Total No. of Printed Pages:03

SUBJECT CODE NO:- H-302
FACULTY OF SCIENCE AND TECHNOLOGY
S.E. (All)
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 from section A and Q.No.6 from section B are compulsory.
2. Solve any two questions from remaining of each section.
3. Figures to the right indicate full marks.
4. Assume suitable data, if necessary.

Section A

Q.1 Solve any five from the following. 10

a) Solve $(D^4 - 1)y = 0$.
b) Solve $(D^3 - 2D^2 + 4D - 8)y = 0$.
c) Find the particular integral of $(D^3 + 8)y = e^{-2x} + 4$.
d) Find the particular integral of $(D^3 + 8)y = x^4 + 2x + 1$.
e) The charge Q of a condenser of capacity C is discharged in a circuit of resistance R and self-inductance L. Find the differential equation of the circuit.
f) A column of length *'l'* is fixed at one end is completely free at other. The load *'p'* is axially applied at the free end, the origin is taken at the fixed end and $'\alpha'$ is the lateral displacement of the free end, its deflection is given by_____.
g) Find the Fourier transform of

$$f(x) = \begin{cases} e^{-\alpha x}; & 0 < x < \infty \\ 0 \quad ; & x < 0 \end{cases}$$

h) Find the Fourier sine transform of

$$f(x) = \begin{cases} x \ ; & 0 < x < 1 \\ 0 \ ; & x > 1 \end{cases}$$

Q.2 a) Solve $(D^3 - 4D)y = 2\cosh^3 2x$. 05

b) In an L-C-R circuit, the charge q on a plate of a condenser is given by 05
$L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{q}{c} = E\sin pt$. The circuit is tuned to resonance so that $p^2 = \frac{1}{LC}$. If initially the current i and the charge q be zero, show that for small values of $\frac{R}{L}$, the current at time t is given by $\frac{Et}{2L}\sin pt$.

c) Find the Fourier cosine and sine transform of $f(x) = 2e^{-5x} + 5e^{-2x}$. 05

Q.3 a) Solve $(D^4 + 2D^2 + 1)y = x^2\cos x$. 05

b) The deflection of a strut of length *l* with one end $(x = 0)$ built in and the other supported and subjected to end thrust P, satisfies the equation. 05
$\frac{d^2y}{dx^2} + \alpha^2 y = \frac{a^2R}{P}(l - x)$. Prove that the deflection curve is

$$y = \frac{R}{P}\left(\frac{\sin ax}{a} - l\cos ax + l - x\right), where\ al = \tan al.$$

c) Find the Fourier cosine integral of the function $f(x) = e^{-x}\cos x$. 05

Q.4

a) Solve $(1+x)^2\frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = \sin 2\{\log(1+x)\}$. 05

b) A mass 40 kg is attached to a spring for which $k = 640\ N/m$ brought to rest. Find the position of the mass at time *t* if a force equal to $10\sin 2t$ is applied to it. 05

c) Find *f(x)* if its Fourier sine transform is $\frac{1}{\omega}e^{-\alpha\omega}$. Hence deduce $F_s^{-1}\left(\frac{1}{\omega}\right)$. 05

Q.5

a) Solve by method of variation of parameter $\frac{d^2y}{dx^2} - y = \frac{2}{1+e^x}$. 05

b) Solve without variation parameter $(D^2 + 3D + 2)y = \cos(e^x)$. 05

c) Solve for *f(x)* from the integral equation $\int_0^\infty f(x)\cos sx\,dx = e^{-s}$. 05

Section B

Q.6 Solve any five from the following. 10

a) Find the mode of the following data

Age	20-30	30-40	40-50	50-60	60-70	70-80	80-90
Freq.	3	61	132	153	140	51	2

b) If $\emptyset = \tan^{-1}\frac{y}{x}$, find $div(grad\ \emptyset)$.

c) State Guass divergence theorem.

d) Determine the area under the normal curve to the right of 1.0

e) Coefficient of Quartile Deviation= _____.

f) If the probability of defective mobile phone is 0.2, find the i) mean, ii) the standard deviation for the distribution of mobile phone in a total of 200.

g) Find the curl of $\overline{A} = e^{xyz}(i+j+k)\ at\ the\ point\ (1,2,3)$.

h) A particle moves along the curve $\overline{r} = e^{-t}\cos t\, i + e^{-t}\sin t\, j + e^{-t}k$. Find the magnitude of velocity at time t.

Q.7

a) Find the Karl-Pearson's coefficient of skewness for the following data 05

Class	55-65	65-75	75-85	85-95	95-105	105-115	115-125
Frequency	10	12	15	20	14	07	02

b) Evaluate $\iint_s (y^2z^2i + z^2x^2j + x^2y^2k)\,dz$, where s is the upper part of the sphere $x^2 + y^2 + z^2 = 9$ above the XOY plane by using Guass-divergence theorem. 05

c) Prove that $\overline{F} = (y^2 - z^2 + 3yz - 2x)i + (3xz + 2xy)j + (3xy - 2xz + 2z)k$ is both solenoidal and irrotational. 05

Q.8 a) A gas is being compressed in a closed cylinder and the value of pressure and corresponding volumes at constant temperature are as shown: 05

Pressure	160	180	200	220	240	260	280	300
Volume	0.034	0.036	0.030	0.027	0.024	0.025	0.020	0.019

Find the coefficient of correlation for these values.

b) Prove that $\nabla.\left(\frac{\overline{a}\times\overline{r}}{r}\right)=0$. 05

c) Evaluate $\oint_c[(x^2+2y)dx+(4x+y^2)dy]$ by Green's theorem where c is the boundary of the region bounded by $y=0, y=2x \; and \; x+y=3$. 05

Q.9 a) According to past record of one day international between India and Pakistan, India has won 15 matches and lost 10. If they decide to play a series of 6 matches now, what is the probability of India winning the series. 05

b) Verify Stoke's theorem for $\overline{F}=(y-z+2)i+(yz+4)j-xz\,k$ over the surface of cube $x=0, y=0, z=0, x=2, z=2$ above the XOY plane (open at the bottom). 05

c) Find the directional derivative of $\emptyset=x^2y^2z^2 \; at \; (1,1,-1)$ in the direction of tangent to the curve $x=e^t, y=2\,sint+1, z=t-cost \; at=0$. 05

Q.10 a) Determine the equation of the regression line of inductive reactance on frequency for the following data 05

Frequency	50	100	150	200	250	300	350
Inductance	30	65	90	130	150	190	200

b) A manufactures known from experience that the resistance of resistors he produced is normal with mean $\mu=100\;ohms$ and standard deviation $\delta=2\;ohms$. What percentage of resistors will have resistance between 98 ohms and 102 ohms? 05

c) Evaluate $\int_c \overline{F}.dr$, over the curve $x^2+y^2=1, z=1$ in positive direction from $(0,1,1)\;to\;(1,0,1)$, where $\overline{F}=(yz+2x)i+xz\,j+(xy+2z)k$. 05