AU – 2521

Third Semester B. E. (Elect. Engg./Elec. and Power) Examination

MATHEMATICS – III

Paper – 3 EP 01 / 3 EX 01 / 3 EL 01 / 3 EE 01

(USC – 10477)

P. Pages : 3

Time : Three Hours] [Max. Marks : 80

Note : (1) Assume suitable data wherever necessary.
(2) Use of calculator is permitted.
(3) Use pen of Blue/Black ink/refill only for writing the answer book.

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

(b) Solve

$$(1+x)^2 \frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = \sin\{2\log(1+x)\}$$ 7

OR

2. (a) Solve

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = x e^x \sin x$$ 6

(b) Solve by variation of parameter

$(D^2+D)y=(1+e^x)^{-1}$ 7

3. (a) Find Laplace Transform of $t \cdot e^{3t} \cdot \sin 2t$. 5

(b) Find inverse Laplace Transform of $\frac{e^{-2s}}{s^4}$ 4

(c) Find Laplace Transform of square wave function of period 2a, defined by

$$f(t)=\begin{cases} 1, & 0<t<a \\ -1, & a<t<2a \end{cases}$$ 5

OR

4. (a) Find inverse Laplace Trasnform of $\tan^{-1}\left(\frac{2}{S^2}\right)$ 5

(b) If $L\{J_0(t)\} = \frac{1}{\sqrt{1+S^2}}$, show that $\int_0^\infty t \cdot e^{-3t} \cdot J_0(4t) \cdot dt = \frac{3}{125}$ 5

(c) If $L\{f(t)\} = F(s)$, prove that $L\{\int_0^t f(u)\,du\} = \frac{F(S)}{S}$. 4

5. (a) Solve by Laplace Transform method

$(D+1)^2 y = \sin t\,;\ y(0)=0,\ \ y'(0)=0$ 6

(b) Find Fourier cosine transform of e^{-x^2}. 7

OR

6. (a) Solve by Laplace Transform method

$(D^3 - 2D^2 + 5D)\,y = 0\,;\ y(0)=0,\ y'(0)=0,\ y''(0)=1$ 6

(b) Solve

$$\int_0^\infty f(x)\cdot\sin xt\cdot dx = \begin{cases} 1, & 0 \le t < 1 \\ 2, & 1 \le t < 2 \\ 0, & t \ge 2 \end{cases}$$ 7

7. (a) Solve $y_{n+1} - 3y_n = n^2 \cdot 2^n$ 4

(b) Solve $y_{n+2} - 3y_{n+1} - 4y_n + 6 = 0$ 4

(c) Find inverse Z–transform of $\frac{z}{(z-2)(z+3)^2}$ 5

OR

8. (a) Solve $y_{n+2} - 2y_{n+1} + 2y_n = \cos\frac{n\pi}{2}$ 4

(b) Find Z–Transform of $K\ a^{k-1}\ ;\ k \ge 1$ 4

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(c) Solve by using Z–Transform

$$y_{n+2} + 3y_{n+1} + 2y_n = 1 \; ; \; y_0 = 0 \text{ and } y_n = 0, \text{ when } n < 0$$ 5

9. (a) Find the directional derivative of $\Phi = 4e^{2x - y + z}$ at point $(1, 1, -1)$ in the direction towards point $(-3, 5, 6)$. 6

(b) If $\overline{F} = 3xy\, i + 4yz^2\, j - 5xz k$ and $\phi = y^2 - zx$ find Div $(\Phi\overline{F})$ and curl $(\Phi\overline{F})$. 8

OR

10. (a) Prove that $\nabla_0 (r^3\, \overline{r}) = \sigma r^3$ 4

(b) If $\overline{r} = xi + yj + zk$ and $\Phi = x^3 + y^3 + z^3 - 3xyz$ find $\overline{r}_0\, \nabla\Phi$. 5

(c) Find the angle between normals to the surfaces $x^2y + z = 3$ and $x \log z - y^2 = -4$ at point $P(-1, 2, 1)$. 5

11. (a) Evaluate $\oint_C \overline{F}_0\, d\overline{r}$ where $\overline{F} = x^2\, i + xy\, j$ and C in the boundary of the square in XY–plane bounded by lines $x = 0, x = a$, $y = 0, y = a$. 7

(b) Express $\iint_S \{(x^3 - yz^2)i - 2x^2yj + 2k\} \cdot d\overline{s}$ as a volume integral and evaluate it for the volume of a cube with edges of length a parallel to the co ordinate axes. 6

OR

12. (a) If $\overline{r} = xi + yj + zk$ and $r = |\,\overline{r}\,|$, then show that $\overline{F} = r^2\, \overline{r}$ is conservative and find the scalar potential Φ such that $\overline{F} = \nabla\Phi$. 7

(b) If $\overline{F}_1$ and $\overline{F}_2$ are irrotational, show that $\overline{F}_1 \times \overline{F}_2$ is solenoidal. 6