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No.

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BII1303

**Engineering Mathematics - III**  
**(New) (1050)**

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.
5. Figures to right indicate full marks.
6. Use of statistical data is allowed.
7. Use of non-programmable calculator is allowed.
8. Draw neat diagrams wherever necessary.

1. Solve any four.

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a) Solve  $(D^3 - 7D - 6)y = \cosh x \cos x$ .

b) Solve  $(D^2 - 1)y = x \sin x + (1 + x^2)e^x$ .

c) Solve  $u = r \frac{d}{dr} \left( r \frac{du}{dr} \right) + ar^3$ .

d) Solve  $\frac{du}{dx} + v = \sin x$   
 $\frac{dv}{dx} + u = \cos x$  given that

When  $x = 0$ ,  $u = 1$  &  $v = 0$ .

e) Solve  $(D^3 + D)y = \sec x$  by method of variation of parameters.

f) An uncharged condensor of capacity  $C$  is charged by applying an emf  $E \sin \frac{t}{\sqrt{LC}}$  through leads of self-inductance 'L' and negligible resistance.

Find the charge on one of the plate of condensor at any time  $t$ .

2. a) Attempt **any two**.

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p) Find the fourier transform of

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

q) Find  $z\{f(k)\}$  where

$$f(k) = \begin{cases} 2^k & k < 0 \\ \left(\frac{1}{2}\right)^k & k = 0, 2, 4, 6, \dots \\ \left(\frac{1}{3}\right)^k & k = 1, 3, 5, 7, \dots \end{cases}$$

r) What is the function  $F(x)$  whose fourier cosine transform is  $\frac{\sin a \lambda}{\lambda}$  ?

b) Attempt **any two**.

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l) Find  $z\{f(k)\}$  if  $f(k) = (k+1)a^k, k \geq 0$ .

m) Find Inverse Z - transform of  $F(Z) = \frac{Z^2}{Z^2 + 1}, |Z| > 1$ .

n) Solve the following integral equations

$$\int_0^{\infty} f(x) \sin \lambda x \, dx = \begin{cases} 1-\lambda & 0 \leq \lambda \leq 1 \\ 0 & \lambda \geq 1 \end{cases}$$

3. Attempt **any four**.

20

a) Find Laplace transform of  $\cosh t \int_0^t e^t \cos ht \, dt$ .

b) Evaluate the integral  $\int_0^{\infty} e^{-2t} \sin^3 t \, dt$

- c) Find the inverse laplace transform of  $\cot^{-1} \left( \frac{S-2}{3} \right)$ .
- d) Use the convolution theorem to find inverse laplace transform of  $\frac{S}{(S^2 + 4)(S^2 + 9)}$
- e) Using laplace transform, solve the following differential equation.  
 $\frac{dy}{dt} + 2y(t) + \int_0^t y(t) dt = \sin t$  given  $y(0) = 1$ .
- f) Find  $L \{ e^{-t} \sin t U(t - \pi) + \sin 2t \delta(t - 2) \}$ .

4. Attempt **any two**.

- a) i) The scores of two batsmen A and B in series of 10 matches are as follows.

Scores A	37	43	28	62	59	20	83	48	52	47
Scores B	35	52	77	38	26	58	63	31	40	46

Which of the two batsmen do you consider to be more consistent.

- ii) Their first four moments of a distribution about  $x = 2$  are 1, 2.5, 5.5 & 16 calculate the four moments about mean.

- b) i) Find the correlation coefficient of the following data.

Sales	50	50	55	60	65	65	65	60	60	60
Expenses	11	13	14	16	16	15	15	14	13	13

- ii) The probability of a poisson variate taking the values 3 and 4 are equal calculate the probabilities of the variable taking the values 0 and 2.

- c) i) The following data relate to the marks of 10 students in the internal test and the university examinations for the maximum of 50 each.

Internal marks	25	28	30	32	35	36	38	39	42	45
University marks	20	26	29	30	25	18	26	35	35	46

obtain the two regression equations.

- ii) In a binomial distribution the mean is 4 and the variance is  $\frac{8}{3}$   
find the mode of the distribution. 4

5. Attempt any two.

- a) i) State Beta and Gamma distributions with their means and variance. 5
- ii) A sample of 400 electric bulbs from company A gave an average life 1225 hours with a standard deviation 42 hours where as sample of 200 bulbs from company B gave an average life 1265 hours with a standard deviation 60 hours can we say that the two companies are producing bulbs of same average life ? 5
- b) i) State properties of Chi-square distributions. 4
- ii) During the country wide investigation the incidence of TB was found to be 1%. In a college of 400 strength 5 were reported to be affected where as in another college of 1200 strength 10 were reported to be affected. Does this indicate any significant difference ? 6
- c) i) Among 64 offsprings of a certain cross between Guinea pigs 34 were red 10 were black and 20 were white according to the genetic model these numbers should be in the ratio 9:3:4 Are the data consistent with model at 5% level (given that  $\chi^2_{2;0.05} = 5.991$ ). 6
- ii) Define Chi-square distribution and write short note on it. 4

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