MODULE-V

IX a) Define level of significance, Type I error, Type II error. (6)

b) The mean of a sample of size 20 from a normal population N $(\mu,\ 8)$ was found to be 81.2. Find a 90% confidence interval for μ. (6)

c) Three specimens of high quality concrete had compressive strength 357, 359, 413 (in kg/cm^2) and for three specimens of ordinary concrete and the values were 346, 358, 302. Test for quality of the population means $\mu_1 = \mu_2$ against the alternative $\mu_1 > \mu_2$. (8)

OR

X a) Define null hypothesis and alternative hypothesis. A random sample of size 18 is taken from a normal distribution $N(\mu,\ \sigma^2)$. Test the hypothesis $H_o : \sigma^2 = 0.36$ against $H_1 : \sigma^2 > 0.36$ at $\alpha = 0.05$ given the sample variance $s^2 = 0.68$. (12)

b) Two independent random samples of size $n_1 = 10,\ n_2 = 7$ where observed to have sample variance $s_1^2 = 16,\ s_2^2 = 3$ Using $\alpha = 0.10$, test $H_o : \sigma_1^2 = \sigma_2^2$ against $H_1 : \sigma_1^2 \neq \sigma_2^2$. (8)

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BTS-C 023 ME

B.Tech. Degree III Semester Examination January 2002

IT/CS/EC/CE/ME/SE/EI/EB/EE 301
ENGINEERING MATHEMATICS-III

Time: 3 Hours Max. Marks: 100

MODULE-I

I a) Obtain the Fourier series of

$$f(x) = \begin{cases} -x & -\pi < x \leq 0 \\ x & 0 \leq x \leq \pi,\ f(x+2\pi) = f(x) \end{cases}$$

Deduce $\sum_{n=1}^{\infty} \frac{1}{(2n-1)^2} = \frac{\pi^2}{8}$ (10)

b) Find the Fourier transform of

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

Hence evaluate $\int_o^{\infty} \frac{\sin x}{x}\, dx$ (10)

OR

II a) Represent the following function in the Fourier integral form

$$f(x) = \begin{cases} x^2 & 0 < x < 1 \\ o & x > 1 \end{cases}$$ (10)

b) Define gamma function and prove that

$$\Gamma(n)\ \Gamma\left(n + \frac{1}{2}\right) = \frac{\sqrt{\pi}}{2^{2n-1}} \Gamma(2n)$$ (10)

(P.T.O)

MODULE-II

III a) Prove that $\int_0^1 x\, J_n(\alpha x)\, J_n(\beta x)\,dx = \begin{cases} o & \alpha \neq \beta \\ \frac{1}{2}\left[J_{n+1}{}^{(\alpha)}\right]^2, & \alpha = \beta \end{cases}$

where α, β are roots of $J_n(x) = 0$ (12)

b) Express $J_5(x)$ in terms of $J_o(x)$ and $J_1(x)$ (8)

OR

IV a) Prove that $nP_n(x) = xP_n^1(x) - P_{n-1}^1(x)$ (10)

b) Show that $\left(1-2xt+t^2\right)^{-\frac{1}{2}} = \sum_{n=0}^{\infty} t^n P_n(x)$ (10)

MODULE-III

V a) (i) Solve $(z-y)p + (x-z)q = y-x$

(ii) Solve $\sqrt{p} + \sqrt{q} = x+y$ (10)

b) A tightly stretched string with fixed end points $x = 0$ and $x = \ell$ is initially in a position given by

$y(x,0) = y_o \sin^3\left(\frac{\pi x}{\ell}\right)$. If it is released from rest from this position, find the displacement y at any time and at any distance from the end ~~$x = 0$~~. (10)

OR

VI a) Using the method of separation of variables solve the Laplace's equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$. (8)

VI b) An infinitely long plane uniform plate is bounded by two parallel edges $x = 0$ and $x = \ell$, and an end at right angles to them. The breadth of this edge y = 0 is ℓ and is maintained at a temperature $f(x)$. All the other three edges are at temperature zero. Find the steady state temperature at any interior point of the plate. (12)

MODULE-IV

VII a) The following is the probability density function of a random variable X.

x	0	1	3	7	13
P(X=x)	$\frac{1}{8}$	α	$\frac{1}{6}$	$\frac{1}{4}$	β

Find α and β if $P\left(X^2 = 4X - 3\right) = \frac{1}{2}$ (7)

b) Obtain the mean and variance of the binomial distribution. (7)

c) Suppose that X has a Poisson distribution.

If $P(X=2) = \frac{2}{3}P(X=1)$. Find P(X = 3) (6)

OR

VIII a) In a test on 2000 electric bulbs, it was found that the life of a particular make was normally distributed with an average life of 2040 hrs. and S.D. 60 hrs. Estimate the no. of bulbs likely to burn for

(i) More than 2150 hrs. (ii) More than 1920 hrs. but less than 2160 hrs. (10)

b) Find the equation of the regression line of y on x and x on y given the following data.

x:	1	2	3	4	5
y:	2	5	3	8	7

(10)