Total No. of Printed Pages:4

SUBJECT CODE NO:- H-111
FACULTY OF SCIENCE AND TECHNOLOGY
S.E. (All Branches) (Sem-II)
Engineering Mathematics -IV
(REV)

[Time: Three Hours] **[Max.Marks:80]**

Please check whether you have got the right question paper.

N.B
i) Q.No.1 and 6 are compulsory.
ii) Solve any two questions from the remaining questions of each section.
iii) Figures to the right indicate full marks.
iv) Assume suitable data, if necessary.

Section A

Q.1 Attempt any five. 10

a) Find Laplace transform of $\frac{sinwt}{t}$.

b) Find Laplace transform of $e^{-4t}\delta(t-3)$

c) Find Laplace transform of $f(t) = \begin{cases} sin\left(t-\frac{\pi}{2}\right), & t > \frac{\pi}{2} \\ 0, & t < \frac{\pi}{2} \end{cases}$

d) Find Inverse Laplace transform of $\frac{e^{-s}}{s^2+\pi^2}$

e) Find Inverse Laplace transform of $\frac{1}{s^2-2s+17}$

f) Find Inverse Laplace transform of $\frac{2s-5}{s^2-9}$

g) From the partial differential equation by eliminating arbitrary constants from the relation $\log(az-1) = x + ay + b$

OR

Find z-transform of $cosh\left(\frac{k\pi}{4}\right), k \geq 0$.

h) Solve $2x\frac{\partial z}{\partial x} - 3y\frac{\partial z}{\partial y} = 0$

OR

Find z-transform of $ke^{-2k+5}, k \geq 0$.

Q.2 a) Evaluate $\int_0^\infty \frac{cos6t-cos4t}{t}dt$ 05

b) Find the inverse Laplace transform of $2tan^{-1}h(s)$ 05

c) Solve $\frac{\partial u}{\partial t} = \alpha^2 \frac{\partial^2 u}{\partial x^2}$, for $0 < x < \pi, u_x(0,t) = 0, u_x(\pi,t) = 0$ and $u(x,0) = sinx$ 05

OR

Solve the difference equation by using z transform
$y(k+2) - 5y(k+1) + 6y(k) = 5^k$,
Given $y(0) = 0, y(1) = 1, k \geq 0$.

Q.3 a) Express the following function in terms of Heaviside unit step function and hence find its Laplace transform. 05

$$f(t) = \begin{cases} cos\, t & 0 < t < \pi \\ \cos 2t & \pi < t < 2\pi \\ \cos 3t & t > 2\pi \end{cases}$$

b) Solve : $\frac{dx}{dt} - y = e^t, \frac{dy}{dt} + x = sin\, t$, 05
Under $x(0) = 1, y(0) = 0$.
By Laplace transform method.

c) Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ subject to condition 05

i. u=0 when $y \to \infty$
ii. u=0 when x=0 for all values of y
iii. u=0 at x=π
iv. u=u_o when y = 0 for 0 < x < π.

OR

Find inverse z-transform of $\frac{z^2}{z^2+9}$

Q.4 a) find inverse Laplace transform by using convolution theorem $\frac{s^2}{(s^2+a^2)^2}$ 05

b) find Laplace transform of $\frac{cosh3t.sin4t}{t}$ 05

c) solve $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ under boundary conditions 05

i. $u(0,t) = u(2,t) = 0$
ii. $u(x,0) = \sin^3 \frac{\pi x}{2}$
iii. $u_t(x,0) = 0$

OR

Find z-transform of $\frac{sinhak}{k}$ for $k \geq 0$.

Q.5 a) Solve : $y'' + 2y' + y = 3t\, e^{-t}, y(0) = 4, y'(0) = 2$. 05
By Laplace transform method.

b) Find Laplace transform of periodic function 05

$$f(t) \begin{cases} t, & 0 < t < \pi \\ \pi - t, & \pi < t < 2\pi \end{cases} \qquad \text{and } f(t) = f(t + 2\pi)$$

c) Solve : $\frac{y^2 z}{x} p + xzq = y^2$ 05

OR

Find z-transform of $e^{-ak}.k(k-1), k \geq 0$.

Section B

Q.6 Attempt any five. 10

a) Find the first approximate value of root(i.e.x_1) by Newton Raphson method for $x \sin x + \cos x = 0$

b) Find values of x,y,z in first iteration by Gauss Seidal method.

$$20x + y - 2z = 17$$
$$3x + 20y - z = -18$$
$$2x - 3y + 20z = 25$$

c) Find residue of $f(z) = \frac{z^2}{(z-1)^2(z+3)}$ at each pole.

d) Evaluate $\int_0^{4+2i} \bar{z} dz$ along the curve given by $z = t^2 + it$

e) State necessary and sufficient condition for $w = f(z)$ to be conformal.

f) Find harmonic conjugate of $u = y + e^x \cos y$.

g) Find $f(2)$ for the following data

x	0	1	3	6
F(x)	18	10	-18	90

h) Find the image of line $y = 2x$ under transformation $w = z^2$.

Q.7 a) Using Cauchy's integral formula evaluate 05

$\oint_c \frac{2z+1}{z^2-z-2} dz$ where c is |z| = 3.

b) Find bilinear transformation which maps the points $z = 1, i, -1$ onto the points $w = 2, i, -2$ respectively. 05

c) Fit a second degree parabola to the following data. 05

X	0	1	2	3	4
Y	1.0	1.8	1.3	2.5	6.3

Q.8 a) Given that $\frac{dy}{dx} = -xy^2, y(2) = 1$. Take $h = 0.1$ find y at $x = 2.2$ by Euler's modified method. 05

b) Use Runge Kutta method of order four, to find y at $x = 0.1$ given that $\frac{dy}{dx} = xy + y^2, y(0) = 1$ 05

c) Expand $f(z) = \frac{7z-2}{z(z+1)(z-2)}$ in the region $1 < |z+1| < 3$. 05

Q.9 a) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 0.96$ for the data. 05

X	0.96	0.98	1.00	1.02	1.04
y	0.7825	0.7739	0.7651	0.7563	0.7473

b) Evaluate $\int_c z\,\bar{z}\,dz$, where c is the upper half of circle |z| = 2 from z = -2 to z = 2. 05

c) Prove that $v = -2xy + \frac{y}{x^2+y^2}$ is harmonic. Find its harmonic conjugate function u and corresponding analytic functions. 05

Q.10 a) Use Newton-Raphson method to find real root of equation $x \tan x + 1 = 0$ correct upto three decimal places. 05

b) Construct analytic function $f(z) = u + iv$ whose real part is $u = e^{-\theta}\cos(logr)$ 05

c) Use Cauchy's residue theorem to evaluate $\oint_c \frac{cosh\,z}{(z+1)^3(z-1)}dz$ over $|z| = 2$. 05

Total No. of Printed Pages:4

SUBJECT CODE NO:- H-112
FACULTY OF SCIENCE AND TECHNOLOGY
S.E. (All Branches) (Sem-II)
Engineering Mathematics -IV
(OLD)

[Time: Three Hours] **[Max. Marks: 80]**

Please check whether you have got the right question paper.

