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Reg. No..............................

Name..................................

B.TECH. DEGREE EXAMINATION, NOVEMBER 2010

Fourth Semester

ENGINEERING MATHEMATICS—III

(Common for all branches)

[Prior to 2007 Admissions—Supplementary]

Time : Three Hours

Maximum : 100 Marks

Answer one full question from each module.
Statistical tables permitted.

Module 1

1. (a) Solve $y'' + 3y' + 2y = e^{-2x} + \sin 2x$. (7 marks)

   (b) Solve $(D^2 + 6D + 9)y = (x^2 + 1)\sinh x$. (7 marks)

   (c) Solve by the method of variation of parameters $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = e^x \tan x$. (6 marks)

Or

2. (a) Solve $(D^2 + 4)y = x^2 e^{-x} + \sin 2x$. (7 marks)

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

   (c) Solve the system of simultaneous equations :

$$\frac{dy}{dx} + 2y - 3z = x$$

$$\frac{dz}{dx} + 2z - 3y = e^{2x}.$$

(7 marks)

Module 2

3. (a) Solve $2zx - px^2 - 2pxy + pq = 0$. (5 marks)

   (b) Solve $\frac{\partial^2 z}{\partial x^2} + 3\frac{\partial^2 z}{\partial x \partial y} + 2\frac{\partial^2 z}{\partial y^2} = x + y$. (5 marks)

Turn over

(c) A tightly stretched string with fixed end points $x = 0$ and $x = l$ is initially at rest in its equilibrium position. If it is set vibrating by giving to each of its points a velocity $\lambda x\,(l - x)$, find the displacement of the string at any distance x from one end at any time t. (10 marks)

Or

4. (a) Form the partial differential equation from $z = f(x + it) + g(x - it)$. (5 marks)

(b) Solve $\dfrac{\partial^2 z}{\partial x^2} + \dfrac{\partial^2 z}{\partial x\,\partial y} - 6\dfrac{\partial^2 z}{\partial y^2} = y \cos x$. (5 marks)

(c) An insulated rod of length 'l' has its ends A and B maintained at 0°C and 100°C respectively until steady state conditions prevail. If B is suddenly reduced to 0°C and maintained at 0°C find the temperature at a distance x from A at time t. (10 marks)

Module 3

5. (a) Express $f(x) = \begin{cases} 1, \text{ for } |x| \le 1 \\ 0, \text{ for } |x| > 1 \end{cases}$ as a Fourier integral. (5 marks)

(b) Find the Fourier transform of $e^{-x^2/2}$. (7 marks)

(c) Find the Fourier sine and cosine transforms of $f(x) = e^{-ax}\ (a > 0)$. (8 marks)

Or

6. (a) Using Fourier integral prove that $\int_0^\infty \dfrac{\cos \lambda x}{1 + \lambda^2}\, d\lambda = \dfrac{\pi}{2} e^{-x}\ (x \ge 0)$. (6 marks)

(b) Find the Fourier transform of $f(x) = \begin{cases} 1, |x| < 1 \\ 0, |x| > 1 \end{cases}$. Hence evaluate $\int_0^\infty \dfrac{x \sin x}{x}\, dx$. (7 marks)

(c) Find the Fourier sine transform of $e^{-|x|}$ and hence evaluate $\int_0^\infty \dfrac{x \sin mx}{1 + x^2}\, dx$. (7 marks)

Module 4

7. (a) In a certain factory producing cycle tyres there is a small chance of one in 500 tyres to be defective. The tyres are supplied in lots of 20. Calculate the approximate number of lots containing no defective, one defective and two defective tyres in a consignment of 20000 tyres. (10 marks)

(b) In an intelligence test conducted on 1000 students the mean was 42 and S.D. 24. Assuming the normality of the distribution, find (i) how many students score between 30 and 54 ; (ii) how many score about 60.

(10 marks)

Or

8. (a) Fit a binomial distribution for the following data and calculate the theoretical frequencies :

x :	0	1	2	3	4	5	6
f :	13	25	52	58	32	16	4

(10 marks)

(b) Define Poisson distribution. Determine its mean and variance. (10 marks)

Module 5

9. (a) An I.Q. test was given to two different sets of college students and the results are given below :

	Mean	S.D.	Size
Set I ...	75	7	90
St II ...	73	5	120

Is the difference between the means significant ?

(10 marks)

(b) Out of a consignment of one lakh tennis balls, 400 were selected and out of them 20 were found to be defective. How many defective balls you can reasonably expect to have in the consignment at 5% level of significance ?

Or

(10 marks)

10. (a) S^2 is the variance of a sample of size 10 taken from a normal population with S.D. 5. Find the probability that S^2 will lie between 8.4 and 42.3.

(10 marks)

(b) If two independent sample of sizes $n = 26$ and $n_2 = 8$ are taken from a normal population, what is the probability that the variance of the second sample will be at least 2.4 times the variance of the first sample.

(10 marks)

[5 × 20 = 100 marks]