

B.Sc. DEGREE EXAMINATION NOVEMBER 2013
BRANCH III - PHYSICS
THIRD SEMESTER

REG. No. _____

COURSE : MAJOR - CORE
PAPER : MATHEMATICAL PHYSICS
TIME : 30 MINUTES

MAX. MARKS : 30

SECTION – A

TO BE ANSWERED IN THE QUESTION PAPER ITSELF

ANSWER ALL QUESTIONS: (30x1=30)

Choose the correct answer:

- $a \times b =$
a) $b \times a$ b) $b.a$ c) $-b \times a$ d) $a.b$
- Two vectors are collinear if and only if $a \times b =$
a) 0 b) 1 c) -1 d) ∞
- The field F is termed as irrotational if
a) $\nabla.F = 0$ b) $\nabla.F = 1$ c) $\nabla \times F = 1$ d) $\nabla \times F = 0$
- $\nabla^2\phi = 0$ is called equation
a) Newton b) Poisson c) Laplace d) Hamiltonian
- If A is a solenoidal vector then = 0
a) $\text{div } A$ b) $\text{grad } A$ c) $\text{curl } A$
- $\text{Curl Curl } A =$
a) ∇A b) $\nabla^2 A$ c) $-\nabla A$ d) $-\nabla^2 A$
- In Bernoulli's equation of $\vartheta = \nabla\psi$, ψ is called
a) scalar potential b) vector potential c) velocity potential d) wave potential
- In an RL series circuit current equation is
a) $i = \frac{E}{R} e^{-\frac{Rt}{L}}$ b) $i = \frac{E}{R} \left(1 - e^{-\frac{Rt}{L}}\right)$ c) $i = \frac{E}{R} \left(1 + e^{-\frac{Rt}{L}}\right)$ d) $i = \frac{E}{R} e^{\frac{Rt}{L}}$
- The first order differential equation for radio active decay $\frac{dN}{dt} =$
a) $-N$ b) $-\lambda N$ c) N d) λN
- $\frac{d^2y}{dx^2} + p(x)\frac{dy}{dx} + \phi(x)y = 0$ is called ----- differential equation of second order.
a) non linear inhomogeneous b) non linear homogeneous
c) linear inhomogeneous d) linear homogeneous
- The roots of the equation $\frac{d^2x}{dt^2} + k^2x = 0$ are
a) $\pm x$ b) $\pm ix$ c) $\pm ik$ d) $\pm k$

12. is an example for second order differential equation
 a) RL circuit b) RC circuit c) RLC damped d) LC circuit
13. $\Gamma_{\frac{1}{2}} = \dots\dots\dots$
 a) $-\sqrt{\pi}$ b) $-2\sqrt{\pi}$ c) $\sqrt{\pi}$ d) $2\sqrt{\pi}$
14. $P_0(x) = \dots\dots\dots$
 a) 1 b) -1 c) 0 d) ∞
15. The recurrence formula $x P'_n(x) = P'_{n-1}(x) = \dots\dots\dots$
 a) $P_n(x)$ b) $P'_n(x)$ c) $nP_n(x)$ d) $xP_n(x)$

Fill in the blanks;

16. $a \cdot a = \dots\dots\dots$.
17. $\text{div}(\text{curl } v) = \dots\dots\dots$.
18. The equation of a SHM is $\frac{d^2y}{dx^2} + w^2x = \dots\dots\dots$.
19. $\beta\left(\frac{1}{2}, \frac{1}{2}\right) = \dots\dots\dots$.
20. The first order differential equation for velocity v is $\dots\dots\dots$.

State whether the following statements are true or false:

21. $\int A \cdot ds = \iiint \text{Curl } A \cdot dv$
22. $\sin \theta = \frac{a \cdot b}{|ab|}$
23. The first order differential equation for voltage drop across inductance L is $L \frac{di}{dt}$.
24. $\Gamma_0 = \Gamma_{-n} = \infty$
25. Dead beat motion of a spring is also called oscillatory.

Answer briefly:

26. S.T. $\Gamma_1 = 1$.
27. If $r = ix + iy + iz$, is the position vector then what is $\frac{dr}{dt}$?
28. If ∇ is vector operator how is it defined?
29. Find the current if a capacitor is changed from $2\mu\text{C}$ to $6\mu\text{C}$ in 10m seconds?
30. S.T. acceleration $a = v \frac{dv}{dx}$.

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2011-2012 and thereafter)
SUBJECT CODE : 11PH/MC/MP34

B.Sc. DEGREE EXAMINATION NOVEMBER 2013
BRANCH III - PHYSICS
THIRD SEMESTER

COURSE : MAJOR - CORE
PAPER : MATHEMATICAL PHYSICS
TIME : 2 ½ HOURS **MAX. MARKS : 70**

SECTION – B

Answer any Five Questions: **5x5=25**

1. Find the value of a if $A = a \hat{i} + \hat{j} + \sqrt{5}\hat{k}$ subtends an angle of 60° with $4 \hat{i} - 5 \hat{j} + \sqrt{5} \hat{k}$.
2. Derive an expression for Gauss's law in differential form.
3. Derive Bernoulli's first order differential equation.
4. An inductance of $2H$ and a resistance of 20 ohm are connected in series with a cell of emf $100V$. Find the current at the end of 0.01 sec.
5. A spring of stiffness $k = 700 N/M$ is fixed at one end and other end has a load of $7 kg$. It is pulled by $0.05 m$ and released. Find the period of oscillation.
6. S.T. $\Gamma_{\frac{1}{2}} = \sqrt{\pi}$.
7. S.T. $(x^2 - 1) P_n'(x) = n[xP_n - P_{n-1}]$.

SECTION – C

Answer any Three Questions: **3x15=45**

8. P.T. $(y^2 - z^2 + 3yz - 2x) \hat{i} + (3xz + 2xy) \hat{j} + (3xy - 2xz + 2z) \hat{k}$ is both solenoidal and irrotational.
9. State and prove Stoke's theorem.
10. Derive expression for population growth over the years using first order differential equation.
11. Get the characteristic 2^{nd} order differential equation and give its solution.
12. Deduce Rodrigue's formula for Legendre polynomial and hence show that

$$\int_{-1}^{+1} P_n(x) dx = 0 \text{ when } n \neq 0 \text{ and } \int_{-1}^{+1} P_n(x) dx = 2 \text{ when } n = 0.$$