N.B
1. Q.No.1 and 6 are compulsory.
2. Solve any two questions from the remaining questions of each section.
3. Figures to the right indicate full marks.
4. Assume suitable data, if necessary.

Section A

Q.1 Attempt any five from following: 10

a) Find the image of $y = 4x$ under $w = z^2$

b) Expand $f(z) = \sin 2z$ about $z = \frac{\pi}{8}$ in Taylor's series.

c) Find harmonic conjugate of $u = x^2 - y^2 - y$

d) Find the residue of $f(z) = z^2 \sin\left(\frac{1}{z}\right) at\ z = 0$

e) Evaluate $\oint_c \frac{\cos 2\pi z}{(z-2)^2} dz$ where C is $|z| = 1$

f) Evaluate $\int_{-2+i}^{5+i} z^2 dz$ along any curve joining the points $(-2,1)$& $(5,1)$

g) Solve $4\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 3u$where $u(o,y) = 3e^{-y}$

OR

Find z-transform of $f(k) = \sin k\ Sn\ Sk,\quad k \geq 0$

h) Solve $4\frac{\partial^2 u}{\partial x^2} - \frac{\partial u}{\partial t} = 0$

OR

Find z-transform of $f(k) = k\ e^{-2k+3}\ ,k \geq 0$

Q.2 a) Expand $f(z) = \frac{(z+2)(z-2)}{(z+1)(z+4)}$ in $1 < |z| < 4$ 05

b) Find bilinear transformation which maps the points $z = 2, i, -2$ onto the points $w = 1, i, -1$ respectively. 05

c) Evaluate $\int_o^\pi \frac{d\theta}{[4+\cos\theta]}$ by residue theorem. 05

Q.3 a) Evaluate $\oint_c \frac{\cot \pi z}{\left(z-\frac{1}{2}\right)^2} dz$ where C is $|z+1| = \frac{1}{2}$ by Cauchy's residue theorem. 05

b) Find and plot the image of rectangular region bounded by $x = 0, y = 0, x = 3, y = 4$ in 05 w-plane under transformation $w = \sqrt{2}\, e^{-i\frac{\pi}{4}}\, z$

c) Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$, under following conditions 05

i) $u(o, y) = 0, \quad y > 0$

ii) $u(\pi, y) = 0\ , \quad y > 0$

iii) $u(x, \infty) = 0, \quad 0 < x < \pi$

iv) $u(x, o) = u_0, \quad 0 < x < \pi$

OR

c) Solve $y_{k+2} - 3y_{k+1} + 2y_k = 4^k$ under condition $y_0 = 0, y_1 = 1$by z-transform. 05

Q.4 a) Evaluate $\oint_c \frac{z^2}{z^4 - 1} dz$, where C is circle $|z + i| = \frac{3}{2}$ by using Cauchy's integral formula. 05

b) Construct an analytic function $f(z) = u(r, \theta) + i\vartheta(r, \theta)$ where imaginary part is $e^{-\theta} \sin(wgr)$ 05

c) Solve: $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ under following 05
Conditions:

i) $\frac{\partial u}{\partial x} = 0 \ \ when\ x = 0, t > 0$

ii) $\frac{\partial u}{\partial x} = 0 \ \ when\ x = l, t > 0$

iii) $u(x, t) = 0, when\ t = 0, \&\ 0 < x < l$

OR

c) find inverse z-transform of $f(z) = \frac{z^2 - z}{z^3 - 5z^2 + 8z - 4}$ 05

Q.5 a) Show that $u = e^x \cos y + x^3 - 3xy^2$ is harmonic function. Also find corresponding analytic function $f(z) = u + i\vartheta$ & harmonic conjugate ϑ. 05

b) Evaluate $\int_c (z - z^2) dz$ along the upper half of $|z - 2| = 3$ 05

c) Solve $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$ under following 05
Conditions:-

i) $y(x, t) = 0 \quad when\ x = 0$

ii) $y(x, t) = 0 \quad when\ x = l$

iii) $y(x, t) = a. \sin\left(\frac{px}{l}\right) when\ t = 0$

iv) $\frac{\partial y}{\partial t} = 0 \ \ when\ t = 0$

OR

c) Find z-transform of $\frac{\cos 2k}{k}, k \geq 1$ 05

Section B

Q.6 Attempt any five: 10

a) Find Laplace transform of: $4 \sin t \sin h^2 2t$

b) Find Laplace transform of: $(4)^t + t^4$

c) Find Laplace transform of: $e^{-t} cost. u\ (t - \pi)$

d) Find inverse Laplace transform of: $\frac{e^{-cs}}{s^2(s+a)}, c > 0$

e) Find inverse Laplace transform of: $\frac{1}{\sqrt{2s+3}}$

f) Find inverse Laplace transform of: $\frac{1}{s^2-s+1}$

g) Find Fourier cosine transform of $f(x) = e^{-a|x|}, a > 0$

h) State modulation theorem of Fourier transform.

Q.7 a) Evaluate $\int_{t=0}^{\infty} e^{-2t}\ \frac{2\ sint - 3\ sinht}{t}\ dt$ 05

b) Find inverse Laplace transform of $2 \cot^{-1}\left(\frac{s+4}{2}\right)$ 05

c) Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}, x > 0, t > 0,$ 05

Subject to the conditions

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

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

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

Q.8 a) Express the following function into Heaviside unit step function & hence find its Laplace transform: 05

$f(t) = \sin(\pi t), \frac{1}{2} < t < 1$

b) Find inverse Laplace transform of $\frac{s}{(s-5)(s^2+25)}$ by using convolution theorem. 05

c) Find Fourier cosine transform of function defined as $f(x) = \cos x; \quad 0 < x < a$ 05

$= 0 \quad ; \quad x \geq a$

Q.9 a) Find Laplace transform of $e^{-3t} \int_0^t t \cos 2t\ dt$ 05

b) Solve $\frac{d^2x}{dt^2} + 9x = \cos 2t$ if $x(0) = 1, x\left(\frac{\pi}{2}\right) = -1$ 05

c) Solve the integral equation $\int_0^\infty f(x)\sin\lambda x\,dx = \frac{sin\lambda}{\lambda}$ 05

Q.10 a) Find Laplace transform of periodic function 05

$$f(t) = a\sin p\,t\,; 0 < t < \frac{\pi}{p} \;\&\; f\left(t + \frac{2\pi}{p}\right) = f(t)$$
$$= 0 \qquad ; \frac{\pi}{p} < t < \frac{2\pi}{p}$$

b) Solve simultaneous Differential equations: 05

$$\frac{dx}{dt} + 5x - 2y + t = 0; \frac{dy}{dt} + 2x + y = 0$$

Conditions $x(0) = 0$ & $y(0) = 0$; by Laplace transform

c) Find Fourier transform of $f(x) = \begin{cases} 4 - x^2 & ; |x| \le 4 \\ 0 & ; |x| > 4 \end{cases}$ 05

Total No. of Printed Pages:03

SUBJECT CODE NO:- H-301
FACULTY OF SCIENCE AND TECHNOLOGY
S.E (ALL - BRANCHES)(Sem-I)
Engineering Mathematics- III
[OLD]

[Time: Three Hours] **[Max.Marks:80]**

Please check whether you have got the right question paper.

