

$$\mathbf{Au_2} = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$$

, then $\mathbf{u_1} + \mathbf{u_2}$ is equal to: (2012)

a)

$$\begin{pmatrix} -1 \\ 1 \\ 0 \end{pmatrix}$$

b)

$$\begin{pmatrix} -1 \\ 1 \\ -1 \end{pmatrix}$$

c)

$$\begin{pmatrix} -1 \\ -1 \\ 0 \end{pmatrix}$$

d)

$$\begin{pmatrix} 1 \\ -1 \\ -1 \end{pmatrix}$$

27) Let $\mathbf{P}$ and $\mathbf{Q}$ be $3 \times 3$ matrices $\mathbf{P} \neq \mathbf{Q}$. If $\mathbf{P}^3 = \mathbf{Q}^3$ and $\mathbf{P}^2\mathbf{Q} = \mathbf{Q}^2\mathbf{P}$ then determinant of $\left(\mathbf{P}^2 + \mathbf{Q}^2\right)$ is equal to (2012)

a) $-2$        b) $1$        c) $0$        d) $-1$

28) If

$$P = \begin{pmatrix} 1 & \alpha & 3 \\ 1 & 3 & 3 \\ 2 & 4 & 4 \end{pmatrix}$$

is the adjoint of a $3 \times 3$ matrix $\mathbf{A}$ and $|\mathbf{A}| = 4$, then $\alpha$ is equal to: (*JEEM*2014)

a) $4$        b) $11$        c) $5$        d) $0$

29) If $\alpha, \beta \neq 0$ and $f(n) = \alpha^n + \beta^n$ and

$$\begin{vmatrix} 3 & 1 + f(1) & 1 + f(2) \\ 1 + f(1) & 1 + f(2) & 1 + f(3) \\ 1 + f(2) & 1 + f(3) & 1 + f(4) \end{vmatrix}$$

$= K(1 - \alpha)^2 (1 - \beta)^2 (\alpha - \beta)^2$, then $K$ is equal to

(*JEEM*2014)

a) $1$        b) $-1$        c) $\alpha\beta$        d) $\frac{1}{\alpha\beta}$

30) If $\mathbf{A}$ is a $3 \times 3$ non-singular matrix such that $\mathbf{AA'} = \mathbf{A'A}$ and $\mathbf{B} = \mathbf{A}^{-1}\mathbf{A'}$, then $\mathbf{BB'}$ equals: (*JEEM*2014)

a) $\mathbf{B}^{-1}$        b) $\left(\mathbf{B}^{-1}\right)'$        c) $\mathbf{I} + \mathbf{B}$        d) $\mathbf{I}$

31) The set of all values of $\lambda$ for which the system of linear equations:

$$2x_1 - 2x_2 + x_3 = \lambda x_1$$
$$2x_1 - 3x_2 + 2x_3 = \lambda x_2$$
$$-x_1 + 2x_2 = \lambda x_3$$

has a non-trivial solution

a) contains two elements
b) contains more than two elements
c) is an empty set
d) is a singleton

32) If

$$\mathbf{A} = \begin{pmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ a & 2 & b \end{pmatrix}$$

is a matrix satisfying the equation $\mathbf{A}\mathbf{A}^T = 9\mathbf{I}$, where $\mathbf{I}$ is $3 \times 3$ identity matrix, then the ordered part $(a, b)$ is equal to:

a) $(2, 1)$            b) $(-2, -1)$

c) $(2, -1)$            d) $(-2, 1)$

33) The system of linear equations

$$x + \lambda y - z = 0$$
$$\lambda x - y - z = 0$$
$$x + y - \lambda z = 0$$

has a non-trivial solution for:

a) exactly two values of $\lambda$
b) exactly three values of $\lambda$
c) inifinitely many values of $\lambda$
d) exactly one value of $\lambda$

34) If

$$\mathbf{A} = \begin{pmatrix} 5a & -b \\ 3 & 2 \end{pmatrix}$$

and $\mathbf{A}\mathbf{A} = \mathbf{A}\mathbf{A}^T$, then $5a + b$ is equal to:

a) 4            b) 13

c) $-1$            d) 5

35) Let k be an integer such that triangle with vertices $(k, -3k)$, $(5, k)$, $(-k, 2)$ has area 28 sq. units. Then the orthocentre of this triangle is at the point:

a) $\left(2, \frac{1}{2}\right)$            b) $\left(2, \frac{-1}{2}\right)$

c) $\left(1, \frac{3}{4}\right)$            d) $\left(1, \frac{-3}{4}\right)$

36) Let $\omega$ be a complex number such that $2\omega + 1 = z$ where $z = \sqrt{-3}$. If

$$\begin{vmatrix} 1 & 1 & 1 \\ 1 & -\omega^2 - 1 & \omega^2 \\ 1 & \omega^2 & \omega^7 \end{vmatrix} = 3k$$

, then $k$ is equal to:

(a) 1            (b) $-z$

(c) $z$

(d) $-1$