



Second Semester B.E. Degree Examination, June/July 2019
Engineering Mathematics – II

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions, choosing at least TWO from each part.

PART – A

1 a. Choose the correct answers for the following : (04 Marks)

i) The factor of $\frac{dy}{dx} - \frac{dx}{dy} = \frac{x}{y} - \frac{y}{x}$ is

A) $\left(P + \frac{y}{x}\right)\left(P - \frac{x}{y}\right) = 0$

B) $\left(P - \frac{y}{x}\right)\left(P - \frac{x}{y}\right) = 0$

C) $\left(P + \frac{y}{x}\right)(P + xy) = 0$

D) $(Px + Py)(Px - Py) = 0$

ii) The Integrating factor of the equation $y = 2px + p^n$ is

A) p^3

B) $1/p^2$

C) $1/p$

D) p^2

iii) Which is the equation of the rectangular hyperbola

A) $xz^2 + c$

B) $x^3y^2 + c$

C) $xy = c$

D) $xy^3 + c$

iv) Replace the differential equation $\frac{dy}{dx}$ by $-\frac{dx}{dy}$, in this product of their slopes at each point of intersection is

A) +1

B) 2

C) 1/2

D) -1

b. Solve $y - 2px = \tan^{-1}(xp^2)$. (06 Marks)

c. Solve $p = \sin(y - xp)$. Also find its singular solution. (05 Marks)

d. Find the curve for which the normal makes equal angles with the radius vector and the initial line. (05 Marks)

2 a. Choose the correct answers for the following : (04 Marks)

i) If roots of $m_1 = \alpha + i\beta$, $m_2 = \alpha - i\beta$, then the general solution is

A) $y = e^{\alpha x}(A \cos \beta x + B \sin \beta x)$

B) $y = e^{\alpha x}(\cos \alpha x + \sin \beta x)$

C) $y = (\cos \alpha x - \sin \beta x)$

D) $y = e^x(\cos x + i \sin x)$

ii) Which is the particular integral of $(D^2 - 5D + 6)y = x$

A) $\frac{x}{5} + \frac{5}{18}$

B) $\frac{x}{6} + \frac{5}{36}$

C) $\frac{x^2}{2} + \frac{2}{7}$

D) $\frac{x}{3} + \frac{1}{2}$

iii) The number of auxillary roots of the $(D^3 + 2D^2 + D)y = 0$ are

A) 4

B) 2

C) 3

D) 1

iv) The complimentary function of the equation $(D^3 + 3D^2 + 3D + 1)y = x^2$ is

A) $y = e^{-x}(c_1 + c_2x + c_3x^2)$

B) $y = e^x(c_1x + c_2x^2 + c_3)$

C) $y = c_1e^{-x} + c_2e^{-x} + c_3e^{-x}$

D) $y = (c_1 + c_2x)e^x + c_3e^{-x}$

b. Solve $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 3y = \sin 3x \cos 2x$. (06 Marks)

c. Solve $\frac{d^3y}{dx^3} - 3\frac{d^2y}{dx^2} + 4y = e^{2x} + x$ (05 Marks)

d. Solve the simultaneous equations

$\frac{dx}{dt} + 5x - 2y = t$, $\frac{dy}{dt} + 2x + y = 0$ being given $x = y = 0$ when $t = 0$. (05 Marks)



3 a. Choose the correct answers for the following : (04 Marks)

i) y_1 and y_2 are the solutions of $y'' + py' + qy = 0$, then which is the formula for finding Wronskian.

A) $W = \begin{vmatrix} y_1' & y_2' \\ y_1'' & y_2'' \end{vmatrix}$ B) $W = \begin{vmatrix} y_1 & y_2 \\ y_1' & y_2' \end{vmatrix}$ C) $W = \begin{vmatrix} y_1 & y_2 \\ y_1'' & y_2'' \end{vmatrix}$ D) $W = \begin{vmatrix} y_2 & y_3 \\ y_2' & y_3' \end{vmatrix}$

ii) Cauchy's homogeneous linear equation reduced to linear differential equation with constant coefficient by putting

A) $x = e^t, t = \log x$ B) $y = e^x$ C) $xy^2 = t$ D) $x + y = z$.

iii) Which is the general solution of the equation $(1+x)^2 \frac{d^2y}{dx^2} + (1+x) \frac{dy}{dx} + y = 0$

A) $y = c_1 \cos t + c_2 \sin t$ B) $y = c_1 \cos 2t + c_2 \sin 3t$
C) $y = c_1 \cos^2 t + c_2 t$ D) $y = (c_1 + c_2 t) \sin t$

iv) Which is the recurrence relation for series equation $\frac{d^2y}{dx^2} + xy = 0$

