SARDAR PATEL UNIVERSITY

T.Y. B. Sc., 5th Semester

10-04-2018, Tuesday

Session: AfternoonTime: 02:00 PM to 05:00 PM

Subject Code: (PHYSICS) US05CPHY02

Subject Title: Mathematical Physics

Max Marks: 70

Que: 1   Write correct answer for each of the following MCQs.   [10]

1   The curvilinear co-ordinates u,v,w are said to be orthogonal if the co-ordinate curves are mutually perpendicular at .... point P(x,y,z) of space.

    a) Infinite   b) one

    c) every   d) zero

2   A square matrix A = [a_{ij}] is known as singular matrix if its determinant is ....

    a) single   b) double

    c) infinite   d) zero

3   The Legendre's polynomial for degree $P_0(\mu)$ = ...

    a) zero   b) infinite

    c) one   d) none

4   To obtain Rodrigue's formula we use .... Theorem.

    a) Newton's   b) Stoke's

    c) Leibnitz's   d) Equivalent

5   Hermite polynomial for degree $H_1(x)$ is ....

    a) 2x   b) Zero

    c) Xy   d) x

6   The fundamental mode is the mode of the .... frequency obtained by putting m = n = 1 in equation of modes.

    a) Medium   b) lowest

    c) highest   d) infinite

7   For steady state heat flow, three dimensional Laplace's equation is ....

    a) $\frac{\partial u}{\partial t} = \nabla^2 u$ b) $\nabla u = 0$

    c) $\nabla^2 u = 0$ d) $\frac{\partial u}{\partial t} = h \nabla^2 u$

8   An (nxn) matrix [A] is said to be orthogonal if ....

    a) $[A]^T = [A]^{-2}$ b) $[A]^T = [A]^1$

    c) $[A]^T = [A]^{-1}$ d) $[A]^T = [A]^{-1}$

9   Y = ax^2+bx +c = is an equation of ....

    a) Exponential curve   b) Straight line

    c) Parabola   d) none

10 In the Simpson's 1/3 rule, we have to used two sub-intervals of equal ....

    a) width   b) length

    c) height   d) none

. (P.T.O.)

Que 2 Write answers of any ten questions in brief. [20]

1 State condition of orthogonality for orthogonal curvilinear co-ordinate.
2 Find ds^2 & metrical coefficients if $u = 2x+3$, $v = y-4$, $w = z+2$.
3 Explain Eigen values & Eigen vectors.
4 State Associated Legendre's differential equation & its Polynomial.
5 Show that $2nH_{n-1}(x) = H'_n(x)$.
6 Show that $nJ_n(x) - xJ_{n+1}(x) = xJ'_n(x)$.
7 To find a sine series for $f(x)$ when $0 \leq x \leq \pi$.
8 Write down Diffusion's equations.
9 Define Fourier's series.
10 Write successive four steps of Power method.
11 Find an equation of the form $y = ax^{bx}$, that fits an exponential curve by using the method of least squares.
12 Define : Interpolation & Extrapolation.

Que 3 [A] Obtain an expression of Curl in terms of orthogonal curvilinear co-ordinates. [05]
[B] Obtain an expression of Divergence in terms of orthogonal curvilinear co-ordinates. [05]

OR

Que 3 [C] Obtain an equivalent expressions for $\nabla\phi$, $\nabla.F$ & $\nabla \times F$ in cylindrical co-ordinates as a special curvilinear system. [05]
[D] Obtain an equivalent expressions for $\nabla\phi$, $\nabla.F$ & $\nabla \times F$ in spherical polar co-ordinates as a special curvilinear system. [05]

Que 4 [A] Solve Bessel's differential equation $y'' - \frac{1}{x}y' + (1 - \frac{n^2}{x^2})y = 0$. & Discuss the orthogonal properties of Bessel's polynomial of first kind. [10]

OR

Que 4 [B] Solve Hermite's differential equation $y'' - \frac{1}{x}y' + 2vy = 0$. & Discuss the orthogonal properties of Hermite's polynomial of first kind. [10]

Que 5 [A] Discuss complex representation of a Fourier's series and find a cosine & sine series for $f(t)$ when $0 \leq t \leq \pi$. [05]
[B] Give the physical interpretation of complex Fourier's series with reference to transverse vibrations of a string. [05]

OR

Que 5 [C] Derive one dimensional diffusion equation in terms of Fourier's equation of heat flow when electricity is in a long insulated cable. [05]
[D] Solve one dimensional wave equation in terms of Fourier's equation . [05]

Que 6 [A] To compute all the Eigen value & the corresponding Eigen vector of areal symmetric matrix describe Jacobi's method. [05]
[B] Deduce Langrage's interpolation polynomial of degree n. [05]

OR

Que 6 [C] Find the derivatives of the function $y = f(x)$ is given for the values of the independent variable $x = x_0 + ph$ for $p = 0,1,2,3$.......using forward difference operatorΔ. [06]
[D] If the integration formula corresponding to integral is based on approximating $y = f(x)$ between (x_0, y_0) & (x_1, y_1) by a straight line then form a Trapezoidal Rule. [04]

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