VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra State]

Matunga, Mumbai-400 019

SEMESTER EXAMINATION	*May 2012*	DATE OF EXAM	*07/05/2012*
SEMESTER & PROGRAM	***SYBTECH* (Civil, Mech, Prod, Text.)**	TIME	*1.30 to 4.30 pm*
TIME ALLOWED	*3 HRS.*	MARKS	*100*
COURSE (Course Code) :	*Applied Mathematics*		

Instructions
1. All questions carry equal marks.
2. Figures to the right indicate full marks.

Q.1 a. Let x be one of the first hundred natural numbers chosen at random. Find the probability that $x + \frac{100}{x}$ is greater than 50 — 5

b. For a normal distribution 31% item are below 45 and 8 % items are above 64. Find the mean and variance of normal distribution. — 5

c. Find the constants a and b so that the surface $ax^2 - byz = (a+2)x$ will be orthogonal to the surface $4x^2y + z^3 = 4$ at (1, -1,2) — 5

d Verify Green's theorem for $\bar{F}=(x^2 - y^2)i + (x+y)j$ and c is the triangle with vertices (0,0), (1,1) (2,1). — 5

Q.2 a. A company has two plants to manufacture scooters. Plant-1 manufactures 70% of scooters and Plant-2 manufactures 30% . At plant-1 80% of the scooters are rated standard quality and at plant-2 90% of the scooters are rated standard quality. A scooter is chosen at random and it is found to be of standard quality, what is the chance that it is from plant-2 — 6

b. Show that $\bar{F}=(2xyz^2)i + (x^2z^2 + 2Cosyz)j + (2x^2yz + yCosyz)k$ is conservative. Find scalar potential $\emptyset$ such that $\bar{F} = \nabla\emptyset$ and hence find the work done by $\bar{F}$ in displacing a particle from A(0,0,1) to B(1, $\frac{\pi}{4}$, 2) along with straight line AB — 6

c i. The height of six randomly chosen sailors are in inches : 63,65,68, 69, 71 and 72. The heights of ten randomly chosen soldiers are in inches: 61, 62, 65, 66, 69, 69, 70, 71, 72, and 73. Discuss in the light that this data threw on the suggestion that the soldiers on an average are taller than sailors. — 5

ii. Explain the following. — 3
   a. One tailed and two tailed test
   b. Type-I and type-II errors
   c. Level of significance.

Q.3 a. The number of accidents in a year attributed to taxi drivers in a city follows Poisson distribution with mean 3. Out of 1000 taxi drivers, find approximately the numbers of drivers with. (i) no accidents in a year, (ii) more than 3 accidents in a year. — 6

b. The equations of the two lines of regression are $5x - y = 22$ *and* $64x - 45y = 24$ Find — 6
   i. Mean of x and y
   ii. Correlation coefficient (r)
   iii. $\sigma y \; if \; \sigma x = 5$

c i. Test the significance of the difference between the means of two normal population with the same standard deviation from the following data — 5

	Size	Mean	SD
Sample 1	100	64	6
Sample 2	200	67	8

P.T.O

ii. The random variable x has the following probability functions

X	1	2	3	4	5	6	7
P(X)	k	2k	3k	k^2	k^2+k	$2k^2$	$4k^2$

Find (i) k, (ii) P ($0 \leq x \leq 5$)

Q4 a Find the mean, variance and moment generating functions of Binomial distributions 6

b Draw the mean chart and range chart using the following data relating to 15 samples each of the size 5 and comment on the state of control. (Given A_2 =0.577, D_3 = 0, D_4 =2.115) 6

$\bar{X}$	65.0	64.6	64.1	68.5	68.4	67.9	65.0	64.6	64.1	63.2	62.9	62.4	67	66.6	66.1
R	9.8	9.8	8.4	3.9	7.6	8.7	0.1	9.7	7.7	7.5	1.2	9.8	6.4	0.6	6.3

c Verify Gauss Divergence Theorem for $\bar{F} = 4xi - 2y^2j + z^2k$ taken over region bonded by $x^2 + y^2 = 4, z = 0, z = 3$ 8

OR

i. Fit a equation of straight line for the following data 5

X	1	2	3	4	5
Y	5	7	9	10	11

ii. If $\bar{F} = (x + 3y)i + (y - 2z)j + (az + x)k$ is solenoidal. Find the value of a. 3

Q5 a The following table gives for a sample of married women the level of education and the marriage adjustment score. Can you conduct from this data that the higher the level of education the greater is the degree of adjustment in marriage? [given $\chi^2_{0.05}(v = 6) = 12.59$] 6

Level of education	Marriage adjustment				
	Very low	low	high	Very high	Total
College	24	97	62	58	241
High School	22	28	30	41	121
Middle School	32	10	11	20	73
Total	135	135	103	119	435

b Verify Stoke's Theorem for $\bar{F} = (2x - y)i - yz^2j - y^2zk$ and S is the surface of hemisphere $x^2 + y^2 + z^2 = a^2$ lying above the xy-plane. 6

c To test the significance of the variation of retail prices of a commodity in three principle cities Mumbai, Kolkata and Delhi, four shops were chosen at random from each city and prices observed in Rs were as given below: 8

Mumbai	18	10	14	16
Kolkata	16	12	12	8
Delhi	4	12	10	10

Do the data show that the prices of the commodity in the three cities are significantly different? (Given $F_{0.05}(v_1 = 2, v_2 = 9) = 4.26$

X X