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AU – 2512

Third Semester B. E. (Electronics and Telecommunication) Examination

(New)

MATHEMATICS - III

Paper – 3 ET 01

(USC – 11824)

P. Pages : 4

Time : Three Hours] [Max. Marks : 80

Note : (1) Separate answer book must be used for each section in the subject Geology, Engineering material of civil branch and Separate answer book must be used for Section A and B in Pharmacy and Cosmetic Tech.

(2) Answer **Three** questions from Section **A** and **Three** questions from Section B.

(3) Assume suitable data wherever necessary.

(4) Use pen of Blue/Black ink/refill only for writing the answer book.

(5) Use of calculator is permitted.

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SECTION A

1. (a) Find the directional derivative of $\phi = xy^2 + yz^3$ at the point P(2,–1, 1) along the normal to the surface $xy + yz + zx = 3$ at the point (1, 1, 1) 5

(b) Find div. F and curl.F where
$F = \text{grad } (x^3 + y^3 + z^3 - 3xyz)$. 4

(c) Find the Fourier sine transform of $\frac{e^{-ax}}{x}$. 5

OR

2. (a) Show that $\nabla^2(r^n) = n(n + 1)\ r^{n-2}$. 4

(b) (i) For a solenoidal vector F. Show that curl·curl·curl-curl $F = \nabla^4 F$. 3

(ii) If $\overline{F_1}$ and $\overline{F_2}$ are irrotational, show that $\overline{F_1} \times \overline{F_2}$ is solenoidal. 3

(c) Find the Fourier cosine transform of $f(x) = \begin{cases} 1 & 0 \leq x\ a \\ 0 & x > a \end{cases}$ 4

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3. (a) If $w = \phi + i\psi$ represents, the complex potential for an electric field and $\psi = x^2 - y^2 + \dfrac{x}{x^2 + y^2}$, determine the function ϕ. 7

(b) Find the Laurent's expansion of

$$f(z) = \frac{7z-2}{z(z+1)\ (z-2)} \text{ in } 1<z+1<3.$$ 6

OR

4. (a) Prove that $w = \dfrac{z}{1-z}$ maps the upper half of the z-plane into the upper half of the w-plane. 6

(b) Evaluate $\oint_c \dfrac{e^z}{\cos \pi z} dz$ where $c : |z| = 1$ 7

5. (a) Find a real root of the equation $x \log_{10}^x = 1.2$ by Regula - Falsi method correct to four decimal places. 6

(b) Solve

$$\begin{aligned} 10x - 7y + 3z + 5u &= 6, \\ -6x + 8y - z - 4u &= 5, \\ 3x + y + 4z + 11u &= 2 \\ 5x - 9y - 2z + 4u &= 7 \end{aligned}$$

by Gauss elimination method. 7

OR

6. (a) Solve by Relaxation method, the equations

$$\begin{aligned} 10x - 2y - 3z &= 205, \\ -2x + 10y - 2z &= 154 \\ -2x - y + 10z &= 120. \end{aligned}$$ 6

(b) Apply Runge-Kutta method to find an approximate value of y when $x = 1{\cdot}1$ and $x = 1{\cdot}2$ given that $\dfrac{dy}{dx} = x^2 + y^2$ with the condition $y = 1{\cdot}5$ at $x = 1$. 7

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SECTION B

7. (a) Solve by variation of parameter

$$(D^2 + D)\, y = (1 + e^x)^{-1}.$$ 6

(b) Solve $\dfrac{d^4y}{dx^4} + 2\,\dfrac{d^2y}{dx^2} + y = x^2 \cos x.$ 7

OR

8. (a) Solve

$$x^2\,\frac{d^2y}{dx^2} - 3x\,\frac{dy}{dx} + y = \frac{1}{x}\,\delta m\,(\log x).$$ 7

(b) Evaluate

$$(D^2 + 5D + 6)y = e^{-2x}\,\sec^2 x\,(1 + 2\tan x).$$ 6

9. (a) Solve $y_{n+2} - 2y_{n+1} + y_n = n^2 \cdot 2^n$ 5

(b) Solve $p + q = \delta m\, x + \delta m\, y$ 4

(c) Solve $p^2 - pq = 1 - z^2.$ 4

OR

10. (a) Solve

$$y_{n+2} + 3y_{n+1} + 2y_n = \delta m\,\frac{n\pi}{2}.$$ 5

(b) Solve $p^2 - q^2 = \dfrac{x-y}{z}$ 4

(c) Solve $(mz - ny)\, p + (nx - lz)q = ly - mx.$ 4

11. (a) If $\bar{f}(s) = \dfrac{s^2+1}{s^3 + 3s^2 + 2s}$ find $L^{-1}\,\{\bar{f}(s)\}$ 4

(b) Evaluate $\displaystyle\int_0^\infty t^3 e^{-t}\,\delta m t\,dt$ 4

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(c) Solve the Differential equation using Laplace transform

$(D^2 + 4D + 8)y = 1$

with $y = 0$ and $y' = 1$ at $t = 0$ 6

OR

12. (a) Find Inverse Laplace transform by Convolution theorem of

$$\frac{s^2}{(s^2 + a^2)^2}$$ 4

(b) Find L. T. of $\frac{d}{dt}\left(\frac{\delta mt}{t}\right)$ 4

(c) Solve the equation

$$\frac{d^3y}{dt^3} + 2\frac{d^2y}{dt^2} - \frac{dy}{dt} - 2y = 0$$

where $y = 1, \frac{dy}{dt} = 2, \frac{d^2y}{dt^2} = 2$ at $t = 0$ 6

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