

**Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati**

**DEPARTMENT OF PHYSICS**

**M.Sc. I PHY- 4101 Mathematical methods in Physics**

**(QUESTION BANK)**

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- 1) Define vector space, vector addition, scalar multiplication, subspaces, basis and dimensions.
- 2) Define norm of a vector, projection of a vector, distance of a vector, angle of a vector.
- 3) Find the Fourier transform of given function.
- 4) Find the inverse Laplace transform of given function
- 5) Find the  $\dim(U+W)$ ,  $\dim U$ ,  $\dim W$ . If  $U$  &  $W$  be the subspace generated by  
 $\{(1,3,3,-1,-4), (1,4,-1,-2,-2), (2,9,0,-5,-2)\}$  &  $\{(1,6,2,-2,3), (2,8,-1,-6,-5), (1,3,-1,-5,-6)\}$
- 6) Determine whether the following vectors are linearly dependent or independent  
i)  $(1,3,-1,4)$   $(3,8,-5,7)$   $(2,9,4,23)$  ii)  $(1,-2,4,1)$   $(2,1,0,-3)$   $(3,-6,1,4)$
- 7) Find the basis and dimensions of given subspace.
- 8) Determine whether the vectors are linearly dependent or independent. Give its reason.
- 9) Find the basis and dimensions of given subspace.
- 10) Diagonalise the given matrix.
- 11) Explain with one illustration
  - i) Complement of an event
  - ii) Mutually exclusive events
  - iii) Exhaustive events
- 12) Define cumulative distribution function (c.d.f.) of a discrete r.v. and state its important properties.
- 13) Define median of discrete probability distribution.
- 14) Define mode of discrete probability distribution.
- 15) Use Lagrange's interpolation formula find value of  $y$  using given  $x$ .
- 16) by using Newton's general interpolation formula find  $f(x)$  as a polynomial in  $x$  from the given table.
- 17) Obtain Fourier series expansion for function  $f(X) = \dots$
- 18) Determine the Fourier series for the function  $f(X) = \dots$  in the interval  $\dots$  & deduce that  $\dots$
- 19) What is the Fourier expansion of the periodic function whose definition in one period is & state the Values of series  $x = \dots$  & hence show that  $\dots$
- 20) Find Fourier series to represent the function  $f(X) = \dots$
- 21) Find the Fourier series expansion of the function  $f(X) = \dots$  & period is  $\dots$ . Also graph the function.
- 22) Graph the following & find its Fourier series  $f(X) = \dots$  & period =  $\dots$ . How should  $f(X)$  be defined at  $x = \dots$  in order that fourier series will converge to  $f(X)$  for  $\dots$
- 23) Determine the Fourier expansion for  $f(X) = \dots$
- 24) Explain the half range for cosine & sine series.
- 25) If  $f(X) = \dots$ , then find that i) Half range cosine & sine series.
- 26) Find cosine series for  $\sin x$  in the interval  $\dots$ , hence deduce that  $\dots$
- 27) Reduction formulae for sine function.

- 28) Define Gamma &  $\beta$  function .
- 29) What is Dirichlet's condition.
- 30) Evaluate using gamma function -----
- 31) Evaluate using gamma function ----
- 32) Evaluate ----- using beta function.
- 33) Prove that --- ---- = ----
- 34) Trace the curve -----
- 35) Determine whether the given vectors form basis or not.
- 36) Find the basis & dimensions of given vectors.
- 37) Find the vector V as a linear combination of given vectors.
- 38) Find the inverse of given matrix.
- 39) Find the rank of given matrix.
- 40) explain Gram-Schmidt orthogonalisation process.
- 41) Using Gram-Schmidt orthogonalization process to find orthogonal vectors.
- 42) Determine the Fourier coefficients -----
- 43) Explain normal distribution
- 44) explain binomial probability distribution
- 44) what are the theorms on probability
- 45) Definition of probability & it's related examples
- 46) Mean & Variance of Binomial distribution
- 47) Explain Poisson distribution
- 48) Fit a Poisson distribution to the given table & calculate theoretical frequencies
- 49) Problems on Binomial distribution & Poisson distribution
- 50) Problems on mean & standard deviation distribution
- 51) What is mean, median & mode
- 52) Define arithmetic mean & solve the problems
- 53) Define mean deviation, standard deviation
- 54) Relation between standard deviation & root mean square deviation.
- 55) Runge- kutta methods for first order, second order & fourth order
- 56) Solve the equation using second order Runge-kutta method
- 57) Solve the equation using Fourth order Runge-kutta method
- 58) Solve the equation using first order Runge-kutta method
- 59) What do you mean by matrix explain the types of matrix
- 60) Define self adjoint & unitary transformation
- 61) Find the rank for given matrix
- 62) Find the inverse of given matrix.
- 63) Convolution Theorem for fourier transform
- 64) Explain Parseval's identity.
- 65) Explain dirac delta function

- 66) what are the applications to the differential equations
- 67) What is mean by group theory
- 68) What are the types of group theory
- 69) Find the residue of given function
- 70) what are the types of tensor
- 71) Explain Simpson's one third rule.
- 72) Define Binomial distribution.
- 73) Find mean of binomial distribution
- 74) Define mode of Binomial distribution
- 75) Determine which vectors are equal.
- 76) Define linear dependence & independence of vector.
- 77) Find the norm & distance between given vectors.
- 78) What is Complex number give it's polar form & exponential form.
- 79) Graphical representation of  $(Z_1 + Z_2)$ ,  $(Z_1 - Z_2)$ ,  $(Z_1/Z_2)$ .
- 80) Find the modulus & amplitude (argument) of given complex number.
- 81) Find the integration by trapezoidal rule
- 82) Find the integration by simpson's one third rule.
- 83) Find the eigen value and eigen vector of the given matrix
- 84) Explain Fourier integral theorem
- 85) Explain Fourier sine & cosine integrals
- 86) Find the orthogonal matrix
- 87) Determine the values of a, b & c for given orthogonal matrix
- 88) What are the properties of eigen values & eigen vectors.
- 89) Define inner product & solve the problem
- 90) What do you mean by linear differential equation
- 91) solve the given linear differential equation
- 92) Obtain the  $n^{\text{th}}$  order linear differential equation with constant coefficient.
- 93) Find the roots of auxiliary equations.
- 94) Explain Trapezoidal rule
- 95) Obtain half range Fourier series
- 96) Explain the properties of gamma function.
- 97) Explain the properties of beta function.
- 98) Give the relation between gamma & beta function
- 99) Reduce the matrix using row Echelon form
- 100) Find the laplace transform of given function.
- 101) Find the Eigen values & Eigen vectors of hermitian matrix

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