B.Sc (H) Physics

V Sem

Advanced Mathematical Physics - I

(32227502)

Class Test (IA)

SET - ODD

27/10/2023

Time: 1Hr

M.M. 20

Q1 Attempt any 2 questions (5x2 = 10m)

(a) Evaluate C^{20}, where $C = \begin{bmatrix} -1 & 3 \\ 1 & 1 \end{bmatrix}$

(b) Solve using matrix method

$$\dot{y} = z$$

$$\dot{z} = y$$

where $y(0) = 4$, $z(0) = 2$

(c) For a given matrix $A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$,

prove that

$$\lambda^2 - \lambda \, Tr(A) + \det(A) = 0$$

(d) Find the condition for following matrix to be orthogonal

$$\begin{bmatrix} a+b & b-a \\ a-b & a+b \end{bmatrix}$$

P.T.O.

Q2 Attempt any 2 (5×2 = 10 m)

(a) Show that- transformation is linear
$T(x,y,z) = (x-4y,\ 3x+2y-2,\ y+2z)$

(b) If A, B, C are linearly independent-vectors determine if A-B, B-C, C-A are linearly dependent- or not-

(c) Show that- the polynomial space of deg $\leq n$ ~~is a vect~~ and real coefficients forms a vector space over the field $\mathbb{R}$.

(d) Consider the set of matrices
$A(\alpha) = \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$, α is a real no.
Determine whether this set forms a group or not under matrix multiplication (Assume that matrix multiplication is associative).

Prepared by
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SET - EVEN

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MM: 20

Q1 Attempt any 2 questions (5×2=10m)

(a) If $B = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$, show that

$$e^{\theta B} = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$$

(b) Verify Cayley-Hamilton theorem for the matrix $H = \begin{bmatrix} 3 & -1 \\ 4 & -2 \end{bmatrix}$ Hence find H^{-1}

(c) If P is non-singular matrix and $P^{-1}AP$ and $P^{-1}BP$ are diagonal matrices, then show that $AB = BA$

(d) Find the Eigen values and Eigen vectors of

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

PTO

Q2 Attempt any 2 $(5 \times 2 = 10\,m)$

(a) If W consists of all square matrices of order 2 with zero determinant, then determine whether W is a subspace of V or not.

(b) Linear transformation T on R^2 is defined as
$T(x,y) = (3x - 4y,\ x + 5y)$
Find the matrix representation of T relative to the Basis $f_1 = (1,3)$, $f_2 = (2,5)$

(c) Determine whether $(1,2,5)$, $(2,5,1)$, $(1,5,2)$ are linearly dependent or not

(d) Find the Basis & dimension of the W, a subspace of R^4
$W = \{(a,b,c,d) : a+b=0,\ c=2d\}$

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