Seat No. | | | | | | |

* 2 6 1 1 *

BBI1303

Engineering Mathematics - III (New)
(1010)

P. Pages : 4

Time : Three Hours **Max. Marks : 100**

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions are compulsory and carry equal marks.
5. Figures to the right indicates full marks.
6. Use of non-programmable calculator is allowed.
7. Use of Statistical tables is allowed.

1. Solve **any four.** **20**

a) $(D^2+4)y = 3x\cos x + z^x$

b) $(D^2+4D+4)y = 12x^2e^{-2x}$

c) $(D^2+1)^2 y = x^2 + e^x$

d) $(D^2+5D+6)y = e^{-2x}\sec^2 x(1+2\tan x)$
by variation of parameters method

e) $x^3\frac{d^3y}{dx^3} + 2x^2\frac{d^2y}{dx^2} + 2y = 10\left(x+\frac{1}{x}\right)$

f) The whirling speed of a shaft of length 'ℓ' is given by $(D^4 - m^4)y = 0$,

where $m^4 = \frac{Ww^2}{g \in I}$.

y is displacement at a distance x from one end. If the ends arc constrained in long bearings, show that the shaft will whirl when,
$\cos m\ell . \cosh m\ell . = 1$

2. Attempt **any two.**

a) i) Solve the system,

$$\frac{du}{dx} + v = \sin x, \quad \frac{dv}{dx} + u = \cos x$$ **6**

ii) Solve,

$$\frac{dx}{x(2y^4 - z^4)} = \frac{dy}{y(z^4 - 2x^4)} = \frac{dz}{z(x^4 - y^4)}$$ **4**

b) Solve, $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ **10**

If i) u is finite $\forall t$.

ii) $u(0,t) = 0 \ \forall t$

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

c) If $\frac{\partial^2 y}{\partial x^2} = \frac{1}{C^2}\frac{\partial^2 y}{\partial t^2}$ represents the vibration of a string of length 'ℓ' fixed at both ends find the solution with boundary conditions;

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

ii) $y(\ell,t) = 0, \ \forall t$

and initial conditions,

i) $\left(\frac{\partial y}{\partial t}\right)_{t=0} = 0$

ii) $y = (x,0) = \ell x - x^2, \ 0 \le x \le \ell$ **10**

3. Attempt **any four.** **20**

a) Find $L\left[e^{-2t}\int_0^t t\sin 3t \, dt\right]$

b) Find $L\left[\frac{d}{dt}\left(\frac{e^{-2t}\sin t}{t}\right)\right]$

c) Evaluate $\int_0^{\infty} \frac{e^{-2t}\sinh t}{t} dt$

d) Find $L^{-1}\left[\frac{1}{s}\cot^{-1}\left(\frac{1}{s}\right)\right]$

e) Find $L^{-1}\left[\frac{1}{s^2(s^2+1)}\right]$ using convolution theorem.

f) Solve, $(D^2+1)y = \sin 3t$, if $y(0) = y'(0) = 0$

4. Attempt **any four.** **20**

a) Following are scores of two players in 7 matches. Find which player is consistent.

Raina	70	85	43	42	37	73	70
Virat	48	62	80	75	55	38	42

b) Given : $n = 6$, $\sum(x-18.5) = -3$, $\sum(y-50) = 20$

$\sum(x-18.5)^2 = 19$, $\sum(y-50)^2 = 850$, $\sum(x-18.5)(y-50) = -120$

find coefficient of correlation.

c) Find the lines of regression for following data.

x	10	14	19	26	30	34	39
y	12	16	18	26	29	35	28

d) Two regression equations of variable x and y are $3x + 2y = 26$, $6x + y = 31$. Find coefficient of correlation and σ_x if varience of y is 4.

e) Calculate first four central moments from following data. Also find Skewness and Kurtosis.

Marks obtained	0-20	20-40	40-60	60-80	80-100
No. of students	6	8	21	10	5

f) Among 64 offspring of certain cross between guine a pigs, 34 were red, 10 were black and 20 were white. According to genetic model these numbers should be in the ratio 9 : 3 : 4. Is the data consistent with the model at 5% level of significance ?

$[\text{Given} ; \chi^2_{0.05,2} = 5.991]$

5. Attempt **any four.** **20**

a) If 10% of bolts produced by a machine are defective, determine the probability that out of 10 bolts, chosen at random (i) one (ii) none (iii) at most 2 bolts will be defective.

b) Fit a poisson distribution to the following data and find theoratical frequencies.

x	0	1	2	3	4	5	6	7	8
f	56	156	132	92	37	22	4	0	1

c) Assuming that the diameters of 10,000 plugs taken consecutively from a machine form a normal distribution with mean 0.7515 cm and S. O. 0.002 cm. How many of the plugs are likely to be rejected if the approved diameter is 0.752 ± 0.004 cm.

d) Find Fourier cosine integral of a function,

$$f(x) = \begin{cases} x & 0 < x < 1 \\ 2 - x & 1 < x < 2 \\ 0 & x > 2 \end{cases}$$

e) Using Fourier sine integral representation,

show that, $\int_0^\infty \frac{s \sin sx}{1+s^2} ds = \frac{\pi}{2} e^{-x}$

f) Find inverse Fourier Sine transform of $\frac{1}{S}$

****