INDIAN MARITIME UNIVERSITY
(A Central University, Government of India)

May/ June 2017 End Semester Examinations
B. Sc. (Nautical Science – Second Semester)

Applied Mathematics – UG21T 3201)
(AY 2016 - 17 batch onwards)

Date: 05.06.2017 Maximum Marks : 70
Time: 3 Hrs Pass Marks : 35

Note: Answer any **seven** Questions. All questions carry Equal Marks. Use of approved type of scientific calculator is permitted.

1. a) Obtain the iterative formula for finding the square root of N and hence find the value of $\sqrt{41}$.
b) Find the missing term from the table:

X	0	1	2	3	4
Y	1	3	9	-	81

(5+5 Marks)

2. a) The values of tan x are given for values of x in the following table.

x	0.10	0.15	0.20	0.25	0.30
y	0.1003	0.1511	0.2027	0.2553	0.3093

Estimate tan (0.26), by using Newton's backward interpolation formula.
b) Using Gauss Seidel method, solve the following system of equations: -3x + y + 12z = 50; 6x – y – z = 40; 6x + 9y + z = 40 with initial values $x = 0, y = 0, z = 0$. If necessary, rearrange equations to achieve convergence. Perform Two iterations. Take approximations correct upto 2 decimal places in each iteration.

(5+5 Marks)

3. a) Solve $2xz - px^2 - 2qxy + pq = 0$

b) Solve $(3x+2)^2 y'' + 5(3x+2)y' - 3y = (3x+2)(3x+1)$

(5+5 Marks)

4. a) Solve $\dfrac{d^3y}{dx^3} - 7\dfrac{dy}{dx} - 6y = e^{2x}(1+x)$

b) Solve $\dfrac{d^2y}{dx^2} + y = \tan x$, by the method of variation of parameters.

(5+5 Marks)

5. a) Form the partial differential equation of all spheres of fixed radius having their centers in the xy-plane.

b) Solve $r - 4s + 4t = e^{2x+y}$ (5+5 Marks)

6. a) Find the Laplace transform of $e^{-4t}\int_0^t t\sin 3t\ dt$

b) Find the inverse Laplace transform of $\dfrac{s}{(s-1)(s^2+1)}$, by using convolution theorem. (5+5 Marks)

7. a) Solve by using Laplace transform method

$\dfrac{dy}{dt} + y = t\,e^{-t},\ y(o) = 2$

b) A periodic function of period $\dfrac{2\pi}{\omega}$ is defined by

$$f(t) = \begin{cases} E\sin\omega t, & 0 \le t < \dfrac{\pi}{\omega} \\ 0, & \dfrac{\pi}{\omega} \le t \le \dfrac{2\pi}{\omega} \end{cases}$$

where E and ω are positive constants.

Show that L [f(t)] = $\dfrac{E\omega}{(s^2+\omega^2)(1-e^{-\pi s/\omega})}$. (5+5 Marks)

8. a) Show that $\bar{F} = \left(y^2\cos x + z^2\right)\hat{i} + 2y\sin x\,\hat{j} + 2xz\,\hat{k}$ is irrotational vector field and find a scalar function ϕ such that $\bar{F} = \nabla\phi$.

b) Find the work done in moving a particle along $x = a\cos\theta,\ y = a\sin\theta,\ z = b\theta$ from $\theta = \frac{\pi}{4}$ to $\frac{\pi}{2}$ under the field of force given by $\bar{F} = -3a\sin^2\theta\cos\theta\,\hat{i} + a\left(2\sin\theta - 3\sin^3\theta\right)\hat{j} + b\sin 2\theta\,\hat{k}$.

(5+5 Marks)

9. a) Use divergence theorem to evaluate $\iint_S \left(y^2z^2 i + z^2x^2 j + x^2y^2 k\right)d\bar{s}$ where S is the upper part of surface $x^2+y^2+z^2=9$ above the XOY plane.

b) Find the directional derivative of $\phi = e^{2x}\cos yz$ at $(0,0,0)$ along the tangent to the curve $x = a\sin t, y = a\cos t, z = at$ at $t = \frac{\pi}{4}$.

(5+5 Marks)

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