N.B
i. Question number one and six are compulsory.
ii. Attempt any two questions from the remaining each section.
iii. Figures to the right indicate full marks.
iv. Assume suitable data if necessary.
v. Use of non- programmable calculator is allowed.

Section – A

Q.1 Solve any five from the following: 10

a) Solve $(D^4)y = 0$
b) Solve $(D^4 - 16)y = 0$
c) Find the particular integral of $(D^2 - 9)y = cosh2x$
d) Solve $(x^2D^2 - 4xD + 6)y = 0$
e) Construct differentional the equation of motion of a body of weight 10kg attached to a spring given that 20kg weight will stretch the spring to 10cm.
f) Construct the differential equation of an electrical circuit consists of an resistance of R, capacitance of C with alternating e.m.f.V.
g) For a normally distributed variate with mean 1 and S.D.3, find probabilities that $3.43 \leq X \leq 6.19$
h) If a random variable has a Poisson distribution such that $P(1) = P(2)$, find mean of the distribution.

Q.2
a) Solve :$(D^3 - D)y = 2x + 1 + 4cosx + 2e^x$ 05
b) A body weighing 10kg is hung from a spring. A pull of 20kg wt. will stretch the spring to 10cm. If the body is pull down to 20cm below the statics equilibrium position and then released. Find the displacement of the body from its equilibrium position at time t sec, the maximum velocity and the period of oscillation. 05
c) Calculate the mean and standard deviation for the following data: 05

Size of tem	6	7	8	9	10	11	12
Frequency	3	6	9	13	8	5	4

Q.3	a)	Solve: $(D^2 - 2D + 1) = e^x logx$, by variation of parameters.	05
	b)	In an L-C-R circuit, the charge q on a plate of a condenser is given by $L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{q}{c} = E\sin pt$ The circuit is tuned to resonance so that $p^2 = \frac{1}{LC}$. If initially the current i and and charge q be zero, show that, for small values of $\frac{R}{L}$,the current in the circuit at time t is given by $\left(\frac{Et}{2L}\right)\sin pt$	05
	c)	The first three moments of a distribution about the value 2 of variable are 1, 16 and -40. Find the mean, variance and μ_3.	05
Q.4	a)	Solve: $(x^3D^3 - 8x^2D^2 + 28xD - 40)y = \frac{-9}{x}$	05
	b)	A light horizontal strut AB of length l is freely pinned at A and B and is under the action of equal and opposite compressive forces P at each of its ends and carries a load W at its center. Prove that the deflection at the center is $\frac{W}{2P}\left(\frac{1}{n}\tan\frac{nl}{2} - \frac{l}{2}\right)$, where $n^2 = \frac{P}{EI}$	05
	c)	In the test on 2000 electric bulbs, it was found that life of a particular make, was normally distributed with an average life of 2040 hours and S.D. of 60 hours Estimate the number of bulbs likely to burn for more than 2150 hours.	05
Q.5	a)	In 256 sets of 12 tosses of a coin, in how many cases one can expect 8 heads and 4 tails.	05
	b)	Solve: $((2x+3)^2D^2 + (2x+3)D + 2)y = 24x^2$.	05
	c)	Find the best value of a and b so that $y = a + bx$ fits the given data:	05

X	0	1	3	6	8
Y	1	3	2	5	4

Section – B

Q.6 Solve any five from the following: 10

a) Find grad (f) at (1,2,3), if $f = x^2y^2z^2$
b) Find the unit vector normal to the surface $x^2 + y^2 + z^2 = 9$ at the point (2,-2,1)
c) Find constant a, b, c so that $\overline{F} = (x + 2y + az)i + (bx - 3y - z)j + (4x + cy + 2z)k$ is irrotational.
d) Evaluate $\int_c ydx + 2xdy$ along the parabola $y^2 =$ x from $(0,0) to$ $(1,1)$
e) State Green's theorem
f) Find the first approximate root of the equation $3x = cosx + 1$ using Newton – Raphson method.
g) Find the first approximate solution of the equation $10x + 2y + z = 9$, $2x + 20y - 2z = -44$, $-2x + 3y + 10z = 22$by Gauss Seidal method.
h) Find the missing term in the following:

x	0	2	3	4
f(x)	-1	7	…….	31

Q.7	a)	Find the directional derivative of $f = x^2 - y^2 + 2z^2$ at the point $P(1,2,3)$ in the direction of the line PQ where Q is the point (5,0,4)	05
	b)	Show that vector field defined by $\overline{F} = 2xyz^3 i + x^2z^3 j + 3x^2yz^2 k$ is irrotational , and find a scalar potential u such that $\overline{F} = \nabla u$	05
	c)	Find the real root of the equation $tanx = 1.5x$ by Newton – Raphson method correct to three decimal places.	05
Q.8	a)	If $\overline{r} = xi + yj + zk$, Prove that $\text{div}(r^n \overline{r}) = (n+3)r^n$	05
	b)	Use Green's theorem in a plane to evaluate the plane $\int_c (2x^2 - y^2)dx + (x^2 + y^2)dy$ where C is the boundary in xy-plane of the area enclosed by the semi – circles $x^2 + y^2 = 1$ and x- axis in the upper half xy – plane.	05
	c)	Use Runge – Kutta fourth order method to find y for $x = 0.1$ given that $\frac{dy}{dx} = xy + y^2, y(0) = 1$	05
Q.9	a)	Find divergence and curl of the vector $\overline{V} = (xyz)i + (3x^2y)j + (xz^2 - y^2z)k$	05
	b)	Evaluate $\iint \overline{F}.\overline{n}dS$ over the entire surface of the region above the xy – plane bounded by the cone $z^2 = x^2 + y^2$ and the plane $Z = 4$, if $\overline{F} = 4xzi + xyz^2 j + 3zk$	05
	c)	Solve the equations $1.2x + 2.1y + 4.2z = 9.9$, $5.3x + 6.1y + 4.7z = 21.6$, $9.2x + 8.3y + z = 15.2$ by Gauss Seidal method.	05
Q.10	a)	Evaluate $\int \overline{F}.d\overline{r}$ by Stoke's Theorem, where $\overline{F} = y^2 i + x^2 j - (x+z)k$ and C is the boundary of the triangle with vertices at (0,0,0) , (1,0,0) and (1,1,0)	05
	b)	Find $y'(1.5)$ and $y''(1.5)$ from the given table	05

x	1.5	2	2.5	3	3.5	4
F(x)	3.375	7.000	13.625	24.000	38.875	59.000

	c)	Solve for y at x = 0.2 by Euler's modified method : $\frac{dy}{dx} = \log(x+y), y(0) = 2 \; with \; h = 0.2$	05

Total No. of Printed Pages:4

SUBJECT CODE NO:- H-302
FACULTY OF SCIENCE AND TECHNOLOGY
S.E. (All) (Sem-I)
Engineering Mathematics-III
(Revised)

[Time: Three Hours] **[Max.Marks:80]**

Please check whether you have got the right question paper.

