B.Tech Degree III Semester Examination November 2005

IT/CS/EC/CE/ME/SE/EB/EI/EE 301 ENGINEERING MATHEMATICS III
(1999 Admissions onwards)

Time : 3 Hours   Max. Marks:100

(All questions carry *EQUAL* marks)

I   a)   Prove that $x^2 = \pi^2/3 + 4\sum_{n=1}^{\infty}(-1)^n \frac{Cosnx}{n^2} - \pi < x < \pi$. Hence show that $\sum \frac{1}{n^2} = \pi^2/6$.

    b)   Express the function $f(x) = \begin{cases} 1 & when |x| \le 1 \\ 0 & when |x| \le 1 \end{cases}$ as a fourier integral. Hence evaluate $\int_0^{\infty} \frac{Sin\lambda Cos\lambda x}{\lambda} d\lambda$.

OR

II   a)   Find the Fourier Sine and Cosine transforms of $\begin{aligned} f(x) &= 1 \quad 0 < x < a \\ &= 0 \quad x < a \end{aligned}$

    b)   Define Beta function and show that $\int_0^{\pi/2} Sin^r\theta Cos^q\theta d\theta = \dfrac{\left|\dfrac{p+1}{2}\right| \left|\dfrac{q+1}{2}\right|}{2 \left) p+q+2 \right.}$

III   a)   Express $f(x) = x^3 - 5x^2 + x + 2$ in terms of legender polynomials.

    b)   Prove that $(2n+1)xP_n(x) = (n+1)P_{n+1}(x) + nP_{n-1}(x)$.

OR

IV   a)   Show that $\dfrac{d}{dx}[x^n Jn(x)] = x^n J_{n-1}(x)$.

    b)   Prove that $\dfrac{2n}{x} Jn(x) = J_{n-1}(x) + J_{n+1}(x)$

V   a)   Solve : $(x^2 - y^2 - z^2)p + zxyq = 2xz$.

    b)   Solve : (i) $p(1+q^2) = q(z-a)$

               (ii) $y^2p - xyq = x(z-2y)$

OR

VI   a)   State one dimensional wave equation and obtain its solution by the method of separation of variables.

    b)   A rectangular plate with insulated surfaces is 10 cm wide and 50 ling compared to its width that it may be considered infinite in length without introducing an appreciable error. If the temperature along the short edge is given by :

$$u(x,0) = 20x, \ 0 \le x \le 5$$

$$= 20(10 - x7, \ 5 \le x \le 10$$

and the two long edges x=0 and x=10 as well as the other short edge are kept at 0°C. Find the steady state temperature at any point (x,y) of the plate.

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VII   a)   A lot of 10 items contains 3 defectives from which a sample of 4 item is drawn at random. Let the random variable x denote the number of defective in the sample. Find: (i) the p. d, f of x   (ii) $p(x<1)$

b)   Suppose the variable x has the poisson distribution. If $p[X = 2] = \frac{2}{3} P[x = 1]$. Find (i) p[

ii) $P[x>3]$.

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 number of bulbs likely to burn for:

(i)   more than 2150 hrs.

(ii)   More than 1920 hrs. but less than 2160 hrs.

b)   If the regression equations between the variables x and y are $4x - 5y + 33 = 0, 2x - 9y = $ find the correlation coefficient and means of the variable.

IX   a)   A random sample of six 15 from a normal population with mean 12 is found to have Variance $S^2 = 5$. Find the probability that mean of the sample is less than 10?

b)   An engineer is making engine Parts with axle diameter 0.7 inches, and standard deviation of 0.04 inches. A random sample of 10 parts shown a mean of 0.742 inches. Test the hypothesis shown a mean of 0.742 inches. Test the hypothesis $H_o : \mu = 0.700;\ H_1 : \mu \neq 0.700$ at 5% level of significance.

OR

X   a)   It is decided to test $H_o : P = 1/2;\ H_1 = P = 2/3$ where p denotes probability of getting head when a coir is tossed 4 times and rejecting the hypothesis if all the four throws result in heads. Obtain the level of significance and Type II error.

b)   A manufacturer suspects a difference in quality of spare parts he receives from two supplier. He obtains the following data on the service life of random samples of parts from the supplier. For supplier A, n_1 =50, $\bar{x}_1$ =150, S_1=10 and for supplier B, n_2=100 $\bar{x}_2 = 153, S_2 = 5$. Test whether the difference between the two samples is statistically significant at 0.01 level of significance.

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