STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2011-12)

SUBJECT CODE : 11PH/MC/MP34

B.Sc. DEGREE EXAMINATION NOVEMBER 2012
BRANCH III - PHYSICS
THIRD SEMESTER

REG. No._____

COURSE : MAJOR – CORE
PAPER : MATHEMATICAL PHYSICS
TIME : 30 MINS. **MAX. MARKS : 30**

SECTION – A

TO BE ANSWERED IN THE QUESTION PAPER ITSELF

ANSWER ALL QUESTIONS: **(30x1=30)**

I CHOOSE THE CORRECT ANSWER:

1. $kXi =$
   a) iXk b) k c) i d) $-iXk$

2. $a.b =$
   a) ab b) $ab\sin\theta$ c) $ab\cos\theta$ d) $ab\ \sin\theta\,\hat{n}$

3. $curl\ \ grad\ \varphi =$
   a) 0 b) ∞ c) 1 d) -1

4. Integral of a point function along a curve is called
   a) surface integral b) line integral c) volume integral

5. $div\ J =$
   a) $\frac{d\rho}{dt}$ b) $\frac{dP}{dt}$ c) $\frac{-d\rho}{dt}$ d) $\frac{-dP}{dt}$

6. Two vectors are collinear if and only if $aXb=$
   a) ∞ b) 1 c) $\frac{\pi}{2}$ d) 0

7. The differential equation whose solution is $y = a\cos(x+3)$ is $^{dy}/_{dx}$=_____
   a) $y\ tan(x+3)$ b) $y\ sec(x+3)$ c) $-y\ tan(x+3)$ d) $-y\ sec(x+3)$

8. A coil of resistance 15Ω and inductance 10H is connected to a 10V supply. The value of current after 2 $secs$ is $(e^{-3} = 0.05)$
   a) 6A b) 5A c) 4A d) 7A

9. Voltage drop across capacitance is
   a) $^{v}/_{c}$ b) $^{c}/_{v}$ c) $^{q}/_{v}$ d) $^{q}/_{c}$

10. The auxiliary equation for $\frac{d^2y}{dx^2} + P\frac{dy}{dx} + Q = 0$ is
    a) $m^2 + Pm + Q = 0$ b) $\frac{1}{m^2} + \frac{P}{m} + Q = 0$ c) $(P_m + Q)^2$ d) $m(P+Q)^2$

..2..

11. The solution to equation $\frac{d^2y}{dx^2} + \mu^2 y = 0$ is $y =$

a) $C_1 cos\mu x$ b) $C_1 sin\mu x$ c) $C_1 cos\mu x + C_2 sin\mu x$ d) $\frac{\cos \mu x + \sin \mu x}{C_1 + C_2}$

12. The voltage gradient of a transmission line from the transmitted end is expressed as

a) dv/dt b) $-dv/dt$ c) dv/dx d) $-dv/dx$

13. $\Gamma_0 =$ _____

a) ∞ b) 0 c) 1 d) -1

14. $\beta_{(m,n)} =$ _____

a) $\Gamma_m \Gamma_n \Gamma_{(m+n)}$ b) Γ_m / Γ_{m+n} c) $\Gamma_{m+n} / \Gamma_m \Gamma_n$ d) $\Gamma_m \Gamma_n / \Gamma_{m+n}$

15. $P_0(x) =$ _____

a) 0 b) ∞ c) 1 d) -1

II. FILL IN THE BLANKS:

16. If s is a scalar function of t, then $\frac{dx}{dt} =$ _____

17. $curl\ curl\ A =$ _____

18. $\frac{dy}{dx} + p(x)y = f(x)$ is a differential equation of _____ order.

19. For an equation $D^2 + K^2 = 0$, D = _____

20. $\Gamma_{n+1} =$ _____

III.STATE WHETHER TRUE OR FALSE:

21. $i.i = 1.$

22. $Curl\ A = \nabla.A$

23. The rate at which ice melts is proportional to the amount of ice at that instant.

24. Complete solution = Complementary function + Particular integral.

25. $\Gamma_1 = 1$

IV.ANSWER THE FOLLOWING:

26. What is the expression for the moment of a force.

27. Give the statement for Stoke's theorem.

28. State any one application for first order differential equation.

29. $A = 2i + 3j + 4k$ and $B = 3i - 4j + k$ find A.B.

30. $\Gamma\frac{1}{2} =$

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TIME : 2 ½ HOURS MAX. MARKS : 70

SECTION – B

ANSWER ANY FIVE QUESTIONS: (5x5=25)

1. If for two vectors $\vec{a}$ and $\vec{b}$, $|\vec{a}+\vec{b}| = |\vec{a}-\vec{b}|$. Find the angles between $\vec{a}$ and $\vec{b}$.
2. A fluid motion is given by $\vec{v} = (y\sin z - sinx)i + (xsinz + 2yz)j + (xycos\, z + y^2)k$. Is the motion rotational or irrotational?
3. Uranium disintegrates at a rate proportional to the amount present at any instant. If m_1 and m_2 grams of uranium are present at time t_1 and t_2 respectively. Show that half life of uranium is $\frac{(t_1-t_2)\,log^2}{log\frac{m_1}{m_2}}$.
4. State $\frac{d^2y}{dx^2} - 8\frac{dy}{dx} + 15y = 0$
5. State and prove Green's theorem.
6. Evaluate $\int_0^\infty \sqrt[4]{x}\ e^{-\sqrt{x}}dx$.
7. Show that $\Gamma_n \quad \Gamma_{1-n} = \frac{\pi}{\sin n\pi}$ (0<n<1)

SECTION – C

ANSWER ANY THREE QUESTIONS: (3x15=45)

8. If r is the distance of a point (x, y, z) from the origin prove that
$$curl\left(k\ X\ grad\frac{1}{r}\right) + grad\ \left(k.grad\frac{1}{r}\right) = 0$$
Where k is the unit vector in the direction 0Z.
9. State and prove divergence theorem of Gauss.
10. A body falling vertically under gravity encounters resistance of the atmosphere. If the resistance varies as the velocity show that $\frac{du}{dt} = g - ku$ where u is the velocity , *k* is a constant and g is acceleration due to gravity. Show that as *t*, increase u approaches the value $g/_k$. Also if $u = \frac{dx}{dt}$ where *x* is the distance fallen by the body from rest in time *t,* show that $x = \frac{gt}{k} - \frac{g}{k^2}(1 - e^{-kt})$.
11. Find expressions for current in a series circuit containing
    i) L and R
    ii) L, C and R
12. Deduce the Rodrigue's formula for legendre polynomial
$P_n(x) = \frac{1}{2^n n!}\ \frac{d^n}{dx^n}(x^2-1)^n$

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