Total No. of Questions— 8] [Total No. of Printed Pages— 5

| Seat No. | |
|---|---|

**[5559]-119**

# S.E. (Mech/Auto./S/W) (I Sem.) EXAMINATION, 2019

## ENGINEERING MATHEMATICS—III

## (2015 PATTERN)

Time : Two Hours Maximum Marks : 50

N.B. :— (i) Neat diagrams must be drawn wherever necessary.

(ii) Figures to the right indicate full marks.

(iii) Use of electronic pocket calculator is allowed.

(iv) Assume suitable data, if necessary.



1. (a) Solve any two of the following differential equations : [8]

(i) $\frac{d^2y}{dx^2} \; 6\frac{dy}{dx} \; 9y \; e^{3x} \cos 4x \; 6e^{2x}$

(ii) $x^2\frac{d^2y}{dx^2} \; x\frac{dy}{dx} \; 16y \; x^2 \; 2^{\log x} \; 4\cosh(\log x)$

(iii) $\frac{d^2y}{dx^2} \; y \; \operatorname{cosec} x$, (by using method of variation of parameters)

(b) Solve the integral equation : [4]

$$\int_0 f(x) \cos x \, dx \; e^{2},$$

P.T.O.

Or

2. (a) A 8 lb weight is placed at one end of a spring suspended from the ceiling. The weight is raised to 5 inches above the equilibrium position and left free. Assuming the spring cosntant 12 lb/ft, find the equation of motion, the displacement function, amplitude and period. [4]

(b) Solve any one of the following : [4]

(i) $L[t\, e^{2t} \cos 3t]$

(ii) $L^{1} \dfrac{2s \quad 7}{s^2 \quad 4s \quad 29}$ .

(c) Solve the differential equation by Laplace transform method : [4]

$$\frac{d^2y}{dt^2} \quad 2\frac{dy}{dt} \quad y \quad te^{t}$$

where $y(0) = 0$, $y(0) = 3$.

3. (a) The first four moments of a distribution about the value 2.5 are 1, 10, 20 and 25. Obtain first four central moments. Also calculate coefficient of skewness $(\ _1)$ and coefficient of kurotsis $(\ _2)$. [4]

(b) A dice is thrown five times. If getting an odd number is a success, then what is the probability of getting : [4]

(i) four successes

(ii) at least four successes.

(c) Find the directional derivative of $xy^2 \quad yz^2 \quad zx^2$ at (1, 1, 1) along the vector $\bar{i} \quad 2\bar{j} \quad 2\bar{k}$ [4]

Or

4. (a) Obtain the regression line of $y$ on $x$ for the following data : [4]

| $x$ | $y$ |
|---|---|
| 1 | 2 |
| 2 | 5 |
| 3 | 3 |
| 4 | 8 |
| 5 | 7 |

(b) Prove the following (any one) : [4]

(i) $\cdot \dfrac{\bar{a} \quad \bar{r}}{r} \quad 0$

(ii) $^2 \, (r^9 \log r) \quad (90 \log r \quad 19) r^7.$

(c) Show that the vector field : [4]

$$\bar{F} = (x^2 \quad yz)\,\bar{i} \quad (y^2 \quad zx)\,\bar{j} \quad (z^2 \quad xy)\,\bar{k}$$

is irrotational. Also find the scalar potential such that $\bar{F} =$ .



5. (a) Evaluate $\int_C \bar{F} \cdot d\bar{r}$ where $\bar{F} \quad zi \quad xj \quad yk$ and C is the arc of the curve $\bar{r} \quad \cos t\,i \quad \sin t\,j \quad t\,k$ from $t = 0$ to $t = 2$ . [5]

(b) Using Gauss divergence theorem, evaluate $\iiint_V \,.\, \bar{F} \, dV$ where $\bar{F} \quad 2x^2yi \quad y^2j \quad 4xz^2k$ over the region bounded by the cylinder $y^2 \quad z^2 \quad 9$ and the plane $z = 2$ in the first octant. [4]

(c) Using Stoke's theorem evaluate $\underset{S}{} F \,.\, \hat{n}\, dS$ where

$F \quad (x \quad y)i \quad (y \quad z)\,j \quad xk$ and S is the surface of the plane $2x + y + z = 2$ which is in the first octant. [4]

Or

6. (a) Using Green's theorem, evaluate $\underset{C}{} e^{x}(\sin\ y\, dx \quad \cos\ y\, dy)$ where 'C' is the rectangle with vertices (0, 0) ( , 0), $, \frac{}{2}$, $0, \frac{}{2}$ . [4]

(b) Using Gauss divergene theorem, evaluate

$$\underset{S}{} [(x^2 \quad yz)\, dydz \quad (y^2 \quad xz)\, dx\, dz \quad (z^2 \quad xy)\, dx\, dy]$$

taken over rectangular parallelopiped $0 \leq x \leq a,\ 0 \leq y \leq b,\ 0 \leq z \leq c$. [4]

(c) Using stoke's theorem evaluate $\underset{S}{} F \,.\, \hat{n}\, dS$ . Where $F \quad yi \quad zj \quad xk$ over the surface $x^2 \quad y^2 \quad 1 \quad z, z \quad 0.$ [5]

7. (a) Solve the wave equation $\frac{^2u}{t^2} \quad C^2 \frac{^2u}{x^2}$ under the conditions : [7]

(i) $u(0, t) = 0$

(ii) $u(4, t) = 0$

(iii) $\frac{u}{t} \quad 0$ when $t = 0$

(iv) $u(x, 0) = 25.$

(b) Solve $\frac{\partial u}{\partial t} = C^2 \frac{\partial^2 u}{\partial x^2}$ under the conditions : [6]

(i) $u(0, t) = 0$

(ii) $u(2, t) = 0$

(iii) $u(x, 0) = x, \ 0 < x < 2$

Or

8. (a) Solve $\frac{\partial^2 V}{\partial x^2} + \frac{\partial^2 V}{\partial y^2} = 0$, given that : [6]

(i) $V(0, y) = 0$

(ii) $V(C, y) = 0$

(iii) $V \to 0$ as $y \to \infty$

(iii) $V = V_0$ when $y = 0$.

(b) Use fourier transform to solve the equation [7]

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial t^2}, 0 < x < \infty, t > 0$$

subejct to conditions :

(i) $u(0, t) = 0, \ t > 0$

(ii) $u(x, 0) = \begin{cases} 6 & 0 < x < 1 \\ 0 & x \geq 1 \end{cases}$

(iii) $u(x, t)$ is bounded.