X. (a) Define terms (i) Point estimate (ii) Interval estimate (iii) Null hypothesis (iv) Critical region (v) Level of significance - all in connection with sampling theory.

(b) A die is tossed 120 times with the following results:

Number turned up	1	2	3	4	5	6
Frequency	30	25	18	10	22	15

Test the hypothesis that the die is unbiased $(\alpha = 0.05)$.

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BTS (C) 062

B.Tech. Degree III Semester Examination
November 2002

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

Time: 3 Hours Maximum Marks: 100

(All questions carry ***EQUAL*** marks)

I. (a) Find the Fourier series for $f(x)$, if

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

Hence evaluate $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \cdots\cdots$.

(b) Find the Fourier transform of $f(x) = \begin{cases} 1-x^2, & \text{if } |x| < 1 \\ 0, & \text{if } |x| > 1 \end{cases}$.

Hence evaluate $\int_0^\infty \frac{x\cos x - \sin x}{x^3} \cdot \cos\frac{x}{2}\,dx$.

OR

II. (a) Show that

$$\beta(m,n) = \int_0^\infty \frac{y^{n-1}}{(1+y)^{m+n}}\,dy = \int_0^1 \frac{x^{m-1} + x^{n-1}}{(1+x)^{m+n}}\,dx.$$

(b) Evaluate

$$\int_0^1 \frac{dx}{(1-x^n)^{1/n}}.$$

(Turn over)

III. (a) Prove that

$$J_{5/2}(x)=\sqrt{\frac{2}{\pi x}}\left[\frac{3-x^2}{x^2}\sin x-\frac{3\cos x}{x}\right].$$

(b) Prove that

$$\int_{-1}^{1} x^2 P_{n+1}(x)P_{n-1}(x)dx=\frac{2n(n+1)}{(2n-1)(2n+1)(2n+3)}.$$

OR

IV. (a) Prove that

$$J_{1/2}(x)=\sqrt{\frac{2}{\pi x}}\sin x.$$

(b) Prove that

$$(1-x^2)P_n'(x)=(n+1)\left[xP_n(x)-P_{n+1}(x)\right].$$

V (a) Solve

$$x^2p^2+y^2q^2=z^2.$$

(b) The vibrations of an elastic string is governed by the partial differential equation $\frac{\partial^2 u}{\partial t^2}=\frac{\partial^2 u}{\partial x^2}$. The length of the string is π and the ends are fixed. The initial velocity is zero and the initial deflection is $U(x,0)=2(\sin x+\sin 3x)$. Find the deflection $U(x,t)$ of the vibrating string for $t>0$.

OR

VI. (a) Solve $(y-z)p+(z-x)q=x-y$ where $p=\frac{\partial z}{\partial x}$, $q=\frac{\partial z}{\partial y}$.

(b) Derive the one-dimensional heat equation in the form $\frac{\partial u}{\partial t}=c^2\frac{\partial^2 u}{\partial x^2}$, stating all the assumptions.

Contd.....3.

VII. (a) An Insurance company found that only 0.01% of the population is involved in a certain type of accident each year. If its 1000 policy holders were randomly selected from the population, what is the probability that not more than two of its clients are involved in such an accident next year?

(b) Fit a curve of the form $y=ab^x$ to the following:

x :	1	2	3	4	5	6
y :	2.98	4.26	5.21	6.10	6.80	7.50

OR

VIII. (a) The table given below shows the number of students who have passed four tests in an examination. Fit a binomial distribution to suit the same constants and calculate the theoretical frequencies.

No. of tests passed :	0	1	2	3	4	Total
Frequency :	4	10	15	9	2	40

(b) Find the coefficient of correlation

x :	1	2	3	4	5	6	7	8	9	10
y :	10	12	16	28	25	36	41	49	40	50

IX. (a) Two gauge operations are tested for precision in making measurements. One operator completes a set of 26 readings with S.D. of 1.34 and the other does 3.4 readings with a S.D. 0.98. What is the level of significance of this difference?

(b) A machine is supposed to produce washers of mean thickness of 0.12cm. A sample of 10 washers was found to have mean thickness of 0.128 cm and S.D. 0.008. Test whether the machine is working in proper order at 5% level of significance.

OR

Contd.....4.