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[52/A15]

SARDAR PATEL UNIVERSITY
T. Y .B.Sc, 5th Semester
Subject Code: (PHYSICS) US05CPHY02
Subject Title: Mathematical Physics

Date: 13 /11/2019 Time: 10:00 am to 1:00pm
Max Marks: 70

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

1 The values of u, v, w for the three surfaces intersecting at P are called the curvilinear ----------.
a) Co-ordinates b) Surfaces
c) Curves d) Plains

2 A non-zero vector X is called an Eigen --------- of a matrix A, if there is a number λ such that AX =λX.
a) Point b) Scalar
c) Value d) Vector

3 Pre multiplying A by E^{-1} and post multiplying by E, we get diagonal matrix, whose diagonal elements are the ----------.
a) Point b) Scalar
c)Values d)Vector

4 The general solution of Legendre's equation is ----------.
a) $AP_n(x)+Q_n(x)$ b) $A P_n(x)+B Q_n(x)$
c) $P_n(x)+Q_n(x)$ d) $BP_n(x)+Q_n(x)$

5 The Hermite polynomial $H_n(x)$ is define as ----------.
a) $e^{2x}-t^2$ b) $e^{2tx}-t^2$
c) $e^{2x}-t^2$ d) $e^{2tx}-t^3$

6 Eigen value of the vibrating string is ----------. Nπc
a) $\lambda_n = n\pi c/1$ b) $\lambda_n = n\pi c/n$
c) $\lambda_n = n\pi c/l$ d) $\lambda_n = n\pi c/3$

7 For steady state heat flow, three dimensional Laplace's equation is ---------.
a) $\nabla^2 u = h^2 \frac{\partial u}{\partial t}$ b) $\nabla^4 u = 0$
c) $\nabla^2 u = \frac{\partial u}{\partial t}$ d) $\nabla^2 u = 0$

8 $Y = ax^2 + bx + c$ is an equation of ---------.
a) exponential curve b) parabola
c) Straight line d) Hyperbola

9 $Y = ax^b$ form of equation is linearized by taking ---------- on both sides.
a) Logarithm b) anti-logarithm
c) bi logarithm d) None

10 Y = ax + b is an equation of ---------.
a)exponential curve b)parabola
c)straight line d)hyperbola

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

1 State condition for orthogonality for orthogonal curvilinear co-ordinate.
2 Find ds^2 and metrical coefficients if $u = 2x + 3$, $v = y - 4$, $w = z + 2$
3 Define transformation and write types of transformations.
4 State Legendre differential equation and its solution.
5 Show that $2nH_{n-1}(x) = H'_n(x)$.
6 Show that $nJ_n(x) - xJ_{n+1}(x) = xJ'_n(x)$.
7 Define Fourier's series.
8 To find cosine series for f(x) when $0 \leq x \leq \pi$.
9 Write down diffusions equations.
10 Write successive four steps of Power method.
11 Define Interpolation and extrapolation.
12 Write Trapezoidal rule.

Que 3 [A] Obtain an expression of Curl in terms of orthogonal curvilinear co-ordinates. [05]
[B] Obtain an equivalent expressions for $\nabla\emptyset$ and $\nabla.F$ in cylindrical co-ordinates as a special curvilinear system. [05]

OR

Que 3 [C] Obtain an expression of Divergence in terms of orthogonal curvilinear co-ordinates. [05]
[D] Obtain an equivalent expressions for $\nabla\emptyset$ and $\nabla.F$ in spherical polar co-ordinates as a special curvilinear system. [05]

Que 4 [A] Solve Bessel's differential equation. Discuss the orthogonal properties of Bessel's polynomial of first kind. [10]
Que 4 [B] Solve Hermite's differential equation. Discuss the orthogonal properties of Hermite's polynomial of first kind. [10]

Que 5 [A] Expand the Fourier series f(x) in an interval $(-\pi, \pi)$. [05]
[B] Give the physical interpretation of complex Fourier's series with reference to thermal states. [05]

OR

Que 5 [C] Derive diffusion equation in terms of Fourier's equation of heat flow. [05]
[D] Solve one dimensional wave equation in terms of Fourier's equation. [05]

Que 6 [A] To compute all the Eigen value and the corresponding Eigen vector of a real symmetric matrix describe Jacobi's method. [06]
[B] Deduce Lagrange's interpolation polynomial of degree n. [04]

OR

Que 6 [C] Explain Simpson's $\frac{1}{3}$ rule for approximate value of integration. [06]
[D] Explain the least square method to fit a curve for a given data. [04]

—X—