N.B
1. Q.No.1 & Q.No.6 are compulsory.
2. Solve any two questions from the remaining questions of each section.
3. Figures to the right indicate full marks.
4. Assume suitable data, if necessary.

Section A

Q.1 Attempt **any five** questions from the following: 10

a) Solve $(D^2 - 2D + 1)y = 0$

b) Solve $(D^2 + 6D + 25)y = 0$

c) Find the P.I. of the equation $(D^2 + D - 6)y = \frac{-e^x}{4}$

d) Solve $(x^2D^2 - xD - 3)y = 0$

e) Write the differential equation of L-C-R-E circuit

f) Find Fourier transform of $f(x) = \frac{1}{2a}, \quad |x| \le a$
$= 0, \quad |x| < a$

g) Find Fourier cosine transform of $f(x) = 1, \quad 0 < x < 1$
$= 0, \quad x > 1$

h) Find Fourier sine transform of $f(x) = e^{-ax}, 0 < x < \infty$

Q.2
a) Solve $(D^2 - 4D + 1)y = \sin^2 x$ 05
b) Find the Fourier cosine transform of $e^{-ax}\cos ax$ 05
c) Find $f(x)$ satisfying the integral equation $\int_0^\infty f(\lambda) cos\lambda x dx = e^{-\lambda},\ \lambda \ge 0$ 05

Q.3
a) Solve by method of variation of parameter $(D^2 + 1)y = cosecx\ cotx$ 05

b) Find Fourier sine transform of $\frac{x}{1+x^2}$ 05

c) A long column of length *l* fixed at one end, and hinged at the other is under the action of axial load p, taking the fixed end as origin, it satisfies the equation $\frac{d^2y}{dx^2} + n^2y = \frac{Fn^2}{p}(l - x), where\ n^2 = \frac{p}{EI}$ and F is the force applied laterally at the hinge to prevent the lateral movement, show that the deflection curve is 05

$$y = \frac{F}{p}\left(\frac{sinnx}{n} - l\ conx + l - x\right)$$

Q.4 a) Solve $x^2y'' - 2x\,y' + 2y = 4x^3$ 05

b) Express the $f(x) = 1, |x| \le 1$ 05

$= 0, |x| > 1$

As a Fourier integral and hence evaluate

$$\int_0^\infty \frac{\sin\lambda\ cos\lambda x}{\lambda} d\lambda$$

c) A circuit consists of an inductance of 0.05 Henry, a resistance of 5 ohms and a condenser of capacity 4×10^{-4} farad, if $q = i = 0$, when $t = 0$, find q and i when a constant EMF of 110 volts. 05

Q.5 a) Solve without using the method of variation of parameter $(D^2 + 5D + 6)y = e^{e^x}$ 05

b) Solve $(x+1)^3y'' + 3(x+1)^2y' + (x+1)y = 6\log(x+1)$ 05

c) Determine the transient and steady-state solution of mechanical system with weight 6 lb, stiffness constant 12 lb/ft, damping force 1.5 times instantaneous velocity, external force 24 cost and initial conditions are $x = \frac{1}{3}\ and \frac{dx}{dt} = 0$ 05

Section B

Q.6 Attempt **any five** questions from the following: 10

a) Calculate the mean from following data:

X:	4-8	8-12	12-16	16-20	20-24	24-28
F:	11	13	16	14	9	6

b) Find the median from the following frequency distribution table:

X:	60-80	80-100	100-120	120-140	140-180
F:	11	14	20	15	10

c) The probability of defective bolt is 0.1. Find mean and standard for the distribution of bolt in a total of 400.

d) Find grad $(\phi), if\ \phi = x^2 + y - z\ at\ (1,1,1)$

e) Prove that $\overline{F} = (z^2 + 2xy + 3y)i + (3x + 2y + z)j + (y + 2zx)k$ is irrotational.

f) Show that the vector $\overline{V} = (x+3y)i + (y-3z)j + (x-2z)k$ is solenoidal.

g) Evaluate $\int_c \overline{F}\,.\,d\overline{r}$ along the line $y = x$ between the points (0,0) to (2,2), where $\overline{F} = x^2 i + y^2 j$

h) State Green's theorem.

Q.7 a) Find the directional derivative of the function $\Phi(x,y,z) = xy^2 + yz^3$ at the point $(1,-1,1)$ in the direction of $(3,1,-1)$ 05

b) Find the mean deviation from the mean of the following data: 05

X:	0-6	6-12	12-18	18-24	24-30
F:	8	10	12	9	5

c) Evaluate $\int_c \overline{F}\,.\,d\overline{r}$ where $\overline{F} = x^2 i + xyj$ along the line $x = 2$ from $y = 0$ to $y = 2$ 05

Q.8 a) Prove that $\overline{A} = (6xy + z^3)i + (3x^2 - z)j + (3xz^2 - y)k$ is irrotational. Find the scalar potential Φ such that $\overline{A} = \nabla\Phi$. 05

b) Calculate Karl Pearson's coefficient of Skewness from the following data: 05

X:	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40
F:	2	5	7	13	21	16	8	3

c) Verify Green's theorem in the plane for $\int_c (xy + y^2)dx + x^2\,dy$ where c is the closed curve of the region bounded by $y = x$ and $y = x^2$ 05

Q.9 a) Prove that $\nabla.\left(r\,\nabla\frac{1}{r^n}\right) = \frac{n(n-2)}{r^{n+1}}$ 05

b) The probability that a bomb dropped from a plane will strike the target is $\frac{1}{5}$. If six bombs are dropped, find the probability that i) exactly 2 will strike the target ii) at least two will strike the target. 05

c) By using Stoke's theorem evaluate $\int_c [(x^2 + y^2)i + (x^2 - y^2)j].\,d\overline{r}$ where c is boundary of the region enclosed by the circles $x^2 + y^2 = 4, \quad x^2 + y^2 = 16$ 05

Q.10 a) Find the co-efficient of correlation for the following data 05

x:	10	14	18	22	26	30
y:	18	12	24	6	30	36

b) Assume the mean height of soldiers to be 68.22 inches with variance of 10.8 inches. How many soldiers in a regiment of 2000 soldiers would you expect to be six feet tall. Assume heights to be normally distributed. 05

c) Evaluate $\iint_S \overline{F}.\,d\overline{s}$ using Gauss divergence theorem where $\overline{F} = 4xzi + xyz^2j + 3zk$ over the region bounded by the cone $z^2 = x^2 + y^2$ and plane $z = 4$, above $xy - plane$. 05

Total No. of Printed Pages:3

SUBJECT CODE NO:- H-1011
FACULTY OF SCIENCE & TECHNOLOGY
S.Y. B.Tech. (All) (Sem-IV)
Engineering Mathematics-IV
[Old]

[Time: Three Hours] **[Max. Marks:80]**

Please check whether you have got the right question paper.