A) $a_n = \frac{a_{n+1}}{(n+1)^2}$ B) $a_{n+2} = \frac{-a_{n-1}}{(n+2)(n+1)}$ C) $a_{n-1} = \frac{a_n}{a_{n+1}}$ D) $a_n = \frac{a_{n+2}}{a_{n+1}}$

b. Solve $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} - 9y = \log x$ (06 Marks)

c. Solve by method of variation of parameters $y'' + a^2y = \sec ax$. (05 Marks)

d. Solve in series the equation $9x(1-x) \frac{d^2y}{dx^2} - 12 \frac{dy}{dx} + 4y = 0$ (05 Marks)

4 a. Choose the correct answers for the following : (04 Marks)

i) Which partial derivative, denotes for S notation

A) $\frac{\partial z}{\partial x}$ B) $\frac{\partial^2 z}{\partial x \partial x^2}$ C) $\frac{\partial^2 z}{\partial x \partial y}$ D) $\frac{\partial^2 z}{\partial y^2}$

ii) Assume the trial solution for solving partial differential equation by separation of variables.

A) $Z = X_{(x)} Y_{(y)}$ B) $Z = X_{(x)}^2 Y_{(y)}^2$ C) $Z = (XY)^2$ D) $Z = Y^2$

iii) The equation is of the form $P_p + Q_q = R$, the subsidiary equation is

A) $\frac{dx}{t} = \frac{dy}{s} = \frac{dz}{z}$ B) $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$ C) $\frac{dx}{x} = \frac{dy}{y} = dz$ D) $\frac{dx}{x} = \frac{dy}{y^2} = \frac{dz}{c}$

iv) The equation $\sqrt{p} + \sqrt{q} = 1$, then the desired solution is

A) $z = ax + (1 - \sqrt{a})^2 y + c$ B) $z = ay + (1 - \sqrt{b})^2 x + c$
C) $z = ax^2 + (1 - \sqrt{a})^3 y + c$ D) $z = axy + c$

b. Form the partial differential equation by eliminating arbitrary function

$z = y^2 + 2f\left(\frac{1}{x} + \log y\right)$ (06 Marks)

c. Solve by the method of separation of variables

$4 \frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 3u$, given that $u(0, y) = 2e^{5y}$. (05 Marks)

d. Solve $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$ (05 Marks)



PART - B

- 5 a. Choose the correct answers for the following : (04 Marks)
- i) The area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is
A) $\pi^2 ab$ B) $\frac{\pi}{2} ab$ C) πab D) $\pi a^2 b^2$
- ii) The value of $\int_0^a \int_0^b \int_0^c (x^2 + y^2 + z^2) dz dy dx$ is
A) $abc(a^2 + b^2 + c^2)$ B) $\frac{abc}{3}(a^2 + b^2 + c^2)$ C) $a^2 b^2 c^2$ D) abc^2
- iii) The definition of $\beta(m, n)$ is
A) $\int_0^1 x^{m-1}(1-x)^{n-1} dx$ B) $\int_0^1 x^{m-2}(1-x)^{n-2} dx$ C) $\int_0^1 x^m(1-x)^n dx$ D) $\int_0^1 x^{m+2}(1-x)^{m^2} dx$
- iv) The coordinates of any point are (ρ, ϕ, z) and the transformation equations from Cartesian are
A) $x = \rho \cos\phi, y = \rho \sin\phi, z = z$ B) $x = \rho \sin^2\phi, y = \sin\phi, z = \rho$
C) $x = \rho \sin\phi, y = \cos^2\phi, z = 3z$ D) $x = \rho \cos\phi, y = \sin\phi$
- b. Using double integral find the area enclosed by the curve $r = a(1 + \cos\theta)$ and lying above the initial line. (06 Marks)
- c. Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} \frac{dz dy dx}{\sqrt{1-x^2-y^2-z^2}}$ (05 Marks)
- d. Evaluate $\int_0^{\infty} e^{-x^2} dx$ (05 Marks)
- 6 a. Choose the correct answers for the following : (04 Marks)
- i) If $\int_C \vec{F} \cdot d\vec{r} = 0$, then F is called
A) rotational B) solenoidal C) irrotational D) circulation.
- ii) If $\vec{F} = (x^2 - yz)\mathbf{i} + (y^2 - zx)\mathbf{j} + (z^2 - xy)\mathbf{k}$, then the value of $\text{div } \vec{F}$ is
A) $2(x + y + z)$ B) $(x + y + z)$ C) $(x^2 + y + z)$ D) xyz
- iii) Given the surface $x^2 + y^2 + z^2 = a^2$, then the value of $\nabla\phi$ is
A) $2x\mathbf{i} + 2y\mathbf{j} + 2z\mathbf{k}$ B) $2x\mathbf{i} + 2y\mathbf{j}$ C) $3x\mathbf{i} + 2y\mathbf{j}$ D) $(2x^2\mathbf{i} + 3y\mathbf{j} + z\mathbf{k})$
- iv) If $\vec{F} = xy\mathbf{i} + yz\mathbf{j} + zx\mathbf{k}$, then the value of $\int_C \vec{F} \cdot d\vec{r}$ is
A) $\int_C xy dx + yz dy + zx dz$ B) $\int_C (xy dx + y^2 z dy + z dz)$
C) $\int_C x^3 \mathbf{i} + y\mathbf{j} + z\mathbf{k}$ D) $\int_C x\mathbf{i} + y^2 \mathbf{j} + z\mathbf{k}$
- b. Find the total work done by the force represented by $\vec{F} = 3xy\mathbf{i} - y\mathbf{j} + 2xz\mathbf{k}$ in moving a particle round the circle $x^2 + y^2 = 4$. (06 Marks)
- c. Verify Stokes theorem for $\vec{F} = (x^2 + y^2)\mathbf{i} - 2xy\mathbf{j}$ taken round the rectangle bounded by the line $x = \pm a, y = 0, y = b$. (05 Marks)
- d. Using the divergence theorem find $\int_S \vec{F} \cdot \mathbf{N} ds$ where $\vec{F} = x^3\mathbf{i} + y^3\mathbf{j} + z^3\mathbf{k}$ and S the surface of sphere $x^2 + y^2 + z^2 = a^2$. (05 Marks)



