

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086
(For candidates admitted from the academic year 2015-16 & thereafter)

SUBJECT CODE : 15MT/AC/MP25

B. Sc. DEGREE EXAMINATION, APRIL 2017
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. Evaluate $\left[\int_1^2 \int_1^x xy^2 dy dx \right]$.

2. Change the order of integration in the integration in the integral $\left[\int_0^a \int_{\frac{x^2}{a}}^{2a-x} xy dx dy \right]$.

3. Integrate: $\left[\int_0^{\frac{\pi}{2}} \int_0^{2\cos\theta} dr d\theta \right]$.

4. If $x + y = u$, $y = uv$ find $\frac{\partial(x, y)}{\partial(u, v)}$.

5. Find $L[\cos^2 3t]$.

6. Find $L^{-1}\left[\frac{1}{s^2 + 4s + 5}\right]$

7. Is $w = z^3$ is a conformal mapping? If so find its critical point.

8. State Taylor's Theorem.

9. Examine whether the differential equation $x^3 \frac{d^2y}{dx^2} + y = 0$ is regular or irregular.

10. Define Legendre equation.

SECTION-B

ANSWER ANY FIVE QUESTIONS:

(5x8=40)

11. Evaluate $\int_R (x - y)^4 e^{x+y} dx dy$, where R is the square with vertices (1,0), (2,1), (1,2) and (0,1).

12. By changing into polar coordinates integrate $\left[\int_0^2 \int_0^{\sqrt{4-x^2}} (x^2 y + y^3) dy dx \right]$.

13. Find the Laplace transform of following functions

(a) $te^{-t} \cos t$ (b) $f(t) = 0$ when $0 < t \leq 2$
 $= 3$ when $t > 2$

14. Find $L^{-1}\left[\frac{1}{(s^2+9)^2}\right]$.

15. Find the image of the square region with vertices $(0,0), (2,0), (2,2), (0,2)$ under the transformation $w = (1+i)z + (2+i)$.

16. Find the residue of $\frac{2z}{(z-1)^2(z+4)}$ at all its poles.

17. Derive the generating function for Legendre polynomial $P_n x$.

SECTION-C

ANSWER ANY TWO QUESTIONS:

(2x20=40)

18. (a) Evaluate $\iint (x^2 + y^2) dx dy$ over the region for which are each ≥ 0 and $x + y \leq 1$.

(b) Evaluate $\iiint \frac{dx dy dz}{(x+y+z+1)^3}$ taken over the region bounded by the planes

$$x = 0, y = 0, z = 0, x + y + z = 1. \quad (10+10)$$

19. (a) Find the inverse Laplace transform of $\frac{s}{(s^2+2s+5)}$

(b) Solve the differential equation $\frac{d^2 y}{dx^2} - 3\frac{dy}{dx} + 2y = e^{3x}$ given that $y(0) = y'(0) = 0$

using Laplace transform. (8+12)

20. (a) Expand $f(z) = \frac{z}{(z-1)(2-z)}$ as a power series in the region

(i) $|z| < 1$ (ii) $1 < |z| < 2$ (iii) $|z-1| > 1$.

(b) Solve the differential equation $(1+x^2)\frac{d^2 y}{dx^2} + xy' - y = 0$ using power series method.

(10+1)