N.B
1) Q:1 in Sec.A and Q:6 in Sec.B are compulsory.
2) Solve any two from Q:2 to Q:5 in Sect. A, and solve any two from Q:7 to Q:10 in Sec.B.

SECTION A

Q.1 Solve any Five (10)

(i) Cauchy-Riemann equations in polar form for analytic function are-------
(ii) State Green's theorem.
(iii) Cross-ratio property for bilinear transformation is --------
(iv) Express Cartesian co-ordinates in cylindrical polar co-ordinates.
(v) State Cauchy's Residue theorem.
(vi) Define zero and pole of a function $f(z)$
(vii) Express $\int_0^{2\pi} f(sin\theta,\ \ cos\theta)d\theta$ in complex form.
(viii) Find residue of $f(z) = \frac{z^2}{z^2-3z+2}$ at Z=2

Q.2 a) Evaluate $\iint_S \bar{F}.d\bar{s}$ where $\bar{F} = (2xy+z)i + y^2 j - (x+3y)K$ and s is the surface bounded by $x = 0$, $y = 0, z = 0$ and $2x + 2y + z = 6$. (05)

b) Determine analytic function $f(z)$ whose imaginary part is $e^{-x}(xcos2y + ysin\ 2y)$ (05)

c) Use residue theorem to evaluate (05)
$$\oint_c \frac{\cos\pi z^2 + \sin\pi z^2}{(z-1)^2.(z-2)}\ dz\ \ where$$
$c: |z| = 3$

Q.3 a) Verify Green's theorem for $\bar{F} = x^2 i + xyj$ where R is the region bounded by $x = 0$, $y = 0, x = a, y = b$ (05)

b) Evaluate $\oint_c \frac{10z+9}{z(z^2-4)} dz$ $c: |z-1| = 3$ (05)

c) Find the bilinear transformation that maps the points $z = \infty, i, o$ on to the points $w = -1, -i, 1$ (05)

Q.4 (a) Evaluate $\int_{-3}^{3} \frac{z+5}{z} dz$, in anticlock direction where c is $|z| = 3$ (05)

(b) Find the work done in moving the partical once round the circle $x^2 + y^2 = 4, z = 0$ under the field of force $\bar{F} = (2xy + 3z^2)i + (x^3 + 4yz)j + (2y^2 + 6xz)k$ (05)

(c) Find Lauzentz's series of $f(z) = \frac{1}{z^2-3z+2}$ over (i) $|z - 2| > 1$ (05)
(ii) $|z| < 1$

Q.5 (a) Show that $u = r^3 \cos 3\theta + r sin\theta$ is harmonic. Find its harmonic conjugate and corresponding analytic function $f(z)$. (05)

(b) Evaluate $\int_{0}^{2\pi} \frac{4}{2+Cos\theta} d\theta$ (05)

(c) Use Stoke's theorem to evaluate $\oint_c \bar{F}.d\bar{r}$, $\bar{F} = y^2 i + xyj + xzk$ C is the curve $x^2 + y^2 + z^2 = 1, z = 0$ (05)

SECTION B

Q.6 Solve any Five (10)

(i) $Z[K.5^K] =$--------

(ii) Define algebraic and transcendental equations.

(iii) State one dimensional heat equation.

(iv) Find $L_3(x) if\ x_0 = 1,\ x_1 = -1, x_2 = 2, x_3 = 0.$

(v) The solution of $PDE\ \frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 5u$ is ------------

(vi) Find $Z^{-1}\left[\frac{Z}{Z^2-9Z+20}\right], |Z| > 5$

(vii) Write down any one solution of wave equation.

(viii) Find $Z[3^K + 5^K], K < 0.$

Q.7 a) Solve the system of equations by Gauss – Seidel method (05)
$6x + 15y + 2z = 72, 27x + 6y - z = 85$
$x + y + 54z = 110$

b) Solve one dimensional heat flow equation $\frac{\partial u}{\partial t} = K \frac{\partial^2 u}{\partial x^2}$ for $u(x,t)$ (05)
subject to $u(o,t) = u(\pi,t) = 0$
$u(x,0) = \pi x - x^2, 0 \leq x \leq \pi$ and
$u(x,\infty)$ is finite

c) Find $Z[4^K.Sin\ (2K + 3)]$ (05)

Q.8

a) For the differential equation $\frac{dy}{dx} = -xy^2$ (05)
$y(0) = 2,$ Calculate $y(0.2)$ by Taylor's series method, retaining 4 non-zero terms only.

b) Solve the difference equation by Ƶ – transform. (05)
$y_{k+2} + 6y_{k+1} + 9y_k = 2^k$, given $y_0 = y_1 = 0$

c) Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ within the rectangle $0 \le x \le a, 0 \le y \le b$ given (05)
$u(0, y) = u(a, y) = u(x, b) = 0$
$u(x, 0) = x(a - x)$

Q.9

a) Use Runge – Kutta 4th order method to find $y(1.4), if\ y(1) = 2$ and $\frac{dy}{dx} = xy$. Take h=0.2. (05)

b) Find $Ƶ^{-1}\left[\frac{10Ƶ}{(Ƶ-1)(Ƶ-2)}\right] |Ƶ| > 2$ (05)

c) A string is stretched tightly between $x = 0$ & $x = l$ and both ends are given displacements $y = a\ sinpt$ perpendicular to string. If string satisfies the equation $\frac{\partial^2 y}{\partial t^2} = C^2 \frac{\partial^2 y}{\partial x^2}$. Show that the oscillation of the string given by $y = a\ sec\frac{pl}{2c}.cos\left(\frac{Px}{c} - \frac{Pl}{2c}\right).sinpt$ (05)

Q.10

a) Use Newton-Raphson method to obtain a root, correct to there decimal places, of the equation $sinx = 1 - x$. (05)

b) Use method of separation of variables to solve $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$ where (05)
$u(x, 0) = 6e^{-2x}$

c) The following table gives the viscosity of an oil as a function of temperature, use Lagrange's formula to find viscosity of oil at temp. 140°C (05)

Temp t °C :	110	130	160	190
Viscosity :	10.8	8.1	5.5	4.8

Total No. of Printed Pages:03

SUBJECT CODE NO:- H-1012
FACULTY OF SCIENCE AND TECHNOLOGY
S.Y. B.Tech. (All) CBC & Grading S. (Sem-IV)
Engineering Mathematics-IV
[REV]

[Time: Three Hours] **[Max.Marks: 80]**

Please check whether you have got the right question paper.

