

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086
(For candidates admitted from the academic year 2011-12 & thereafter)

SUBJECT CODE: 11MT/PE/BM24

M. Sc. DEGREE EXAMINATION, APRIL 2015
BRANCH I – MATHEMATICS
SECOND SEMESTER

COURSE : ELECTIVE
PAPER : BASIC MATHEMATICAL METHODS
TIME : 3 HOURS

MAX. MARKS: 100

SECTION –A

Answer all the questions:

5×2=10

1. If $A = \begin{bmatrix} 1 & 3 & -2 & 5 \\ 3 & 1 & 2 & 6 \end{bmatrix}$; $B = \begin{bmatrix} 4 & 7 & 1 & 3 \\ 2 & 5 & 2 & -3 \end{bmatrix}$, then find $4A - 3B$.
2. If $f(x) = 1 + x$, $g(x) = \frac{1}{x^2}$, find $f \circ g$.
3. Evaluate $\int (\sqrt{x} + x^{3/2}) dx$.
4. Find a_0 in the Fourier series expansion of $f(x) = e^{-x}$.
5. Solve $\frac{dy}{dx} = \frac{y+2}{x-1}$.

SECTION –B

Answer any five questions:

5×6=30

6. Find the adjoint of $\begin{bmatrix} 3 & 1 & 2 \\ 2 & 2 & 5 \\ 4 & 1 & 0 \end{bmatrix}$.
 7. Differentiate with respect to x: (i) $\left(\frac{2x-3}{x^2}\right)^3$ (ii) $(\tan x)^{\log x}$.
 8. Find the maxima and minima of the function $\frac{x^2 - 7x + 6}{x - 10}$.
 9. Evaluate $\int \frac{x+2}{x^2 + 2x + 3} dx$.
 10. Find the value of y at $x = 2$ using Lagrange's interpolation formula from the data given below
- | | | | | | |
|---|-----|-----|-----|-----|-----|
| x | 0 | 3 | 5 | 6 | 8 |
| y | 276 | 460 | 414 | 343 | 110 |
11. Find the three numbers in AP whose sum is 12 and the sum of whose cubes is 408.
 12. Solve $\frac{dy}{dx} + \frac{y}{x} = xe^x$.

SECTION -C

Answer any three questions:

3×20=60

13. Verify the Cayley Hamilton theorem for the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 0 & -1 & 2 \\ 1 & 0 & 2 \end{bmatrix}$ and hence find inverse of the matrix.

14. (a) Find $\frac{dy}{dx}$, when $x = a \cos^3 \theta$, $y = b \sin^3 \theta$.

(b) If $y = x^2 \cos x$, then prove that $x^2 \frac{d^2 y}{dx^2} - 4x \frac{dy}{dx} + (x^2 + 6)y = 0$.

(c) Verify Euler's theorem on homogeneous function $u = x^3 - 3x^2 y + 3xy^2 + y^3$.

(6+7+7)

15. (a) Prove that $\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} dx = \frac{\pi}{4}$.

(b) Find the value of y at $x = 20$ using Newton's backward interpolation formula:

x	15	17	19	21	23
y	226	290	362	442	530

(10+10)

16. (a) Find the sum to n terms of the series $5 + 55 + 555 + \dots$

(b) Sum to infinity the series $1 + \frac{1+2}{2!} + \frac{1+2+2^2}{3!} + \frac{1+2+2^2+2^3}{4!} + \dots$

(10+10)

17. Solve (i) $(D^2 + D - 6)y = e^{3x} + e^{-3x}$ (ii) $(D^2 + 9)y = \cos 3x + 3 \sin 2x$.

(10+10)

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