

T.Y.B.SC. SEM – V (2014 Course) : SUMMER - 2019
SUBJECT : MATHEMATICAL METHODS FOR PHYSICS

Day : Monday
Date : 08/04/2019

Time : 12.00 NOON TO 02.00 PM
Max. Marks: 40.

S-2019-0991

N.B.:

- 1) All questions are **COMPULSORY**.
- 2) Figures to the **RIGHT** indicate full marks.
- 3) Draw neat labeled diagrams **WHEREVER** necessary.

Q.1 Answer any **TWO** of the following: **(10)**

- a) Find the polar and cylindrical equation of surface Cartesian equation $x^2+y^2+z^2=16$.
- b) Prove that $(n+1)P_{n+1}(x)=(2n+1)xP_n(x)-nP_{n-1}(x)$.
- c) If $U=2x+3$, $V=y-4$, $W=z+2$. Show that U , V , W are orthogonal and find ds^2 . Also calculate numerical co-efficient h_1 , h_2 , h_3 .

Q.2 Answer any **TWO** of the following: **(10)**

- a) Obtain the mass energy relation in relativity.
- b) Obtain the expressions for divergence, gradient and curl in Cartesian co-ordinate system.
- c) Prove that $\int_{-\infty}^{+\infty} x^2 e^{-x^2} H_n(x) H_n(x) dx = \sqrt{\pi} 2^n n! (n + \frac{1}{2})$.

Q.3 Answer any **TWO** of the following: **(10)**

- a) Find power series solution about $x=0$ of $4xy''+2y'+y=0$.
- b) Show that the point $x=0$ is regular singular point of the Laguerre's differential equation $xy''+(1-x)y'+\lambda y=0$, where λ is constant.
- c) Write short notes on Four vectors. Give two examples for Four vectors.

Q.4 Answer any **FIVE** of the following: **(10)**

- a) Prove that $(n+1)P_n(x) = P'_{n+1}(x) - xP'_n(x)$.
- b) Find the degree and order of the equation $\frac{d^3 y}{dx^3} + \sqrt{\frac{d^2 y}{dx^2}} + x = 0$.
- c) Show that $P_n(1) = 1$.
- d) What are inertial and non-inertial frames of reference.
- e) A rocket ship leaves the earth at a speed of $0.98c$. How much time does it take for minute hand of clock in ship to make complete revolution as measured by an observer on the earth?
- f) Define the term (i) Co-ordinate surface (ii) Co-ordinate curves.
- g) Show that $\frac{d}{dx} [x^n J_n(x)] = x^n J_{n-1}(x)$.

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