N.B
1) Q.No.1 and 6 are compulsory.
2) Solve any two questions from remaining of each section.
3) Figures to right indicate full marks.
4) Assume suitable data, if necessary.

Section A

Q.1 Solve any five from the following 10

a) Cauchy-Riemann equations in Cartesian form are
b) Show that $v = r^3 \sin 3\theta$ is harmonic
c) A transformation $w = \frac{az+b}{cz+d}$ is bilinear if and only if ----
d) State Cauchy's Residue theorem.
e) Determine a, b such that $u = e^{ax} \cos by$is real part of analytic function
f) State Gauss Divergence theorem
g) Find the image of $|z| = 2$ under the mapping $W = z + 3 + 2i$.
h) Evaluate the line integral $\int_c (y^2 dx - 2x^2 dy)$, along the parabola $y = x^2\ from\ (0,0)\ to\ (2,4)$

Q.2
a) If $f(x) = u + iv$ is an analytic function, find $f(z) if\ u - v = \frac{cosx+sinx-e^{-y}}{2\cos x - 2\cosh y}\ \ and\ f\left(\frac{\pi}{2}\right) = 0$ 05
b) Evaluate $\int_c Re(z)dz, where\ C$ is the semi-unit circle. 05
c) Verify Green's theorem for $\int_c [(xy + y^2)dx + (x^2)dy]$ where C is bounded by $y = x\ and\ y = x^2$. 05

Q.3
a) Find and plot the image of triangular region with vertices (0, 0), (0,1) and (1, 0) under the transformation $w = (1 - i)z + 3$. 05
b) Evaluate $\oint_c \frac{e^{-z}}{(z+3)^3} dz$, where C is the circle $|z| = 3.5$ by Cauchy's residue theorem 05
c) Using Stokes' stheorem evaluate $\int_c [(2x - y)dx - yz^2 dy - y^2 z dz]$ where C is the circle $x^2 + y^2 = 1$, corresponding to the surface of unit radius 05

Q.4
a) Find the bilinear transformation which maps the point 1, -1, ∞ in z – plane onto the points 1, i, -1 in w – plane 05
b) Show that $u(r, \theta) = r^3 \cos 3\theta$ is harmonic, find its harmonic conjugate function 05
c) Evaluate the line integral $\int_c (x^2 dx + xydy)$, where C is the rectangle formed $by\ x = 0$, $y = 0,\ x = a,\ y = b$. 05

Q.5

a) If $f(\alpha) = \int_c \frac{3z^2+7z+1}{z-\alpha} dz$ where C is the circle $x^2 + y^2 = 4$, find the value of $f(3), f'(1-i) and\ f''(1-i)$. 05

b) Evaluate $\int_0^{2\pi} \frac{d\theta}{2+\cos\theta}$ by calculus of residue 05

c) Use Gauss divergence theorem to evaluate $\iint_s \overline{ds}\ where\ \bar{F} = 4xi - 2y^2 j + z^3 k\ and\ S$ is close surface bounded by $y^2 = 4x, z = 0, z = 3\ and\ x = 1$ 05

Section- B

Q.6 Solve any five from the following 10

a) Using Newton's Raphon method, find initial root of

$$xlog_{10}x = 1.2$$

b) Using Lagrange's interpolation formula find the value of y at $x = 4$ from the following data:

x:	5	6	9	11
y:	12	13	14	16

c) 5 coins is tossed simultaneously, find the probability that two or less Heads will appear.

d) Determine the area under the normal curve to the left of $z = 1.2$

e) Write Range-Kutta fourth order formula for finding y_1

f) Solution of one dimensional heat equation is…. (for Civil/Mech/PPE/Agri)

OR

Find the Z Transform of $\sin(\frac{k\pi}{2} + \alpha)$. (for CSE/ETC/Electrical)

g) Solve $\frac{\partial z}{\partial x} - 2\frac{\partial z}{\partial y} = z$ (for Civil/Mech/PPE/Agri)

OR

Find the Z Transform of $ka^k,\ k \geq 0$ (for CSE/ETC/Electrical)

h) Find the value of x, y, z in first iteration by Gauss seidel method

$$6x + y + z = 105\ ,4x + 8y + 3z = 155\ , 5x + 4y - 10z = 65$$

Q.7

a) Find first and second derivative of following at x=1.1 05

X	1.1	1.3	1.5	1.7	1.9
Y	0.21	0.69	1.25	1.89	2.61

b) The probability that a bomb dropped from a plane will strike the target is 1/5. If six bombs are dropped, find the probability that: (1) exactly three will strike the target (2) at least two will strike the target. 05

c) Solve: $3\frac{\partial u}{\partial x} + 2\frac{\partial u}{\partial y} = 0, u(x,0) = 4e^{-x}$ (Civil/Mech/PPE/Agri) 05

OR

Find the Z Transform of $f(k) = \frac{5^k}{k}$ for $k \geq 1$ (for CSE/ETC/Electrical)

Q.8

a) Find $y(1.1)$ $if \frac{dy}{dx} = \sqrt{x^2 + y^2}, y(1) = 1.5, h = 0.1$ using R-K fourth order method 05

b) A manufactures knows from experience that the resistance of resistor he produced is normal with mean 100 ohms and standard deviation 2 ohms. What is % of resistor between 98 ohms and 102 ohms 05

c) Solve: $\frac{\partial u}{\partial t} = 4\frac{\partial^2 u}{\partial x^2}$ subject to conditions $u(0,t) = 0 = u(\pi, t) and$ $u(x, 0) = 5\sin 3x - 7\sin 5x$ (Civil/Mech/PPE/Agri) 05

OR

Find the inverse z-Transform of: $\frac{z}{(z-2)(z-3)}$ $for\ |z| > 3$ (for CSE/ETC/Electrical)

Q.9

a) Use Gauss-Seidal iteration method to solve the equation 05

$$20x + y - 2z = 17; 3x + 20y - z = -18, 2x - 3y + 20z = 35$$

b) According to past record of one day international between India and Australia, India has won 15 matches and lost 10. They decide to play a series of 6 matches now, what is the Probability of India winning series (use Poisson Distribution). 05

c) Solve: $\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} = 0$, subject to the conditions i) v = 0 when $y \to \infty$ ii) $v = 0$ when $x = 0$ for all values of y iii) $v = 0\ at\ x = 1$ iv) $v = x(1-x)$ when y=0 for $0 \prec x \prec 1$. (Civil/Mech/PPE/Agri) 05

OR

Solve difference equation: $y_{k+3} + 6y_{k+2} + 11y_{k+1} + 6y_k = \delta(k)$, $k \geq 0$.
Given that: $y_0 = 0, y_1 = 0$, $y_2 = 0$ (for CSE/ETC/Electrical)

