Total No. of Printed Pages—5

Seat	
No.	9, %
•	

[5668]-142

S.E. (Elect/E.&TC) (Second Semester) EXAMINATION, 2019 ENGINEERING MATHEMATICS—III

(2015 PATTERN)

Time: Two Hours

Maximum Marks: 50

N.B. :- (i) Attempt question Nos. 1 or 2, 3 or 4, 5 or 6, 7 or 8.

- Neat diagrams must be drawn wherever necessary.
- Figures to the right indicate full marks. (iii)
- Use of electronic pocket calculator is allowed. (iv)
- Assume suitable data, if necessary. (v)
- Solve any two 1. (a)
 - $(D^3 + 6D^2 + 12D + 8)y = e^{-2x} + 3^x + \cos 2x$
 - (ii) $x^2 \frac{d^2y}{dx^2} x \frac{dy}{dx} + 4y = \cos(\log x) + \sin(\log x)$
 - (iii) $\frac{d^2y}{dx^2} + 4y = \tan 2x$ (By method of variation of parameter).
 - (*b*) [4]

Find Fourier sine transform of :
$$f(x) = \begin{cases} \frac{\pi}{2} & 0 < x < \pi \\ 0 & x > \pi \end{cases}$$

P.T.O.

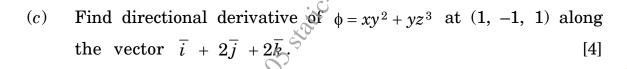


- A 0.1 henry inductor, a 0.004 farad capacitor and a generator 2. (a)having e.m.f. given by 180 cos 40t, $t \ge 0$ are connected in series. Find the instantaneous charge Q and current I, if [4]
 - Solve any one: (*b*) [4]
 - Find Z-transform of $\frac{2^k}{k}$, $k \ge 1$.
 - inverse z-transform for
 - Find f(k), given that: [4] $12f(k+2) - 7f(k+1) + f(k) = 0, k \ge 0, f(0) = 0, f(1) = 3.$
- **3.** (a)Given:

Evaluate y(1.1) by Euler's modified method (Take h =

Use it to find y at x = 1.5 and $\int_0^2 y \, dx$. Find Lagrange's interpolating polynomial passing through set [4]

x	0	1	2
у	2	3	6



Show that (any one): 4. (*a*)

$$(i) \quad \nabla^2[\nabla.(\overline{r}/r^2)] = 2/r^4$$

(ii)
$$\sqrt{\frac{\overline{a} \cdot \overline{r}}{r^2}} = \frac{\overline{a}}{r^2} - \frac{2(\overline{a} \cdot \overline{r})}{r^4}\overline{r}$$

- Show that the vector field $\overline{F} = (y^2 \cos x + z^2) \overline{i} + (2y \sin x) \overline{j}$ (*b*) + $2xz\overline{k}$ is irrotational and find scalar potential ϕ such that [4]
- Evaluate $\int_0^3 \frac{dx}{1+x}$ by dividing the interval into six parts using (c) Simpson's $\frac{3}{8}$ th rule correct upto four decimal places. [4]
- Evaluate the integral $\int_c \overline{F} \cdot d\overline{r}$, where $\overline{F} = (3x^2 + 6y)i 14yzj$ **5.** $+20 xz^2k$ and C is the curve x = t, $y = t^2$, $z \neq t^3$ from t = 0 to t = 1.[4]
 - Verify Green's lemma for $\overline{\mathbf{F}} = x^2i + xyj$ over the region bounded (*b*) x = 0, y = 0, x = 1, y = 1by the boundaries: [5]

$$x = 0, y = 0, x = 1, y = 1$$

- (c) Use Stokes theorem to evaluate $\int_C \overline{F} \cdot d\overline{r}$ where $\overline{F} = xy^2i + yj + xz^2k$ over the surface bounded by x = 0, y = 0, z = 0, x = 1, y = 2.
- 6. (a) Use Green's Lemma to evaluate $\int_{\mathcal{C}} (3ydx + 2xdy)$ where \mathcal{C} is the boundary of the region bounded by y = 0, $y = \sin x$ for $0 \le x \le \pi$.
 - (b) Find the work done by force field $\overline{F} = 2xy^2i + (2x^2y + y)j$ in taking a particle from (0, 0, 0) to (2, 4, 0) along the parabola $y = x^2, z = 0.$ [4]
 - (c) Maxwell's equations are given by : [5] $\nabla \cdot \overline{E} = 0, \ \nabla \cdot \overline{H} = 0, \ \nabla \times \overline{H} = \frac{\partial \overline{E}}{\partial t}, \ \nabla \times \overline{E} = -\frac{\partial \overline{H}}{\partial t}$

then show that E satisfies the equation $\nabla^2 u = \frac{\partial^2 u}{\partial t^2}$.

- 7. (a) If f(s) = u + iv is analytic function with constant amplitude, show that f(z) is constant. [4]
 - (b) Evaluate:

 $\oint_{C} \cot z \, dz$

where 'c' is the circle |z| = 4. [5]

(c) Find the bilinear transformation, which maps the points 1, i, -1 from z-plane onto the points i, 0, -i of the w-plane respectively. [4]

Or $u = \frac{1}{2}\log(x^2 + y^2)$ that f(z) = u + iv is analytic.

(*a*) If: 8.

$$u = \frac{1}{2}\log(x^2 + y^2)$$

[4]

[4]

Evaluate (*b*)

$$\oint_{\mathcal{C}} \frac{z^2 + 1}{z - 2} dz$$

- C is the circle |z 2| = 1.

 C is circle |z| = 1.
- Show that under the transformation $w = z + \frac{1}{z}$ family of circles (c) = c are mapped onto family of ellipses. What happens if