

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086  
(For candidates admitted from the academic year 2008-09)

SUBJECT CODE : MT/AC/MP24

B. Sc. DEGREE EXAMINATION, APRIL 2009  
BRANCH III – PHYSICS  
SECOND SEMESTER

COURSE : ALLIED CORE  
PAPER : MATHEMATICS FOR PHYSICS - II  
TIME : 3 HOURS

MAX. MARKS : 100

SECTION – A

ANSWER ALL QUESTIONS:

(10X2=20)

1. Eliminate the arbitrary function  $f$  from  $f(x^2 + y^2 + z^2, z^2 - 2xy) = 0$ .
2. Solve the differential equation  $y = (x - a)p - p^2$ .
3. Find  $L(te^{-5t})$ .
4. Find  $L(\sin^2 2t)$ .
5. Find  $L^{-1}\left\{\frac{1}{s(s^2 + A)}\right\}$ .
6.  $\int_0^a f(x) dx = \int_0^a f(a - x) dx$  Prove
7. If  $f(n)$  is an even function give the expressions for  $a_0, a_n$  and  $b_n$ .
8. State Cauchy Reimann equations for analytic functions.
9. State Cauchy's theorem.
10. State Taylor's series.

SECTION – B

ANSWER ANY FIVE QUESTIONS:

(5X8=40)

11. Solve  $x^2 p + y^2 q = (x + y)z$
12. Solve a)  $q(p - \sin x) = \cos y$   
b)  $z = px + qy + \log pq$
13. Find a)  $L\{(t + 2)^2 e^t\}$   
b)  $L\left\{\cos 2t + \frac{1}{2}\sin 2t\right\}$
14. Find  $L^{-1}\left\{\frac{1}{(s + 1)(s^2 + 2s + 2)}\right\}$ .
15. If  $f(x) = \pi^2 - x^2$  in  $-\pi < x < \pi$  find the Fourier series of  $f(x)$ .
16. Evaluate  $\oint_C |z|^2 dz$  around the square with vertices at (0,0), (1,0), (1,1) and (0,1).
17. Find the Taylor's series for  $\frac{z^2 + 1}{z^2 + 5z + 6}$  in the region  $|z| < 2$

## SECTION – C

ANSWER ANY TWO QUESTIONS:

(2X20=40)

18. a) Solve:  $\frac{\partial^2 z}{\partial x \partial y} = e^{-y} \cos x$  given that  $z = 0$  when  $y = 0$  and  $\frac{\partial z}{\partial u} = 0$ , when  $x = 0$ .

b) Solve  $(x^2 - y^2 - z^2)p + 2xyq = 2xz$ .

19. a) Solve using Laplace transform the following differential equation

$$\frac{d^2 y}{dx^2} + 2 \frac{dy}{dx} + 5y = 4e^{-x} \text{ given that } y = 0, \frac{dy}{dx} = 0 \text{ when } x = 0.$$

b) If  $f(x) = x$  in the range  $(0, \pi)$   
 $= (2\pi - x)$  in the range  $(\pi, 2\pi)$ .

Express  $f(x)$  as Fourier series in the range  $(0, 2\pi)$ . Hence deduce that

$$\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{8}.$$

(10+10)

20. a) If  $u = \frac{\sin 2x}{\cosh 2y + \cos 2x}$ , find the corresponding analytic function

$$f(z) = u + ih. \quad (10)$$

b) Find the Laurents series about the indicated singularities for each of the following function. Name the singularity in each case

(i)  $\frac{e^{2z}}{(z-1)^3}$ ,  $z = 1$       (ii)  $\frac{z}{(z+1)(z-2)}$ ,  $z = -2$

(5+5)

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