Q.10

a) Obtain the missing term from the following data: 05

x:	5	6	9	11
y:	12	13	-	16

b) Use Gauss elimination method to solve the system 05

$$2x + y + z = 10; 3x + 2y + 9z = 18; x + 4y + 9z = 16$$

c) Solve the partial differential equation of vibration of string: $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$, with subject to the condition $y(0,t) = (1,t) = 0$ $\frac{\partial y}{\partial t} = 0\ at\ t = 0, y(x, 0) = \text{a}\sin\frac{\pi}{l}x$ (Civil/Mech/PPE/Agri) 05

OR

Find Z- transform of $F(k) = 2^k \cos\left(\frac{k\pi}{2} + \frac{\pi}{4}\right)$ (for CSE/ETC/Electrical)

Total No. of Printed Pages:04

SUBJECT CODE NO:- H-1183
FACULTY OF SCIENCE AND TECHNOLOGY
S.Y.B.Tech. (All) (Sem III)
Engineering Mathematics-III
[OLD]

[Time: Three Hours] **[Max.Marks: 80]**

Please check whether you have got the right question paper.

N.B
i. Q. No. 1 and 6 are compulsory.
ii. From section A, solve any two questions from Q. No. 2, 3, 4 and 5.
iii. From section B, solve any two questions from Q. No. 7, 8, 9 and 10.
iv. Figure to the right indicate full marks.
v. Assume suitable data, if necessary.

Section A

Q.1 Solve any five (each of two marks) 10

a) Solve $(D^3 - 1)y = a$

b) Find C.F. of$(D^2 - 2D + 4)y = \cos h\, 2x$

c) Convert following legendre's differential equation to linear differential equation of $(3x+2)^2 \frac{d^2y}{dx^2} + (3x+2)\frac{dy}{dx} - y = 4x + 9$

d) Show that $\bar{F} = (\sin y + z)i + (x \cos y - z)j + (x - y)k$ is irrotational

e) If $\bar{F} = (ax + 3y + 4z)i + (x - 2y + 3z)j + (3x + 2y - z)k$ is solenoidal then find the value of constant a.

f) Find grad $\phi\ at\ (1, -1, 1), if\ \phi = x^2y + xy^2 + yz^2$

g) The first four moments of a distribution about the value of the variable $x = 5$ are 2, 20, 40 and 50. Find mean, moments about mean.

h) Write a formula of standard deviation for ungrouped data.

Q.2 a) Solve $(D^2 - 1)y = e^{-x} \sin(e^{-x}) + \cos(e^{-x})$ by using method of variation of parameter 05

b) Find radial and transverse components of theacceleration at $t = \pi$ for the curve $r = 2 + 3\cos\theta\ and\ \theta = \sin t$ 05

c) Calculate standard deviation for the following data. 05

Marks	0-10	10-20	20-30	30-40	40-50
Number of student	5	8	15	16	6

Q.3 a) Solve $(x^2D^2 - 3xD + 3)y = x^2\log x$ 05

b) Find the directional derivative of 05
$\phi = x^2y^2 + y^2z^2 + z^2x^2 \; at \; (1, 1, -2)$ in the direction of the tangent to the curve
$$x = e^{-t}, y = 2\sin t + 1, z = t - \cos t \;\; at \; t = 0$$

c) Find the value of coefficient of variance from the following data 05

Number of days for which absent (less than)	5	10	15	20	25	30	35	40	45
Number of student	29	224	465	582	634	694	650	653	655

Q.4 a) A long column of length l is fixed at one end and completely free at other end. If load P is axially applied at the other end where origin is taken at fixed point and 'a' is lateral displacement, show that $y = a\left(1 - \cos\sqrt{\frac{P}{EI}}x\right)$, if curve satisfies the differential equation $EI\frac{d^2y}{dx^2} = P(a - y)$ 05

b) Prove that $\nabla^2 f(r) = f''(r) + \frac{f'(r)}{r}$ 05

c) The first four moment of a distribution about the value 4 are 0, 2, 0, 11. Calculate i) moments about mean ii) remains β_1 and β_2 05

Q.5 a) $L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{q}{c} = 0$ where $L = 0.25, \; R = 250, \; C = 2 \times 10^{-6}, \; q = 0.02, \; \frac{dq}{dt} = 0 \; at \; t = 0$ 05

b) Solve $(D^3 - 7D - 6)y = e^{zx}(1 + x)$ 05

c) A particle moves along the curve $\bar{r} = (3\cos t)i + (3\sin t)j + 4tk$. Find the tangential and normal component of acceleration. 05

Section B

Q.6 Solve any five (each of two marks) 10

a) Find $L\{\sin(wt+\alpha)\}$

b) It $L\{f(t)\} = \bar{f}(s) then\ L\left\{\frac{f(t)}{t}\right\} = --$

c) If $L^{-1}\{\bar{f}(s)\} = f(t) then\ L^{-1}\{\bar{f}(s-a)\} =$ __

d) Find $L^{-1}\left\{\frac{1}{25-3}\right\}$

e) Find Fourier transform of

$$f(x) = x \quad , \quad |x| \le a$$
$$= 0 \quad , |x| > a$$

f) Write a formula for cosine transform

g) Out of 800 families with 5 children each, how many families would be expected to have 3 boys and 2 girls.

h) Write a formula for Poisson distribution

Q.7 a) Find Fourier Transform of 05

$$f(x) = 1 - x^2 \quad , \quad |x| \le 1$$
$$= 0 \quad , |x| \ge 1$$

And hence evaluate $\int_0^\infty \frac{x\cos x - \sin x}{x^3} \cos\left(\frac{x}{2}\right) dx$

b) Find $L\{t^3 e^{-2t}\}$ 05

c) The probability of any ship being destroyed on a certain voyage is 0.02. Company owns 6 ships for voyage. What is the probability of i) loosing no ship ii) loosing one ship iii) loosing at the most 2 ships. 05

Q.8 a) The square wave function of period 2Q is defined by 05

$$f(t) = 1 \quad , 0 < t < a$$
$$= -1, \quad a < t < 2a$$

b) Find Fourier cosine transform of 05

$$f(x) = 0, \quad 0 < x < a$$
$$= x, \quad a < x < b$$
$$= 0, \quad b < x < 0$$

c) The mean weight of 500 students at certain institute is 75.5 kg and the standard deviation is 7.5 kg. assuming that weights are normally distributed, find how many student weight 05

i. Between 60 and 77.5 kg

ii. More than 92.5 kg

Q.9 a) Find $L^{-1}\{\frac{4s+15}{16s^2-25}\}$ 05

b) Find Fourier cosine integral of 05

$$f(x) = x, \quad 0 < x < 1$$
$$= 2 - x, \quad 1 < x < 2$$

c) 6 coins are tossed 320 times, using poisson distribution find approximately the probability of getting 6 heads at the most 2 times. 05

