Total No. of Questions— 8] [Total No. of Printed Pages— 6

Seat No.	

[5668]-111

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

(Common to Mech. S/W)

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) $\frac{d^2y}{dx^2} \quad 16y \quad x\sin 3x \quad 2^{2x} \quad 16$

(ii) $(2x \quad 1)^2 \frac{d^2y}{dx^2} \quad 4(2x \quad 1)\frac{dy}{dx} \quad 8y \quad \cos \sqrt{2}\log(2x \quad 1)$

(iii) $\frac{d^2y}{dx^2} \quad 25y \quad \cot 5x$

by using the method of variation of parameters.

(b) Solve the integral equation : [4]

$$\int_0 f(x)\sin \quad x\,dx \qquad \begin{matrix} 4 & , & 0 & & 4 \\ & 0, & & 0 & \end{matrix}$$

P.T.O.

Or

2. (a) The differential equation : [4]

$$\frac{d^2x}{dt^2} \quad 2k\frac{dx}{dt} \quad n^2x \quad 0,$$

where k is constant and $k < n$ represents the damped harmonic oscillations of a particle. Solve the differential equation and show that the ratio of amplitude of any oscillation to its preceeding one is constant.

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

(i) $L \quad e^{\;2t} t \sin 2t$

(ii) $L^{\;1} \quad \frac{s \quad 3}{(s \quad 4)(s \quad 8)}$.

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

$$\frac{dx}{dt} \quad 4x \quad te^{\;4t}$$

where $x(0) = 1$.

3. (a) The first four moments of a distribution about 2 are 1, 2.5, 5.5 and 16. Calculate first four moments about the mean. Also obtain the coefficient of skewness ($_1$) and coefficient of kurtosis ($_2$). [4]

(b) In a town, 10 accidents took place in a span of 50 days. Assuming that the number of accidents per day follows Poisson distribution, find the probability that there will be : [4]

(i) at least 3 accidents in a day

(ii) at least 2 accidents in a day.

5. (a) Find the work done in moving a particle in the field [5]

$$F \quad yzi \quad xzj \quad zyk$$

along the curve

$$x = 2(t + \sin t), \quad y = 2(1 - \cos t), \quad z = 2t$$

in xy-plane from $t = -$ to $t =$.

(b) Use divergence theorem for [4]

$$F \quad 2xzi \quad yzj \quad z^2k$$

over upper half of the sphere $x^2 + y^2 + z^2 = a^2$.

(c) By using Stokes' theorem, evaluate : [4]

$$\underset{C}{} \; e^x dx \quad 2ydy \quad dz$$

where C is the curve $x^2 + y^2 = 4$, $z = 2$.

Or

6. (a) Using Green's theorem evaluate : [5]

$$\underset{C}{} \; (x^2 \quad 2y)dx \quad (4x \quad y^2)dy$$

where C is the boundary of the region bounded by $y = 0$, $y = 2x$, and $x + y = 3$.

(b) By using Gauss divergence theorem, evaluate [4]

$$\underset{S}{} \; r \cdot \hat{n}\, ds$$

over the closed surface of the sphere of unit radius.

(c) By using Stokes' theorem evaluate : [4]

$$\underset{C}{} \left(x^2 \quad y^2\right)dx \quad 2xy\, dy$$

in the rectangular region in the xy-plane bounded by the lines $x = -a$, $x = a$, $y = 0$, $y = b$.

7. (a) Solve the equation : [7]

$$\frac{{}^2 y}{t^2} \quad c^2 \frac{{}^2 y}{x^2},$$

representing the vibration of a string of length l, fixed at both ends, given boundary conditions :

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

(ii) $y(l, t) = 0$,

(iii) $\frac{y}{t}_{t \quad 0} \quad 0$

(iv) $y(x, 0) = x$, $0 < x < l$.

(b) Solve : [6]

$$\frac{u}{t} \quad k \frac{{}^2 u}{x^2}$$

if

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

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

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

(iv) $u(x, 0) = u_0$.

Or

8. (a) Solve : [6]

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$$

which satisfies the conditions :

$$u(0, y) = u(l, y) = u(x, 0) = 0 \text{ and } u(x, a) = \sin\frac{n\pi x}{l}.$$

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

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

subject to conditions :

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

(ii) $u(x, 0) = \begin{cases} 4 & 0 \le x \le 1 \\ 0 & x > 1 \end{cases}$

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