7 a. Choose the correct answers for the following :

(04 Marks)

i) The $L\{e^{at}t^n\}$ is

- A) $\frac{1}{(s-a)^{n+1}}$ B) $\frac{n!}{(s-a)^{n+1}}$ C) $\frac{n^2}{s^{n+1}}$ D) $\frac{n!}{s^n}$

ii) If $L\{f(t)\} = f(s)$ then the value of $L\{t^n f(t)\}$ is

- A) $(-1)^n \frac{d^n}{ds^n} f(s)$ B) $\frac{d^{n+1}}{ds^{n+1}}$ C) $\frac{d}{ds} f(s)$ D) $(-1)^n \frac{d^{n+1}}{ds^{n+1}}$

iii) If $L\{f(t) = f(s)\}$ then $L\{f(t-a)u(t-a)\}$ is

- A) $e^t f(as)$ B) $e^{-as} \bar{f}(s)$ C) $e^{2s} \bar{f}(s)$ D) $e^{2as} \bar{f}(s)$

iv) If $L\{t^n \delta(t-a)\}$ is

- A) $e^{-as} a^n$ B) $e^{ns} a$ C) $e^{3s} a^2$ D) $e^s a$

b. Find Laplace transform of the full wave rectifier $f(t) = E \sin wt, 0 < t < \pi/w$ having period π/w .

(06 Marks)

c. Find the $L\{e^{3t}u(t-2)\}$

(05 Marks)

d. Using Laplace transform evaluate $\int_0^\infty e^{-t} \cdot t \cdot \sin^2 3t \cdot dt$

(05 Marks)

8 a. Choose the correct answers for the following :

(04 Marks)

i) The inverse Laplace transform of $\frac{s}{(s^2 + a^2)^2}$ is

- A) $\frac{t \cos at}{2a}$ B) $\frac{t \sin at}{2}$ C) $\frac{t \sin at}{2a}$ D) $t^2 \sin at$

ii) If $L^{-1}\left\{\frac{3s+1}{(s-1)(s^2+1)}\right\} = L^{-1}\left\{\frac{P}{s-1} + \frac{Qs+R}{s^2+1}\right\}$ then the values of P, Q and R are

- A) $P = 2, Q = -2, R = 1$ B) $P = 1, Q = 2, R = 2$
 C) $P = 2, Q = 3, R = 1$ D) $P = 2, Q = 3, R = 2$

iii) The inverse Laplace transform of $\tan^{-1}\left(\frac{2}{s}\right)$ is

- A) $\frac{\sin 2t}{t}$ B) $\frac{\sin t}{3}$ C) $\frac{-\sin 2t}{t}$ D) $\cos 2t$

iv) The $L^{-1}\left\{\frac{s}{(s-a)^{n+1}}\right\}$ is

- A) $\frac{e^{at}t^n}{n!}$ B) $\frac{e^{at}t^2}{n!}$ C) $e^{2t}t^3$ D) $e^{t}t^4$

b. Find the inverse Laplace transform of $\frac{2s-1}{s^2+2s+17}$.

(06 Marks)

c. Using convolution theorem find inverse Laplace transform of $\frac{s}{(s^2+a^2)^2}$.

(05 Marks)

d. Solve the following initial value problem by using Laplace transform method

$$\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 4y = e^{-t}, \text{ given } y(0) = 0, y'(0) = 0.$$

(05 Marks)