Q.10 a) Express into Heaviside and hence find Laplace transform of 05

$$f(t) = \sin t, \quad 0 < t < \pi$$
$$= \sin 2t, \quad \pi < t < 2\pi$$
$$= \sin 3t, \quad t > 2\pi$$

b) Solve by Laplace transform 05

$\frac{d^2x}{dt^2} - 3\frac{dx}{dt} + 2x = 4e^{2t}$ given that $x = -3, \frac{dx}{dt} = -5\ when\ t = 0$

c) Using Fourier integral representation prove that $\int_0^\infty \frac{\cos\ dx + d\sin\ dx}{1+d^2} dd = \theta,\ \ x < 0$ 05

$$= \frac{\pi}{2},\ \ x = 0$$
$$= \pi e^{-x},\ \ x > 0$$

Total No. of Printed Pages:3

SUBJECT CODE NO:- H-1184
FACULTY OF SCIENCE AND TECHNOLOGY
S.Y.B.Tech. (All) (Sem-III)
Engineering Mathematics-III
[Revised]

[Time: Three Hours] **[Max.Marks: 80]**

Please check whether you have got the right question paper.

N.B
1) Q.No.1 and Q.No.6 are compulsory
2) From Section A solve any two questions from the remaining Q.No.2,3,4 and 5.
3) From Section B solve any two questions from the remaining Q.No.7,8,9 and 10.
4) Assume suitable data, if necessary

Section A

Q.1 Solve any five(Each for two marks) 10

a) Find complementary function for: $(D^2+1)^3 y = xsin3x$
b) Find particular Integral for: $(D+2)(D-1)^2 y = e^x$
c) $\frac{1}{D+a}\ X = \ \dots \dots$
d) In civil application, Beam is fixed at one end then initial conditions are………
e) Convert Cauchy's differential equation to Linear differential equation$(x^3D^3 + x^2D^2 - 2)y = x + \frac{1}{x^3}$
f) Define vector point function
g) Is the vector $\bar{F} = (y^2cosx + z^2)i + (2ysinx)j + 2xzk$ is conservative?
h) Find the velocity & acceleration of a particle moving along the curve $x = t^3+1, y = t^2, z = 2t+5$

Q.2 a) Solve $(D^2-1)y = coshx\ cosx$ 05

b) An electric circuit consists of an inductance L, a condenser of capacitance C, and e.m.f. $E = E_0 \cos \omega t$ So that the charge Q satisfies the differential equation $\frac{d^2Q}{dt^2} + \frac{Q}{LC} = \frac{E_0}{L}\cos \omega t$ If $\omega = \frac{1}{\sqrt{LC}}$ and initially at $t = 0,\ Q = Q_0$ and current $i = i_0$ Find the charge at any time t 05

c) If $\bar{r} = (t^3-4t)i + (t^2+4t)j + (8t^2-3t^3)K$ Find the tangential and normal components of acceleration at $t = 2$ 05

Q.3 a) Solve: $(D^3 - D^2 - 6D)y = 1 + x^2$ 05

b) Solve: $(D^2 + a^2)y = cosecax$ by general method 05

c) A struct of length l freely pinned at each end, satisfies the equation: 05

$$EI\frac{d^2y}{dx^2} + py = \frac{-WL^2}{8}\sin\left(\frac{\pi}{l}x\right)$$

Prove that, the deflection at the centre is $\frac{WL^2}{8(Q-P)}$ where $Q = \frac{EI\pi^2}{l^2}$

Q.4 a) Solve by using method of variation of parameters: 05
$(D^2 - 1)y = (1 + e^{-x})^2$

b) Solve: $(x^3D^3 + x^2D^2 - 2)y = x + \frac{1}{x^3}$ 05

c) Find the directional derivative of scalar function $f(x, y, z) = x^2 + xy + z^2$ at the point $A\ (1, -1, 1)$ in the direction of the line AB, where B has coordinates (3,2,1) 05

Q.5 a) Solve: $(D^3 - D^2 - 6D)y = 1 + x^2$ 05

b) Solve: $(2x + 3)^2 \frac{d^2y}{dx^2} - 2(2x + 3)\frac{dy}{dx} - 12y = 6x$ 05

c) Find $\nabla^2(r^2 \log r)$ 05

Section B

Q.6 Solve any five (Each for two marks) 10

a) Find $L[e^{-t}t^{3/2}]$

b) $L[\cos(2t + 3)] =$ ….

c) $L^{-1}\left[\frac{3+2s+s^2}{s^3}\right] =$ … ….

d) $L^{-1}\left[e^{-45}\frac{1}{s^2+9}\right] =$ … ….

e) Find fourier cosine transform of e^{-x}

f) Write formula to find fourier transform for odd function in the interval $-\infty < x < \infty$ and corresponding inverse Fourier transform

g) Find standard deviation for the data:

Class	0-10	10-20	20-30	30-40	40-50
Frequency	5	7	10	16	11

h) Write formula for mean and standard deviation for grouped data

Q.7 a) Find: $L\left\{e^{-3t}\int_0^t t\sin 2t\ dt\right\}$ 05

b) Find the Fourier transform of: 05

$f(x) = x, \quad |x| \le a$

$\quad = 0, \quad |x| > a$

c) Find standard deviation and coefficient of variation for the following data: 05

Class	1-10	11-20	21-30	31-40	41-50	51-60
Frequency	3	16	26	31	16	8

Q.8 a) Find $L\{f(t)\}$ if: 05

$f(t) = \frac{t}{a}, \quad 0 < t < a$

$\quad = \frac{(2a-t)}{a}, \quad a < t < 2a$ and $f(t) = f(t + 2a)$

b) Find Fourier sine transform of: 05

$f(x) = \frac{1}{x}$

c) Find Quartile deviation & its coefficients for: 05

Class	11-15	16-20	21-25	26-30	31-35
Frequency	10	17	22	31	42

Q.9 a) Evaluate $\int_0^{\infty} \frac{e^{-at} - e^{-bt}}{t} dt$ 05

b) Use convolution theorem to find: 05

$L^{-1}\left(\frac{s^2 - a^2}{(s^2 + a^2)^2}\right)$

c) Show that: $\int_0^{\infty} \frac{\sin\pi s \ \sin sx}{1-s^2} = \frac{\pi}{2} \sin x, x < \pi$ 05

$= 0, \quad x > \pi$

Q.10 a) Express it into Heaviside function and hence find Laplace transform of: 05

$f(t) = \cos t, \quad 0 < t < \pi$

$= \sin t, \quad t \geq \pi$

b) Find $L^{-1}\left[\frac{s^2+s-2}{s(s-2)(s+3)}\right]$ 05

c) Find the Fourier cosine transform of: 05

$f(x) = x, \quad 0 \leq x \leq 1$

$= 2 - x, \quad 1 \leq x \leq 2$

$= 0, \quad x > 2$